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Demands and Resources in Work Mediated by Digital Platforms: A Scoping Review of the Literature

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Abstract

Work arrangements with hiring mediated by digital platforms (digiwork) have grown exponentially in recent years, both in the form of crowdwork and in the form of work on demand via app. However, there is still little systematization regarding knowledge about the elements that characterize this arrangement. Through a scoping review of the literature covering the period from 2005 to 2021, this study sought to identify the digiwork design characteristics, organizing it based on two specific categories: its requirements and the resources available to the worker. For that, it used the model of job demands and resources (JD-R) as a theoretical basis. After applying the inclusion and exclusion criteria, the 43 articles reviewed allowed for the identification of an important imbalance between the demands and resources present in digiwork. It also indicated many missing resources that make it difficult for workers to adequately deal with the demands of both the organization and the task. Among the most prominent demands, imprecision in labor categorization, surveillance via algorithmic management and self-management of risks stand out, while flexibility appears as the most cited resource present, and social protection as the most relevant resource absent. Taken together, the digiwork design characteristics may contribute to the

worker's burnout process, in addition to interfering with their motivational process. This generates both suboptimal performance and damage to the worker's health and well-being.
Keywords: alternative work arrangements, JD-R, work design

Introduction

The relationship between individuals and work has been historically restructured according to the technologies and needs of the period in which the work activity is contextualized (Bentivi, Bastos, & Carneiro, 2021). More recently, the technological advances achieved and the integrated and globalized economy (resulting from the Fourth Industrial Revolution) have made this relationship easier, making contracts, time and workspace more easy-flowing, and making up alternative arrangements to the traditional work model of fixed, stable and long-term employment (Bentivi et al., 2021; Spreitzer, Cameron, & Garrett, 2017).

This new context gives rise to the gig economy, characterized by the provision of services or small short-term tasks that strengthens a model of on-demand work mediated by digital platforms and apps, called digiwork (Carneiro, Moscon, Dias, Oliveira, & Alves, forthcoming; Moscon, Carneiro, & Gondim, 2022). Digiwork is divided into two macro-categories: crowdworking and work on demand via app (De Stefano, 2016). Both are similar in that they provide a range of varied and flexible opportunities and differ on two main aspects: regional reach and the role of the Internet in performing the work.

Before the COVID-19 pandemic and its effects on unemployment rates, gig economy technology already provided quick access to an available labor force, almost as a commodity. After that period, in a variation that the Brazilian Institute of Geography and Statistics (IBGE) reports as historic, the category of informal workers in Brazil showed a 10.1% increase while work with formal contracts increased by only 4.2% (Akemi, 2021). The undeniable effect of the health crisis on the Brazilian labor dynamics heightens the importance of knowing more about digiwork, taking into account its increasing presence in comparison with the decreasing presence of formal work, according to the statistics.

Despite encompassing an exponentially increasing contingent of workers, the fact that it is still a recent and developing phenomenon indicates the need to better understand the characteristics of this model, especially regarding the potential impacts of digiwork on the worker's health and performance (Carneiro et al., forthcoming; Moscon et al., 2022). In this sense, this article intended to identify the digiwork design characteristics, organizing and reviewing it in a critical light based on two specific categories: its demands and the resources it offers to the worker. The paper focuses on answering the following research question: what are the main resources and demands present in work mediated by digital platforms?

To that end, this study results from a scoping review of the literature that allows us to map and establish an overview of the scientific production on an object of study that is still scarcely explored in a systematic way in the literature, in order to include both theoretical and empirical productions that allow us to identify the breadth and types of evidence (Munn et al., 2018). Articles from all over the world were collected and gathered following predefined criteria to allow the review of knowledge that has been produced so far regarding this group of workers. To understand

these work relationships and the impact of the precarization of their structures on workers' health and well-being, the model of job demands and resources (JD-R) (Bakker & Demerouti, 2017) was used as a theoretical basis.

A brief theoretical and contextual background on digiwork and the core categories of the JD-R model is presented below. Next, the study's methodological design is detailed, including the steps followed in the review and final scope of articles considered for analysis. In the results and discussion section, the basic characteristics of the texts reviewed are described, and the main characteristics classified as demands or as work resources mapped in the review are discussed. In the final remarks, the conclusions of the study, its limitations, and suggestions for a research agenda on the topic are pointed out.

The gig economy based on digital platforms: characterizing digiwork

Traditionally speaking, the gig economy represents a way of structuring labor relations based on short-term contracts and "minor services." This term, however, has been used as synonymous with the platform economy driven by intermediating organizations that employ technological solutions to connect goods and services providers with potential consumers. This confusion is due to the fact that digital platforms are currently the main and growing means of enabling this type of work, which opposes the classic employment model (Malik, Visvizi, Skrzek-Lubasińska, 2021). In the platform economy, however, "minor services" have the specificity of being hired through the intermediation of digital platforms, making up a macrocategory, here referred to as digiwork (Carneiro et al., forthcoming; Moscon, Carneiro, & Gondim, 2022), which represents the central model of the work arrangement in the gig economy based on digital platforms (Malik et al., 2021).

Crowdworking is one of the configurations of digiwork. It is executed through digital platforms that connect an indefinite number of organizations and individuals (De Stefano, 2016; Tan et al., 2021), mediating the relationship between customer demand and worker supply at a global level (Carneiro et al., forthcoming). Made known by Amazon Mechanical Turk, it is characterized by activities performed completely online ranging from microtasks (Keith, Harms, & Long, 2020), such as answering questionnaires, to more robust functions, such as developing a marketing campaign (De Stefano, 2016). To be characterized as work, however, such tasks need to result in financial compensation (Spreitzer et al., 2017).

Another form of digiwork is that of on demand via app, in which the worker offers an on-site service on the platform and is subject to the demands available at the time. It encompasses traditional work activities, such as cleaning and transportation, or forms of administrative work in which the relationship between the customer and worker is mediated by apps (De Stefano, 2016; Tan et al., 2021). Uber was the organization that initiated this contracting model and, thus, the term uberization of work came to be used to designate this alternative work arrangement (Bentivi et al., 2021). Over time, however, this expression has gained more varied connotations, being extended to encompass the process of precarization of labor relations even in contexts free of the intermediation of digital platforms. In this sense, uberization comes to represent forms of work supported by the premise that its workers are the ones to take responsibility for their own economic destiny (Fleming, 2017).

