



Exploring the Implications of Working Conditions for Corporate Sustainability in Last-Mile Delivery Platform Companies

Annachiara Longoni¹ · Sergio Salas¹ · Cristina Sancha¹ · Vicenta Sierra¹ · Frank Wiengarten¹

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Abstract

Last-mile delivery platforms have recently emerged as effective business models to match supply and demand, even though they have been criticized for potentially exploiting their workers. This paper investigates the corporate sustainability and socio-economic trade-offs of platform companies in relation to working conditions (i.e., work relationships, social subsystems, and technical subsystem). A survey of 392 paid-per-order workers from six food delivery platforms across Spain was conducted to validate our research framework. Our findings provide a nuanced understanding of the impact of working conditions on corporate sustainability in platform companies. On the one hand, there are positive implications for both social and economic sustainability in the presence of higher earnings, rights and protections, and empowerment for workers. Conversely, prolonged work relationships between workers and platform companies are negatively related to workers' perceived stress and individual performance. Based on these insights, we advance our understanding of how platform companies can deal with conflicting objectives regarding working conditions by adopting an instrumental approach in the case of short-term workers and an integrative approach with long-term workers.

Keywords Social sustainability · Worker well-being · Last-mile delivery · Sharing economy

Introduction

The sharing economy is revolutionizing traditional economic models by, for example, giving rise to delivery platform companies for distributing food services and other products, such as Uber Eats, Deliveroo, or Glovo. The existence of a coordinated central platform that matches restaurants, customers, and independent workers who are acting as service providers has been suggested to increase wealth for all

involved actors (Etter et al., 2019). All in all, these platforms help in making the transactional process more effective and the underlying operational processes more efficient by benefiting companies and consumers (Pourrahmani & Jaller, 2021) and providing job opportunities for delivery drivers (henceforth referred to as workers) (Pourrahmani & Jaller, 2021; Upadhyay et al., 2021).

In this paper we investigate corporate sustainability of this business model meant as the management of conflicting goals related to multiple sustainability dimensions (i.e., social and economic sustainability) (Hockerts and Searcy, 2023). Indeed, platform companies have been criticized from an ethical perspective in relation to worker exploitation (Fieseler et al., 2019; Chai and Scully, 2019; Etter et al., 2019; Ahsan, 2021) with an impact on the social and economic sustainability of platform companies. Noronha and Premilla D'Cruz (2022) call for developing an understanding of how platform companies can develop sustainable business models to deal with the socio-economic trade-offs associated with working conditions.

Worker exploitation is defined as the “harmful, merely instrumental, utilization of an individual or her capacities for one's own advantage or ends in a transaction” (Buchanan,

✉ Annachiara Longoni
annachiara.longoni@esade.edu

Sergio Salas
sergio.salas@esade.edu

Cristina Sancha
cristina.sancha@esade.edu

Vicenta Sierra
vicenta.sierra@esade.edu

Frank Wiengarten
frank.wiengarten@esade.edu

¹ Esade Business School – Ramon Llull University,
Avinguda de la Torre Blanca, 59, Sant Cugat del Vallès,
08172 Barcelona, Spain

1988, p. 87). Although a transaction—such as the one between workers and platform companies—benefits both parties involved, one party might not benefit sufficiently by some applied standard of equity or equality (Arnold & Bowie, 2003). In platform companies, worker exploitation is associated with the classification of platform workers as independent contractors who are only paid on demand for each delivery (Cachon et al., 2017). Thus, companies have been accused to externalize the costs of flexibility to workers while controlling them and limiting their autonomy through the algorithm used to assign orders (Pulignano et al., 2023). The constant monitoring of worker performance and use of ratings to assign orders can create lock-in situations, making it difficult for workers to manage their time in a flexible way or change platforms, and this lack of autonomy can lead to worker exploitation (Berg et al., 2018; Jabagi et al., 2019). In addition, worker exploitation stems from unfair working conditions, such as work instability, because workers can be deactivated or their working hours reduced without notice (Anjali Anwar et al., 2021); low earnings and “unpaid labor” for the time made available to platform companies while waiting for delivery orders (Pulignano et al., 2023); and limited rights and protections because this type of workers is not eligible for minimum wages or other benefits (Fieseler et al., 2019). In addition, workers have to invest in their own vehicles and protective equipment, resulting in significant expenses and, on the other hand, in inhomogeneity in the ability to deliver the job and potentially unsafe working conditions (Castillo et al., 2021; Mbare, 2023).