Importantly, when compared to "crowdsourcing", "on-demand work via app" platforms often exert more control over workers (Tan et al., 2021), although both hiring modalities have flexibility as their alleged main attraction and, therefore, both are configured as alternative work arrangements that may be deleterious for workers (Spreitzer et al., 2017). Political and economic scenarios in developing and underdeveloped countries are conducive to various risks for digiworkers, who are subjected to physical and psychological impacts due to long working hours in order to earn enough to survive. Low remuneration and lack of legal protection have been the focus of digiworkers (Filgueiras & Antunes, 2020). However, this work arrangement can become for many a possibility of independence and escape from unemployment, since the losses of not having any work are greater than having a poor configuration. At the same time, for some more specialized areas, especially those involving technology, digiwork emerges as an alternative that is equivalent to or better than a normal salaried job, offering more adequate remuneration and having freedom as a major attraction (Bessa, 2021). In this sense, it is a work arrangement with a high level of complexity and variations, which has absorbed a significant number of workers and, therefore, should be better understood regarding its basic characteristics.

The job demands and resources (JD-R) model

The job demands and resources model (JD-R model) was proposed in the early 21st century by Demerouti, Bakker, Nachreiner, and Schaufeli (2001) and has since been consistently refined (e.g. Bakker & Demerouti, 2017; Schaufeli & Taris, 2014). Inspired by previous models aimed at explaining occupational stress, the proponents conceive of the JD-R as a theoretical framework capable of explaining two fundamental processes to which the worker is subjected (the motivational and the attrition processes) as a function of the characteristics involved in their work design. These characteristics are initially organized into two major categories: demands and resources.

Demands are characteristics of work that place some level of requirement on the individual, having costs for workers to meet or solve these demands. The nature of the demand may be physical, psychological, social, or organizational (Bakker & Demerouti, 2017). Depending on this nature, the types of costs to which the worker is subjected also vary, since demands may involve physical, cognitive, affective, and/or social efforts. For example, the work of an app driver demands from their body the necessary movements to drive, involving cognitive costs of attention to the traffic and the route taken, in addition to dealing with the need to socially interact with customers and be mobilized in their affections.

It is important to emphasize that no job is exempt from demands, as they can be seen as the drivers for performance. However, their presence is responsible for triggering the process of wear and tear at work, which occurs when it is very intense, and when the worker does not have at their disposal means to adequately cope with such demands, which may lead to occupational stress and the risk of mental illness (Bakker & Demerouti, 2017). The demands most likely to damage the worker's health and productivity are those classified as impeding or restrictive (such as, for example, time pressure), while challenging or stimulating demands (such as, for example, task responsibility), despite also generating costs to the worker, tend to contribute less to their wear and tear (Carneiro, 2021; Crawford, Lepine, & Rich, 2010).

In turn, resources provided by the individual or by the organization are factors that help the worker's development, enabling the achievement of their goals, and their control over the environment (Demerouti et al., 2001; Schaufeli & Bakker, 2004). In this sense, these are resources that, when present, allow the worker to deal with the many demands at work, buffering the wear and tear unleashed by them, thus triggering the motivational process (Bakker & Demerouti, 2017; Demerouti & Bakker, 2011). Additionally, their mobilization allows the attainment of valuable new resources, and facilitates the protection of the existing ones (Demerouti & Bakker, 2011; Hackman & Oldham, 1976; Hobfoll, 1989). This way, they play both an instrumental role (extrinsic motivational role focusing on effort to perform activities) and a particular role (intrinsic motivational role focusing on the maintenance and accumulation of resources because they are already desirable and stimulating) (Carneiro, 2021; Demerouti & Bakker, 2011; Schaufeli & Taris, 2014).

Resources, just like demands, may come from different sources or have different natures (Bakker & Demerouti, 2017; Nielsen et al., 2017). At the individual level there are personal resources, including personality traits and other individual competencies (e.g. psychological capital, openness to experience, communication). At the group or organization level, there are aspects more related to the task itself (e.g. role clarity) as well as interactional (e.g. social support) and managerial aspects (e.g. autonomy, feedback practices).

In brief, the interaction between work characteristics categorized as demands or as resources is responsible for explaining several important phenomena for both workers and organizations. These phenomena are triggered by the processes of motivation and attrition/tension (Bakker & Demerouti, 2017). The motivational process usually excels in work arrangements that abound in resources and challenging demands, as well as low restrictive demands. This brings about effects such as higher levels of work engagement, commitment to the organization, and well-being, among others that ultimately improve the individual's performance at work, including extra-role behaviors. On the other hand, the attrition process occurs when resources are insufficient to deal with the high level of demands involved in the work, generating effects such as higher levels of anxiety, exhaustion, and health complaints, among others that end up harming labor productivity and increasing undesirable indexes such as absenteeism and turnover (Carneiro, 2021).

The JD-R model is, thus, a theoretical model with high heuristic power, applicable to the most varied work contexts and arrangements. In the case of digiwork, the object of the current study, the use of this theoretical reference may help in understanding the main characteristics present in the work design (including demands and resources), in order to provide support for the debate on the potential impact of such characteristics on the worker's health and job performance.

Methodological design

This is a literature scoping review study. The process started by defining the study scope by means of the research question, checking whether a similar review had already been conducted, and appropriating the basic literature. This was followed by planning, in which the keywords, databases, inclusion and exclusion criteria, and a review execution protocol were established. The identification stage continued through a database search and exportation of articles, followed by an initial screening based on the reading of abstracts, titles, and main information, eliminating those articles that did not fit into the scope defined. Finally, in the eligibility stage, a full reading was

performed considering all the inclusion and exclusion criteria. This led to us having the final number of included articles, applying several analysis categories, performing the syntheses based on the review questions and objectives (Munn et al., 2018; Siddaway, Wood, & Hedges, 2019).

The search for articles was performed in April and May 2021, through the Scopus, Lilacs, and Web of Science databases, which were chosen because of their international and national coverage and relevance. The keywords used in Portuguese and English were organized around three main axes. The words that make up the first axis refer more broadly to the work configuration targeted by this research, and to the intermediating companies. The second axis concerns the types of work found within this more general design of digital platforms. The third axis encompasses the words linked to the theoretical model used as a basis for analysis, the JD-R model. Searches were carried out based on all possible combinations using one element of each axis, linking them through the Boolean operator AND. The keywords and their respective axes are shown in Table 1.

Along with the keywords, search filters were used to include only articles in Portuguese, English, Spanish, and French, and those published from 2005 onwards, the year one of the pioneering organizations in this business model was launched (Moscon et al., 2022). The languages were selected because the authors are proficient in them. The State of the Art through Systematic Review (StArt) software, version 2, developed by the Federal University of São Carlos, was used to organize and screen articles (Zamboni, Thommazo, Hernandes, & Fabbri, 2010). First the protocol of the literature review was inserted into the program, and then the article files in bibtex format were exported to the program. Duplicate articles were excluded through a combination of the software's automatic function and the complementary verification by researchers.

Table 1

Axes of Keywords for Search in Databases

First Axis	(“Plataformas digitais” OR “Digital platforms”) ("Gig economy" OR "economia de compartilhamento" OR "economia gigante") ((Uber*) OR (Turk* OR Mturk*))
Second Axis	(Digitrab OR Gigwork OR "Gig work" OR work OR workers) (Crowdwork* OR "trabalho de multidão") (“Arranjos alternativos de trabalho” OR “alternative work arrangements”) ("Work-on-demand via app*" OR "trabalho sob demanda via ap*")
Third Axis	(“Recursos” OR “Resources*” OR “Demand*” OR "JD-R")

Source: Prepared by the authors

Next, articles were selected based on their abstracts and main information, excluding all articles that: 1) did not have as their object of study workers hired through the intermediation of digital platforms; 2) did not mention characteristics of the work arrangement that could be evaluated in the light of work demands and resources; 3) focused on the business model and not on the work model. After the initial selection, the eligible articles were downloaded in full, excluding articles whose full versions were not available, and their main information was exported to a Microsoft Office Excel spreadsheet. After reading the full articles found, only those that fit the study theme and were peer-reviewed remained, obtaining the final set of 43 articles for this study. Figure 1 shows the review process flowchart.

In the spreadsheet consolidated with the articles included in the study, the relevant data for the proposal of this scoping review were entered, including structural, methodological, and content information regarding the studies mapped. In the analysis of work design characteristics cited in the articles using the JD-R model as a basis, information relevant to any section that could be fit into one of three categories was considered: present demands, present resources, and missing resources. The information was then organized to identify the name of the characteristic (e.g. job insecurity) and its description, based on the articles that mentioned it.

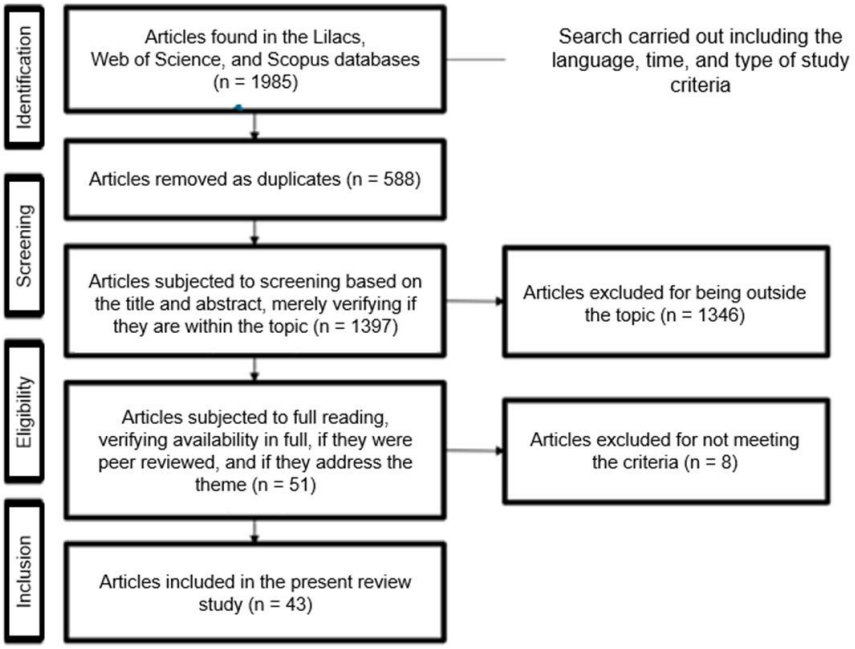

Figure 1. Flowchart of Article Search and Review

Source: Prepared by the authors

Results and discussion

A significant geographical distribution of the publications was identified (Figure 2), most being from Europe (with 20 publications in total, one of them being a Canada-UK partnership) and North America (with 12 publications in total, one of them being a Canada-UK partnership), with less representation from South America (four), Africa (three), Oceania (one) and Asia (one). There were no publications from Central America or Antarctica. Two articles did not specify their locations. Finally, the language that accounted for the largest number of publications was English, found in about 90% of the articles reviewed.

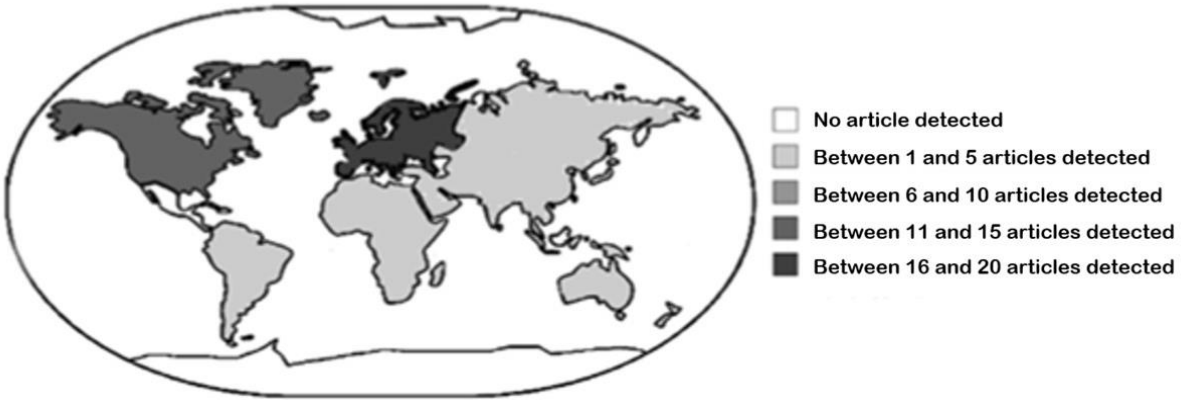

Figure 2. Number of publications distributed by continents

Source: Prepared by the authors

Although the time criterion for inclusion was from 2005 onward, the year MTurk was launched (Moscon et al., 2022), the first three publications focused on digiwork were detected only in 2016. This fact may reflect the maturation and diffusion process of this working arrangement to the point of drawing the attention of the scientific sphere. From then on, the number of publications increased over time, reaching 15 articles in 2020, and six in 2021 (in only the first four months of the year).