Working conditions in last-mile delivery platform companies are widely discussed by governments and policy makers, questioning whether delivery workers should be treated as employees and should be provided with a better work environment both from the social and technical perspectives (European Commission, 2021). For platform companies, such change in the status of workers might benefit their social sustainability but may be unsustainable from an economic perspective because, in countries in which regulatory rules were introduced to protect workers, some companies decided to leave or go out of business (Ahsan, 2021; Steer et al., 2021). Thus, we pose the following research question: *What is the relationship between working conditions in platform companies and perceived individual workers' well-being (i.e., stress and fatigue) and performance?* Answering this research question will allow us to understand whether platform companies can adopt an instrumental approach in managing conflicting objectives, optimizing both social and economic sustainability (Gao & Bansal, 2013; Hahn & Figge, 2011) when dealing with working conditions. Thus, we hypothesize that decent working conditions in terms of work relationship (i.e., higher work stability, earnings, and rights and protections (Campbell & Price, 2016)), social subsystem (i.e., the workers'

perceptions regarding perceived empowerment and involvement by the platform company (Jabagi et al., 2019)), and the technical subsystem (i.e., the quality of the transportation vehicles and protective equipment (Castillo et al., 2021)) can make the delivery platform business model more sustainable by understanding their impact on both the social and economic dimensions. We investigate social sustainability in terms of individual perceived well-being (i.e., stress and fatigue) (Godard, 2001) and economic sustainability using perceived individual performance (i.e., customer satisfaction and delivery performance) as a proxy of the effectiveness of the platform company operations and economic performance (Berg et al., 2018).

To test our hypotheses, we conducted a survey involving 392 paid-per-order workers on last-mile food delivery platform companies in Spain. Our analysis reveals that decent working conditions characterized by higher earnings, rights and protections, and perceived empowerment are associated with lower perceived stress and higher perceived individual performance, which is in line with an instrumental view of corporate sustainability. In addition, the technical subsystem related to the presence of motor vehicles and protective equipment reduces worker's perceived fatigue. However, higher work stability comes at a cost for both workers and companies, being associated with higher perceived stress and lower perceived individual performance, hence showing that there are tensions between independent workers and platform companies that cannot be fully resolved in the case of long-term workers. This evidence contributes to the business ethics and management literature by making multiple theoretical, policy, and managerial advancements in the sharing economy setting and platform companies.

Literature Review

Corporate Sustainability in Last-Mile Delivery Platform Companies

Sharing economy sectors, such as the platform-based last-mile delivery industry, are built on the principle of matching supply and demand through a crowdsourced labor force (Belk, 2014; Benjaafar & Hu, 2020; Etter et al., 2019). Platform-based companies, such as UberEats, Deliveroo, and Glovo, have emerged in recent years and have reshaped service offerings through redesigning workflows and processes in the last-mile food delivery industry. The delivery process is managed by an algorithm and carried out by nominally independent delivery workers to increase service flexibility and efficiency.

Advocates of the sharing economy propose an instrumental win-win perspective of the corporate sustainability of platform companies because they should provide

benefits for all involved stakeholders, such as those managing the platform, the workers, and the customers (Scholz, 2013). Thus, they advance that the sharing economy allows for using untapped resources (such as workers in the case of last-mile delivery platforms) in an efficient way and even reduces poverty and inequality by providing employment opportunities (Botsman & Rogers, 2010).

On the other hand, in recent years, a debate regarding the ethical implications of the platform business model has emerged. Specifically, business ethics scholars have suggested that platform companies are in a dominant, powerful position, and in many cases, this could lead to the exploitation of workers (Schor & Attwood-Charles, 2017; Minter, 2017; Fieseler et al., 2019). Most platform companies are viewed as having a short-term orientation toward profit maximalization at the expense of exploited workers (e.g., Srnicek, 2016). Worker exploitation might be seen as a consumption of human capital to a maximum “carrying capacity” (Daily & Ehrlich, 1992) with negative consequences for corporate sustainability.