A slight prevalence of theoretical studies (22) over empirical ones (21 in total, 19 qualitative and two quantitative) was detected. This may be because, being a relatively recent phenomenon, digiwork has attracted much attention from researchers attempting to understand and/or build explanatory hypotheses about this arrangement and its consequences for workers, either through theorization or through exploratory empirical and qualitative research. At the same time, this number may indicate the difficulty of identifying and accessing these professionals for collecting empirical quantitative data on the theme. Because they are largely "invisible" workers, such obstacles may be difficult to overcome, although there is significant attention from the scientific community focused on this public.

When reviewing the target audience in detail, it was found that most articles were dedicated to discussing jobs whose hiring is intermediated by digital platforms, i.e., they focused more broadly on digiwork (21 publications). There was a higher concentration of articles focused on work arrangements that may be grouped into the subcategory of work-on-demand via app (17), with a lower concentration of articles focused on crowdwork (only five). Such data may reinforce the importance of understanding the broader digiwork scenario and, at the same time, show that the so-called uberized workers (those who perform their activities in person) gain more notoriety compared to those who develop activities 100% online (Carneiro et al., forthcoming). A closer look at occupational categories reveals that most articles directly addressed workers active in transportation services for people and goods (18 publications), which have a diverse range of intermediating companies (Artur & Cardoso, 2020; Carneiro et al., forthcoming). Some focus on online workers in firms such as Mturk and Upwork (five, of which three are theoretical and two are

qualitative-empirical) and others on more specific occupations such as home workers, lawyers, and software developers. The general data on the studies are shown in Table 2.

With regard to the use of the JD-R theoretical framework to assess the digiwork phenomenon, only two publications referred to the model: that of Schulte, Schlicher and Maier (2020) and that of Watson, Kistler, Graham and Sinclair (2021). Both are theoretical in nature, suggesting that this is a promising model for understanding this work arrangement.

The work by Schulte et al. (2020) provides an overview of crowdwork, and highlights the need for more studies on this work design, both at the platform level and at the level of tasks performed by workers. It mentions the JD-R model as one of the possible approaches for such research. In order to highlight how activities can be more satisfying and motivating for workers, the authors address the variability of resources in crowdwork as a result of the possibility of switching tasks, highlighting autonomy and flexibility. The possibility of redesigning work is also broad, meeting personal and professional needs (freedom in organizing tasks and work schedules). Some of the necessary personal resources are professional expertise, a wide variety of skills and knowledge, and problem-solving skills. When it comes to missing resources, ergonomics is highlighted, being left to the crowdworker. In the field of demands, the exploitation of workers and need for constant learning and improvement are mentioned. In addition, the authors highlight family-work interference, derived from the fine line between work spaces and schedules and time for personal life (Schulte et al., 2020).

Schulte et al. (2020) pose some factors as double-edged knives, as the lack of defined schedules and spaces, constant updating, and multi-tasking will have both positive and negative impacts on workers, highlighting the need for further research on this public. Such elements can be considered as both challenging demands that will contribute to the worker's motivational process, and as restrictive demands that will imply an increase in the attrition process, depending on the context and its interaction with the available resources (Crawford et al., 2010).

The article by Watson et al. (2021), in turn, develops a typology that differentiates specific groups of gig workers, considering the characteristics of temporary, flexible, and task-based work. There are five worker profiles, two of which cover those who do not use a technological network to work, and therefore do not fit digiwork. The other three are those in which technological mediation is a mandatory requirement, namely: gig service providers, workers who offer services through apps and websites (e.g. Uber, Airbnb); gig good providers, workers who offer products and goods that they have created, also through apps (e.g. Etsy, Redbubble); and, finally, the profile of gig data providers: those who work remotely via virtual platforms (e.g. Amazon Mechanical Turk, Google Surveys), performing small tasks.

Table 2

Main characterization data of the studies

Study	Type of study	Nature	Data collection strategy	Type of job	Professional category
Altenried (2020)	Theoretical	-	-	Crowdwork	Mturkers
Arcidiacono, Borghi, & Ciarini (2019)	Theoretical	-	-	Digiwork	General
Bajwa, Gastaldo, Di Ruggiero, & Knorr (2018)	Theoretical	-	-	Digiwork	General
Barros & Raymundo (2021)	Empirical	Qualitative	Interviews	Digiwork	People transportation
Brawley (2017)	Empirical	Quantitative	Online questionnaire	Crowdwork	Mturkers
Bulian (2021)	Theoretical	-	-	Digiwork	General
Chan. (2019)	Theoretical	-	Interviews	Work on demand	People transportation
Chen & Sun (2020)	Empirical	Qualitative	Interviews	Work on demand	Delivery
Chesta, Zamponi, & Caciagli (2019)	Empirical	Qualitative	Media documents; observation; interviews	Work on demand	Delivery
Chinguno (2019)	Empirical	Qualitative	Interviews	Work on demand	People transportation
Cockayne (2016)	Empirical	Qualitative	Interviews	Digiwork	Software developers and others
Crain, Brossoit, Robles-Saenz, & Tran (2020)	Theoretical	-	-	Digiwork	People transportation
Dablanc et al. (2017)	Empirical	Qualitative	Interviews; Online content analysis	Work on demand	Delivery and people transportation
Del Bono (2019)	Empirical	Qualitative	Interviews	Work on demand	Delivery
Fabrellas (2019)	Theoretical	-	-	Digiwork	General
Fieseler, Bucher, & Hoffmann (2019)	Empirical	Qualitative	Self-administered online interviews	Work on demand	People transportation
Gandini (2019)	Empirical	Qualitative	Open-question questionnaire	Crowdwork	Mturkers

Gregorky (2021)	Theoretical	-	-	Digiwork	General
Harpur & Blanck (2020)	Empirical	Qualitative	Interviews	Digiwork	Delivery
Healy, Pekarek, & Vromen (2020)	Theoretical	-	-	Digiwork	General
Hunt & Samman (2020)	Empirical	Quantitative	Online questionnaire	Digiwork	General
Idowu & Elbanna (2020)	Empirical	Qualitative	Interviews; Questionnaires	Work on demand	Domestic work
Jan (2018)	Empirical	Qualitative	Interviews; Observation; Online content	Crowdwork	General
Jarrahi, Sutherland, Nelson, & Sawyer (2020)	Empirical	Qualitative	Interviews	Work on demand	Delivery
Kahancová, Meszmann, & Sedláková (2020)	Empirical	Qualitative	Interviews; Debate forums; Online documents	Digiwork	Upworkers
Kaine & Josserand (2019)	Empirical	Qualitative	Interviews	Work on demand	People transportation
Köbis, Soraperra, & Shalvi (2021)	Theoretical	-	-	Digiwork	General
Malin & Chandler (2017)	Theoretical	-	-	Digiwork	General
Cardoso & Oliveira (2020)	Empirical	Qualitative	Interviews	Work on demand	People transportation
Newlands (2021)	Theoretical	-	-	Work on demand	Hotels, delivery and people transportation
Poon (2019)	Theoretical	-	-	Work on demand	Delivery
Ravenelle (2017)	Theoretical	-	-	Digiwork	General

Reid-Musson, MacEachen, & Bartel (2020)	Empirical	Qualitative	Interviews	Digiwork	Airbnb, Taskrabbit, Kitchensurfing and Uber
Rosenblat & Stark (2016)	Empirical	Qualitative	Focal groups	Work on demand	People transportation
Rosenblat & Stark (2016)	Empirical	Qualitative	Online content analysis	Work on demand	People transportation
Schulte Schlicher, & Maieret (2020)	Theoretical	-	-	Crowdwork	General
Shapiro (2020)	Theoretical	-	-	Work on demand	People transportation
Corujo (2017)	Theoretical	-	-	Digiwork	General
Sutherland , Jarrahi, Dunn, & Nelson (2020)	Empirical	Qualitative	Semi-structured interviews	Crowdwork	Upworkers
van Doorn (2017)	Theoretical	-	-	Digiwork	General
Watson, Kistler, Graham, & Sinclair (2021)	Theoretical	-	-	Digiwork	General
Wuytens & De Groof (2019)	Theoretical	-	-	Digiwork	General
Yao (2020)	Empirical	Qualitative	Semi-structured interviews	Work on demand	Attorneys on online platforms

Source: Prepared by the authors

Regarding the application of the JD-R model for these profiles, the authors relate demands and resources to stress and motivation processes, as well as to workers' health. Three examples of demands and three examples of resources are broken down in the article, distributed in relation to the characteristics of each gig worker's profile. Demands include alienation, emotional labor, and underemployment; the resources identified are autonomy, social support, and identification with the task (Watson et al., 2021).

The first demand identified most affects the profile of gig data providers. The sociological concept of alienation, such as that proposed by Karl Marx, refers to the estrangement and detachment of the worker from the product of their work, and the society that their work affects (Marx & Engels, 1837/1978). Because they work physically isolated via virtual platforms on simple and repetitive tasks, these workers are more exposed to this demand than those who create their own products or work interacting on social media.

The second demand, emotional labor, refers to self-regulations such as suppression, feigning, or intensification of emotions, a necessary behavior in work activities involving interpersonal interactions (Zapf, Kern, Tschan, Holman, & Semmer, 2021). Thus, consequences of this demand such as emotional exhaustion, job dissatisfaction, and health problems affect the gig service provider profiles (such as app drivers) the most. Their jobs require them to maintain positive emotions and make good impressions, even in stressful situations, as also pointed out by Moscon et al. (2022).

Finally, the demand of underemployment encompasses stressors such as insufficient use of their skills and qualifications, insufficient pay, or being active at work for fewer hours than desired. Consequences of underemployment such as less organizational commitment, psychological well-being, and job satisfaction stem from the flexibility so typical of gig work. Gig service and data providers are the two profiles identified as suffering from underemployment due to their tendency to be more skilled than necessary for the role they perform.

Regarding resources, autonomy is the first one identified by the authors. The theories mentioned to conceptualize autonomy evoke two main factors: freedom and independence at work. Thus, all three categories of gig workers that fit the digiwork definition are listed as those with more autonomy (especially in terms of working hours) than the other categories. The social support resource refers to the degree to which individuals feel valued by colleagues, supervisors, and the organization in which they work. Because of the very nature of the social organization of their work, digiwork groups are identified as the profiles least likely to experience social support at work. Finally, the resource of identification with the task takes the worker away from the experience of alienation, referring to the extent to which they are able to establish a relationship of identity with the fruit of their work, including some or all parts of the product or service they offer. In this sense, among the digiwork profiles, only gig good providers (sellers of original and copyrighted products) are highlighted by Watson et al. (2021) as having a higher possibility of identification with the task.

Although most of the articles did not aim at reviewing the work design and did not specifically use the JD-R model to describe the basic characteristics of digiwork, their analysis allowed us to identify demands and resources (present or absent) that were frequently problematized in these studies. Table 3 presents a synthesis of the main features of work design mapped.

Table 3

Characteristics of digiwork design mapped in the studies

Demands	Source		
Imprecise job categorization: Refers to the lack of proper labor classification, combining characteristics of both self-employed and independent workers and employees (but only with regard to duties, not rights). Subjects workers to unexpected political and management changes. Associated with precariousness, informality, and exploitative labor relations.	● Altenried (2020) ● Bajwa, Gastaldo, Di Ruggiero, & Knorr (2018) ● Bulian (2021) ● Barros & Raymundo (2021) ● Chesta, Zamponi, & Caciagli (2019) ● Chen & Sun (2020)	● Chinguno (2019) ● Corujo (2017) ● Dablanc et al. (2017) ● Fabrellas (2019) ● Fielbaum & Tirachini (2021) ● Harpur & Blanck (2020)	● Jan (2018) ● Kaine & Josserand (2019) ● Malin & Chandler (2017) ● Newlands (2021) ● Rosenblat & Stark (2016) ● van Doorn (2017)
Self-management of risks / investment: Designates the obligation that workers have to assume the risks of the work, in both financial and health terms. It is up to the digiworkers to provide the means to make their services possible (Internet, transportation, equipment, etc.), and to take care of their maintenance. They must also manage the risks of exposure to harassment, discrimination and violence by customers, as well as the risks of being unable to work due to illness.	● Altenried (2020) ● Bajwa et al. (2018) ● Cardoso & Moreira (2020) ● Chesta et al. (2019) ● Corujo (2017) ● Fabrellas (2019)	● Gregory (2021) ● Harpur & Blanck (2020) ● Hunt & Samman (2020) ● Jarrahi, Sutherland, Nelson, & Sawyer (2020) ● Kaine & Josserand (2019) ● Kahancová, Meszmann, & Sedláková (2020)	● Malin & Chandler (2017) ● Rosenblat & Stark (2016) ● Sutherland, Jarrahi, Dunn, & Nelson (2020) ● van Doorn (2017)
Surveillance & control through algorithmic management: Covers management mechanisms based on algorithmic analysis, with a high level of control (economic, behavioral) and surveillance over workers. These include: practices of determining the amounts to be paid (including surge pricing); gamification to deal with variations in demand and supply; norms of conduct and standards for equipment involved in the provision of services; control over workflow; transaction management; forms of real-time digital monitoring (also	● Altenried (2020) ● Arcidiacon, Borghi, & Ciarini (2019) ● Bajwa et al. (2018) ● Bulian (2021) ● Chan (2019)	● Del Bono (2019) ● Fabrellas (2019) ● Gandini (2019) ● Gregory (2021) ● Idowu & Elbanna (2020) ● Jarrahi et al. (2020)	● Moreira & Cardoso (2020) ● Ravenelle (2017) ● Reid-Musson, MacEachen, & Bartel (2020) ● Rosenblat & Stark (2016) ● Shapiro (2020)