According to Haffar and Searcy (2017), the conflict between competing sustainability–profitability objectives should be managed by considering the different stakeholders’ perspectives (i.e., workers and platform company). In this sense, the worker perspective should be considered, and the worker exploitation issue should be addressed to manage corporate sustainability and socio-economic trade-offs in platform companies. In the present paper, we build on the management view of worker exploitation as described by Gutierrez-Huerter et al. (2023) and suggest that such a trade-off should be acknowledged and managed by platform companies. This might lead to a win–win situation if the bundles of practices associated with worker exploitation are identified and overcome by establishing decent working conditions. In such context, decent working conditions are meant as going beyond the exploitation level in terms of earnings, rights and protections, work security and health and safety (Gutierrez-Huerter et al., 2023).

To identify such bundles, we build on previous business ethics literature labeling the work relationship between platform companies and workers as unfair and exploitative (Fieseler et al., 2019; Ahsan, 2021) and on the human resource management and information technology literature considering the social and technical subsystems that are characterizing the platform as crucial in understanding their effects on working conditions (Pugliano et al., 2023; Dedema and Rosenbaum, 2024). Indeed, specific socio-technical systems can be put in place in relation to different platform settings affecting the social and economic sustainability of platform companies (Pugliano et al., 2023).

Work Relationship in Last-Mile Delivery Platform Companies

A first key aspect of working conditions that has been suggested to be associated with worker exploitation is the work relationship between workers and platform companies (Fieseler et al., 2019; Ahsan, 2021; Chai & Schully, 2019). Several authors have noted that such work relationships are characterized by limited work stability, low earnings and the absence of rights and protections (Jabagi et al., 2019).

In the organizational and management literature, the work relationships between delivery workers and platform companies have traditionally been analyzed from the companies’ perspective, identifying the benefit of matching supply and demand in a flexible way because of an always available workforce at no cost (Archetti et al., 2016; Arslan et al., 2019). Recently, an extensive body of research in business ethics has criticized this overly simplistic view of efficiency and flexibility gains achieved on the backs of workers (Pulignano et al., 2023). The work relationship between the worker and platform company has become increasingly transactional, temporary, virtual, and characterized by strong power asymmetries between the partners involved (Fieseler et al., 2019; Winby & Mohrman, 2018).

The first aspect analyzed in relation to the worker relationship between workers and platform companies is the low earnings of workers (Fieseler et al., 2019). The sharing economy allows platform companies to gain higher benefits in terms of flexibility, and the related costs are assumed by workers. Indeed, platforms are associated with the notion of unpaid labor that exists in a proximate relationship with paid work and is defined as unremunerated working time that directly contributes to the completion of platform tasks, such as time spent waiting for new deliveries (Pulignano et al., 2023). As a result, workers are formally independent, but they earn relatively low wages after deducting expenses, and many are forced to drive for long hours to mitigate low hourly earnings (Rosenblat, 2018).

Another key aspect is the short-term relation between the worker and platform, a relationship that can be interrupted any time by the platform with no justification (Anjali Anwar et al., 2021), which is a key feature of platform workers’ experience of “algorithm insecurity” (Wood & Lehdonvirta, 2022).

A further element associated with worker exploitation and the work relationship is the lack of rights and protections, as suggested by Fieseler et al. (2019), showing that, on many of these platforms, workers have limited options to raise their voices. Similarly, Chai and Scully (2019) explore labor issues in the sharing economy with a view to power imbalances between workers and owning and managing the platform, leading to unequal exchange and injustice. Overall, Etter et al. (2019) point out that

platform-based workers in the sharing economy, such as the delivery workers in our study, are faced with exploitative work relationships that offer little earnings, work security, and representation.