known as panoptic digital control) such as the use of GPS (Global Positioning System), facial recognition techniques, and use of the platform's own chat.	● Chen & Sun (2020) ● Chingano (2019) ● Cockayne (2016) ● Corujo (2017) ● Crain, Brossoit, Robles-Saenz, & Tran (2020)	● Hunt & Samman (2020) ● Kaine & Josserand (2019) ● Newlands (2021) ● Malin & Chandler (2017)	● Sutherland et al. (2020) ● Wuytens & De Groof (2019) ● Yao (2020)
Performance appraisal system: Refers to the need for digiworkers to adapt to a performance appraisal system for factors that are not under their control, both situational (e.g., traffic interfering with delivery times) and subjective of the evaluator (e.g., customer satisfaction with the intermediating company interferes with satisfaction with the worker's service). This is a specific form of control (high customer power), with constant demands for maintenance of the metrics. Low scores may imply sanctions, and high scores may bring rewards. It fosters competitiveness. Gamification can also turn work into a fun "game."	● Arcidiacono et al. (2019) ● Cockayne (2016) ● Corujo (2017) ● Chingano (2019) ● Crain et al. (2020) ● Del Bono (2019) ● Gandini (2019) ● Healy, Pekarek, & Vromen (2020) ● Idowu & Elbanna (2020)	● Jarrahi et al. (2020) ● Malin & Chandler (2017) ● Köbis, Soraperra, & Shalvi (2021) ● Ravenelle (2017) ● Reid-Musson et al. (2020) ● Rosenblat & Stark (2016) ● Sutherland et al. (2020) ● Wuytens & De Groof (2019) ● Yao (2020)	
Microtasks: Indicates a need to develop fragmented and servile tasks that give rise to alienation from work and emptiness of meaning .	● Altenried (2020) ● Bajwa et al. (2018)		
Emotional labor: Refers to the need for direct, patient and friendly contact with customers and other people in the course of the service provision. Social-emotional interaction at work exposes digiworkers to conflicts, disrespect, harassment, and discrimination, among others. However, the possibility to interact socially may also be positive.	● Bulian (2021) ● Chan (2019) ● Chingano (2019) ● Gandini (2019)	● Healy et al. (2020) ● Kaine & Josserand (2019) ● Köbis et al. (2021) ● Newlands (2021)	● Malin & Chandler (2017) ● Reid-Musson et al. (2020) ● Yao (2020)
Unpredictability: Encompasses the unpredictable nature of digiwork in a more task-related way (e.g. routes to be followed by drivers).	● Bulian (2021) ● Reid-Musson et al. (2020)		

Salary uncertainty: Includes the need to deal with wage variations ensuing from service instability and the platform's control over values to be charged (depending on the area, the day, the time). Another highlight here is the absence of a guaranteed minimum wage, the tendency for low pay, and the failure to monitor fluctuations of values of inputs required to provide services.	● Altenried (2020) ● Bajwa et al. (2018) ● Barros & Raymundo (2021) ● Bulian (2021) ● Cockayne (2016) ● Corujo (2017) ● Chen & Sun (2020)	● Chesta et al. (2019) ● Crain et al. (2020) ● Del Bono (2019) ● Fieseler, Bucher, & Hoffmann (2019) ● Gregory (2021) ● Healy et al. (2020) ● Hunt & Samman (2020)	● Jan (2018) ● Kaine & Josserand (2019) ● Kahancová et al. (2020) ● Reid-Musson et al. (2020) ● Sutherland et al. (2020) ● Yao (2020)
Job insecurity: Comprises both unhealthy working conditions with a high level of occupational risks and accidents and workers' exposure to uncertainty (about the people they will interact with, their financial health, etc.).	● Bajwa et al. (2018) ● Barros & Raymundo (2021) ● Brawley (2017) ● Cockayne (2016) ● Chinguno (2019) ● Dablanc et al. (2017)	● Del Bono (2019) ● Fabrellas (2019) ● Fielbaum & Tirachini (2021) ● Gregory (2021) ● Jan (2018)	● Kaine & Josserand (2019) ● Malin & Chandler (2017) ● Newlands (2021) ● Ravenelle (2017) ● Reid-Musson et al. (2020)
Idle / unstable work hours: Encompasses the requirement of dealing with the instability of service hours (days with many hours of work, days with few hours of work, and also the interval between one work demand and another).	● Altenried (2020) ● Bulian (2021) ● Crain et al. (2020) ● Fabrellas (2019)	● Gregory (2021) ● Hunt & Samman (2020) ● Jan (2018) ● Kahancová et al. (2020)	● Kaine & Josserand (2019) ● Poon (2019) ● Reid-Musson et al. (2020)
Time pressure: Indicates the requirement to perform services in a short period of time that often disregards the conditions necessary to meet the deadline defined, increasing the possibility of risky behaviors.	● Gregory (2021) ● Hunt & Samman (2020)	● Kahancová et al. (2020) Köbis et al. (2021)	
Work overload / Long working days: Refers to the need to work long hours to achieve the economic performance needed for subsistence and/or required by the platform, leading to overload.	● Barros & Raymundo (2021) ● Chen & Sun (2020) ● Crain et al. (2020)	● Del Bono (2019) ● Gregory (2021) ● Jan (2018)	● Kahancová et al. (2020) ● Köbis et al. (2021) ● Poon (2019)

Use of technology: Refers to the need to learn how to use technology to perform the work (especially an older audience).	● Barros & Raymundo (2021)
Ergonomics: Refers to the demands on the body, including repetitive movements and many hours working in the same position.	● Bajwa et al. (2018) ● Barros & Raymundo (2021)
Work-family conflict: Refers to the intrusion of work into domestic space and time (real and symbolic), interfering with family dynamics.	● Barros & Raymundo (2021) ● Chinguno (2019)

Present Resources	**Source**		
Autonomy / Flexibility: Refers to the ability to work flexibly in terms of time, place, and ways of working. It includes the possibility of creating one's own work routines, refusing tasks, working for different platforms, and not reporting to a direct boss. However, this characteristic is cited with reservations in many cases, with greater autonomy being attributed to those who develop more specialized work.	● Altenried (2020) ● Arcidiacono et al. (2019) ● Bajwa et al. (2018) ● Barros & Raymundo (2021) ● Brawley (2017) ● Bulian (2021) ● Chen & Sun (2020) ● Chinguno (2019) ● Corujo (2017) ● Crain et al. (2020)	● Del Bono (2019) ● Fabrellas (2019) ● Fielbaum & Tirachini (2021) ● Fieseler et al. (2019) ● Gregory (2021) ● Harpur & Blanck (2020) ● Healy et al. (2020) ● Hunt & Samman (2020) ● Idowu & Elbanna (2020) ● Jan (2018)	● Jarrahi et al. (2020) ● Kaine & Josserand (2019) ● Köbis et al. (2021) ● Malin & Chandler (2017) ● Poon (2019) ● Ravenelle (2017) ● Rosenblat & Stark (2016) ● Reid-Musson et al. (2020) ● Sutherland et al. (2020) ● Yao (2020)
Informational support / Security: The monitoring by platforms allows for a greater sense of security, both in the case of financial transactions and in the performance of work (e.g. a standardized service protocol, including routes to be followed, helps to avoid arguments with customers, and protects against urban violence; the exact location of the customer offered by the app favors good performance).	● Jarrahi et al. (2020) ● Köbis et al. (2021) ● Newlands (2021) ● Rosenblat & Stark (2016) ● Newlands (2021)		
Intermediation of communication with customers: The communication infrastructure provided by the platform allows for easier and more precise interaction	● Fielbaum & Tirachini (2021) ● Jarrahi et al. (2020)		

between customers and workers, and helps in conflict resolution.	● Köbis et al. (2021)		
Customer appraisal system: The customer appraisal system (provided by the organization or organized in parallel by the workers) allows for more confidence in the workers' choice about who they will interact with in the service.	● Altenried (2020) ● Cockayne (2016) ● Köbis et al. (2021)		
Informal social support: Workers have informal access to social support via forums, social networks, and collective movements , either to exchange experiences or to collectively build forms of resistance.	● Altenried (2020) ● Brawley (2017) ● Bulian (2021) ● Chesta et al. (2019)	● Chinguno (2019) ● Gregory (2021) ● Idowu & Elbanna (2020)	● Jan (2018) ● Kaine & Josserand (2019) ● Reid-Musson et al. (2020)
Social interaction: For the audience of older workers, social interaction was highlighted as a facilitator provided by digiwork.	● Barros & Raymundo (2021)		
Sense of belonging and identity building: Digiwork allows opportunities for personal expression and the building of a social identity by cultivating relationships with people in the same professional community.	● Arcidiacono et al. (2019) ● Harpur & Blanck (2020) ● Jan (2018)		
Learning: Some platforms offer on-the-job training, enabling the learning of social-emotional skills and development of on-the-job experience.	● Harpur & Blanck (2020) ● Hunt & Samman (2020) ● Yao (2020)		
Less discrimination / Low barriers to entry: Platforms offer anonymous entries to work, with a low need for detailed information about workers, especially for the disabled audience.	● Arcidiacono et al. (2019) ● Fieseler et al. (2019) ● Harpur & Blanck (2020)	● Healy et al. (2020) ● Köbis et al. (2021) van Doorn (2017)	
Compensation and benefits: Among the most vulnerable working population (e.g. domestic workers and people with disabilities - PWDs), digiwork appears to offer better compensation and benefits packages than other work alternatives.	● Harpur & Blanck (2020) ● Hunt & Samman (2020)		
Remote work / Expanded geographical barriers: The remote model allows workers to expand their	● Chinguno (2019) ● Fieseler et al. (2019)	● Harpur & Blanck (2020) Jarrahi et al (2020)	

employment possibilities beyond geographical boundaries; it is attractive for residents of disadvantaged locations or who have difficulty with mobility.	
Technology knowledge: Technology knowledge is a personal resource for those already working in the industry.	● Barros & Raymundo (2021) ● Idowu & Elbanna (2020)
Nature of the activity: Some digiwork modalities may be intrinsically motivating, being defined as fun; a light "game"; allowing the development of a "sporting spirit."	● Jan (2018) ● Malin & Chandler (2017)
Task variability: The opportunity to develop different tasks allows for the learning of new routines and skills, especially in the case of crowdworkers acting as online freelancers.	● Kaine & Josserand (2019) ● Sutherland et al. (2020)
Identification with the task: In the case of more specialized jobs, the worker identifies with what they do, producing sense.	● Ravenelle (2017)
Work-family balance: Digiwork allows for a better balance between family and work demands compared to traditional arrangements.	● Bulian (2021)

Missing Resources		**Source**
Transparency: Lack of transparency regarding decisions and the operation of the platform, preventing workers from understanding the rules and being able to resort to potential penalties. There are few options for appeal in the case of unfair treatment - few opportunities for workers to have a voice . Deactivation of workers' accounts may be done unilaterally, without any kind of explanation. In some cases, information regarding the client and their history is missing.	● Crain et al. (2020) ● Del Bono (2019) ● Fielbaum & Tirachini (2021) ● Fieseler et al. (2019) ● Gregory (2021)	● Jarrahi et al. (2020) ● Kaine & Josserand (2019) ● Ravenelle (2017) ● Reid-Musson, MacEachen, & Bartel (2020) ● Rosenblat & Stark (2016) ● Sutherland et al. (2020)
Communication with the platform: Digiworkers co-exist with the absence of proper communication with the platforms, from the moment of registration (they must	● Crain et al. (2020) ● Gregory (2021)	● Jan (2018) Rosenblat & Stark (2016)