Worker exploitation negatively affects the well-being of workers (e.g., increasing perceived stress and deteriorating health) (Jabagi et al., 2019; Mbare, 2023) as well as their individual performance in delivering the service (Friedman, 2014). Similar to recent studies in disciplines such as human resources management, industrial relations, sociology, and operations management, we propose that worker exploitation has negative implications on platform workers' well-being and performance (Jabagi et al., 2019). Specifically, workers under constant exploiting working conditions in terms of monetary rewards, losing their work, and lack of voice will likely suffer detrimental effects on their perceived well-being. Several studies in more traditional business contexts show that work relationships characterized by low work stability, low earnings, and rights and protections—such as in the case of platform work—might result in economic and social insecurities for workers, apart from the impact of physiologically and psychologically stressful and possibly harmful working conditions on their well-being (Berry & Bell, 2018; Fisher & Connelly, 2017). Over 20 years ago, Dekker and Schaufeli (1995) published their findings on the longtime negative relation between perceived work insecurity and psychological health and well-being. In 2016, de Witte et al. conducted a meta-analysis on the health implications of work insecurity, concluding that it is widely known that job insecurity is a work stressor. Furthermore, work insecurity affects health and well-being, leading to detrimental individual, company, and societal consequences.

In addition, studies on working conditions have demonstrated that workers who are at risk, stressed, and unhealthy do not contribute as well as they could to the organization (Pagell et al., 2015) and typically show low levels of individual performance at work (Guest, 2004). Indeed, exploitative work relationships may lead to degraded work attitudes and disrupted work behaviors as well as a lack of organizational commitment and organizational citizenship behaviors (Allan et al., 2021; Jiang et al., 2012).

On the other hand, we propose that decent work relationships characterized by higher work stability, earnings, and rights and protections will result in better perceived individual well-being and performance (Guest, 2004), being a win-win approach in terms of socio-economic trade-offs. Thus, in the present study, we assess the potential direct effects of work relationships characterized by different levels of work stability, earnings, and rights and protections on workers' perceived individual well-being (i.e., stress and fatigue) and performance outcomes. We hypothesize the following:

H1A Work relationships characterized by (a) higher levels of work stability, (b) higher levels of earnings, and (c) higher levels of rights and protections negatively influence delivery workers' individual perceived stress level.

H2A Work relationships characterized by (a) higher levels of work stability, (b) higher levels of earnings, and (c) higher levels of rights and protections negatively influence delivery workers' individual perceived fatigue level.

H3A Work relationships characterized by (a) higher levels of work stability, (b) higher levels of earnings, and (c) higher levels of rights and protections positively influence delivery workers' perceived individual performance level.

Social and Technical Subsystems in Platform-Based Mile Delivery Companies

In addition, we build on socio-technical (STS) theory to identify the key aspects describing working conditions beyond the work relationship. The underlying assumption of STS theory is that an organization or a work unit is “an entity that can be separated into parts, which are all simultaneously linked to each other in a specific way” (Vermaas et al., 2011, p. 68). These parts comprise a social subsystem including the people who work within it and include their work-related attitudes and experiences; and a technical subsystem involving the tools, techniques, procedures, and devices used by members of the social system to accomplish their tasks (Pasmore et al., 1982). Another foundational assumption is that these two subsystems are deeply and inextricably entangled in a single socio-technical system; people and technologies are in relationships of mutual shaping (Cartelli, 2007). Recent literature in human resources management and information technology suggests that, to understand the implications on working conditions in platform companies, it is important to consider both the social and technical subsystems (Dedema & Rosenbaum, 2024). Therefore, we use the socio-technical perspective to explore the key aspects related to the work environment and their intended and unintended consequences on the social and economic sustainability of platform companies.

A first element of the social subsystem underlying platform companies investigated by recent studies is workers' perceptions and experiences of limited empowerment and involvement (Deng et al., 2016; Jabagi et al., 2019; Pulignano et al., 2023). This aspect is another element resonating with the definition of worker exploitation provided in the business ethics literature. Indeed, the way to overcome worker exploitation in the platform setting is to provide workers with autonomy and freedom to decide (Fieseler et al., 2019; Hickson, 2023).