automatically accept what is presented in the app, with no possibility of negotiation) to the execution of daily activities (they receive standardized answers to their questions).			
Autonomy: Lack of autonomy is highlighted with regard to control over critical aspects of the work, chances to decide which tasks to perform, and possibilities to negotiate values or other important aspects with consumers.	● Bajwa et al. (2018) ● Fieseler et al. (2019) ● Del Bono (2019) ● Ravenelle (2017)	● Reid-Musson et al. (2020) ● Rosenblat & Stark (2016) ● Sutherland et al. (2020) ● Yao (2020)	
Social protection / Social security rights: The absence of social protection backed up by legal regulations means that digiworkers have to deal with the absence of rights in a wide variety of areas, including, for example, health insurance, leave in the case of accidents, labor compensation, minimum wage, limits on working hours or payment for overtime worked.	● Altenried (2020) ● Arcidiacono et al. (2019) ● Bulian (2021) ● Cardoso & Oliveira (2020) ● Chesta et al. (2019) ● Chinguno (2019) ● Corujo (2017) ● Crain et al. (2020)	● Dablanc et al. (2017) ● Fabrellas (2019) ● Gregory (2021) ● Harpur & Blanck (2020) ● Healy et al. (2020) ● Hunt & Samman (2020) ● Jan (2018) ● Kahancová et al. (2020)	● Köbis et al. (2021) ● Malin & Chandler (2017) ● Ravenelle (2017) ● Reid-Musson et al. (2020) ● Rosenblat & Stark (2016) ● Shapiro (2020) ● Van Doorn (2017) ● Wuytens & De Groof (2019)
Recognition: Digiworkers receive no recognition for the work they do, which is often just like a side hustle. Thus, they suffer from devaluation and a low status.	● Barros & Raymundo (2021) ● Cockayne (2016)	● Yao (2020)	
Career development: Digiwork offers few opportunities for career advancement or development.	● Idowu & Elbanna (2020) ● Jan (2018)	● Yao (2020)	
Formal social support: They have low access to formal social support, lacking formal spaces of articulation and socialization with peers and/or groups of collective representation , such as unions.	● Arcidiacono et al. (2019) ● Bajwa et al. (2018) ● Bulian (2021) ● Cardoso & Oliveira (2020)	● Chinguno (2019) ● Dablanc et al. (2017) ● Fabrellas (2019) ● Fielbaum & Tirachini (2021) Fieseler et al. (2019)	● Gandini (2019) ● Hunt & Samman (2020) ● Kahancová et al. (2020) ● Köbis et al. (2021)

Infrastructure: Digiworkers do not have a formal place where they can go during their breaks and/or to interact with customers or peers.	• Brawley (2017) • Crain et al. (2020)	• Dablanc et al. (2017) • Fieseler et al. (2019)

Source: Prepared by the authors

The demands raised may be grouped according to their nature. Some of them are related to the relationships established with the organization (imprecision in work categorization, surveillance and control carried out through algorithmic management, self-management of risks, and performance appraisal system), and others to the exercise of the work (microtasks, emotional work, unpredictability, salary uncertainty, job insecurity, time pressure, overload, idle/unstable work hours, use of technology, ergonomics, and work-family conflict). With regard to the first group, the emphasis given in the publications to surveillance and control through algorithmic management is striking. This is a demand quite peculiar to the digiwork arrangement, in which the worker is subjected to constant monitoring through the use of digital technologies. In the second group, salary uncertainty and job insecurity stand out. Both are related to the digiworkers' need to be at the platform's disposal for a longer period of time, generating long working hours made up of many idle hours.

It is noteworthy that most of the mapped demands may be classified according to the proposal of Crawford et al. (2010) as restrictive, with emotional labor being the only one reviewed in a dubious way (either as a challenging or restrictive demand depending on the context). It is also worth noting that many of them (imprecise job categorization, unpredictability, salary uncertainty, job insecurity, idle/unstable work hours) share a common characteristic: insecurity, which is one of the demand factors most cited in the literature (e.g. Schaufeli & Taris, 2014), and is also evaluated as one of the most detrimental to workers' health (Moscon et al., 2022). This characteristic refers to fear and instability, requiring digiworkers to frequently mobilize their own resources (financial, cognitive, affective) and leading them, not infrequently, to frustration regarding their personal growth and goal achievement (Bakker, Demerouti, & Sanz-Vergel, 2014).

In the field of resources, flexibility stands out as the most striking characteristic present in digiwork. However, studies approach this flexibility with reservations, because although they supposedly may choose when, how and where to work, workers have their autonomy conditioned to the need for survival and to the control (often disguised) exercised by the intermediating platforms, as already discussed in the explanation about demands. Filgueiras and Antunes (2020), for example, emphasize that these ideals are often put aside by the need to meet the demands of customers, and to work specific schedules that ensure higher pay and the number of tasks delegated to them. This scenario is in line with the notion of demutualization of risks: autonomy and flexibility, which pass on the idea of entrepreneurship, transfer to workers responsibilities previously assigned to organizations (De Stefano, 2016), generating new demands on them. This configuration then leads to the absence of labor benefits such as medical leave in the case of work accidents, maximum working hours, and a wage floor to ensure adequate subsistence for the worker. Paradoxically, autonomy also gains evidence among the mapped studies as a missing resource, since digiworkers are denied control over critical aspects of the work: they are often prevented from choosing which tasks to perform, and from negotiating values or other important aspects of the transaction with consumers.

Next, the most important resource highlighted is informal social support, built up by workers through social networks that allow the exchange of experiences, and the construction of collective forms of resistance. Among the other resources, some refer to very specific advantages of the digiwork, such as informational support regarding financial transactions and/or the way work is performed, infrastructure for intermediating communication with customers, and customer

appraisal systems, which may work as protective factors for the worker. Others encompass advantages in comparison with traditional work arrangements.

Final remarks

This study allowed a broad characterization of the digiwork design, identifying its main demands and main resources (present or absent) that interfere in the worker's experience. Thus, it denounces the flagrant imbalance between the demands to which the worker is subjected, and the resources they may resort to in order to adequately cope with such demands, which may generate damage to their health and well-being (Carneiro, 2021; Moscon et al., 2022).

Knowing the characteristics that interfere in workers' motivational process and in the attrition process may contribute to more effective work redesign interventions in favor of reducing restrictive demands, increasing challenging demands, and investing in the generation of resources identified as absent (e.g. Bakker & Demerouti, 2017). Likewise, it may contribute to researchers wishing to look at specific demands and resources mapped in order to review the relationships they establish and that have important consequences for work and workers.

The broader characterization of this work arrangement, however, inherently runs into the limitation of not being able to account for the particularities concerning each of its work segments. Although all digiwork modalities share the fact that they are on-demand hires via intermediating digital platforms (De Stefano, 2016), there is a great diversity of tasks developed and worker profiles to which the attention of future studies should be directed. In this sense, we suggest, as a research agenda, that the characteristics of the digiwork design be mapped according to the type of service provided, and considering the different forms of intermediation (for example: who controls pricing – the worker, customer or platform?) that may configure more or less flexible jobs. Comparisons between workers with higher or lower levels of qualification could also allow us to understand if the imbalance between demands and labor resources is present for all workers who are part of this arrangement or if the experience of precarization changes depending on the degree of specialization required to perform the tasks.

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Inclusive language

The authors use inclusive language that recognizes diversity, demonstrates respect for all people, is sensitive to differences, and promotes equal opportunity.

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