In the context of platform work, empowerment is defined as the ability to make decisions autonomously regarding work aspects (as opposed to full control by the platform) (Mbare, 2023) and involvement of workers (Jabagi et al., 2019). However, most studies show that platforms exert pressure on the worker in terms of monitoring their actions, measuring delivery times, and controlling the number of orders accepted/rejected, all of which condition the next orders that will be assigned to the worker and limit their autonomy and involvement in decision-making (Ahsan, 2021). Chai and Scully (2019) suggest that the nature of work in the sharing economy oscillates between understandings of workers as empowered entrepreneurs who enjoy independent flexibility and exploited digital workers oscillating between platform companies in search of the next job/task. Related to this, Deng et al. (2016) find that platform work is framed by a duality of marginalization and empowerment. This marginalization is often associated with limited autonomy and perceived control for the worker, whereas empowerment stems from perceived worker autonomy and engagement in platform work. Castillo et al. (2021) highlight the importance of guaranteeing the worker's autonomy when improving platform system effectiveness in the presence of an on-demand work relationship for more respectful working conditions. In this sense, Mbare (2023) provide evidence that a key aspect for food delivery platform workers in Helsinki was the possibility to control and freedom of choosing where and when to work, the duration of work, and the freedom of the work arrangement. Furthermore, drawing on self-determination theory, Jabagi et al. (2019) suggest that the adoption of human resources management practices facilitating empowerment and involvement may provide platform workers with more respectful working conditions. These contributions hint at the fact that the worker's perception and experience of the social subsystem of platform work arrangement, here in terms of empowerment and involvement, contribute to describing the working conditions of the platform and the worker and their individual outcomes.

Subsequently, we propose that decent working conditions resonate with a social subsystem meant as high empowerment and involvement—as opposed to worker exploitation through a social subsystem meant as limited autonomy and perceived control—is important for the delivery workers to perform and be well and manage possible trade-offs between social and economic sustainability performance. Berg et al. (2018) indeed suggest that, to be decent and positively affect worker well-being, platform work should be designed to facilitate empowerment and involvement. In general, most of the human resource management literature building on self-determination theory and job demand and control models posits that empowerment and involvement are fundamental psychological needs that positively influence well-being and positive outcomes in various life domains, including work

(Deci & Ryan, 2012; Karasek, 1979). Likewise, the literature on platform work builds on these theories to show how empowerment and involvement are relevant to building a decent work environment for platform workers (e.g., Jabagi et al., 2019).

Applying this to our study, platform companies that allow their workers to be empowered to make decisions in terms of their working hours or speed of work and are generally more involved in the decision-making process of the company should perceive higher levels of well-being and individual performance. Thus, social subsystem of platform companies empowering workers and providing opportunities for involvement are associated with more respectful working conditions and workers' perceived well-being (i.e., stress and fatigue) as well as better perceived individual outcomes and, thus, better social and economic sustainability. Thus, we hypothesize the following:

H1B Social subsystems characterized by (a) higher levels of perceived empowerment and (b) higher levels of perceived involvement negatively influence delivery workers' individual perceived stress level.

H2B Social subsystems characterized by (a) higher levels of perceived empowerment and (b) higher levels of perceived involvement negatively influence delivery workers' individual perceived fatigue level.

H3B Social subsystems characterized by (a) higher levels of perceived empowerment and (b) higher levels of perceived involvement positively influence delivery workers' individual perceived individual performance level.

In advancing our thinking of decent working conditions in platform companies and social sustainability, our analysis builds on the socio-technical notion that recognizes that “technology is not neutral” (Bélanger and Edwards, 2007, p. 717), such that it offers a more or less favorable ground for decent work. Most previous studies have focused on the technical aspects in terms of algorithms used to assign on-demand orders and their impact on costs and flexibility for platform companies (Benjaafar & Hu, 2020). However, the technical subsystem also encompasses the means and equipment used by workers (Pasmore et al., 1982), which affects their ability to perform their jobs. In addition, the algorithm used is quite homogeneous among platforms, and it is implemented in the same way for all workers (Berg et al., 2018). In contrast, other elements characterizing the technical subsystem, such as transportation vehicles and protective equipment, depend on the means available to these independent workers and are crucial technical aspects of the last-mile delivery industry from the workers' perspective and in terms of worker exploitation (Castillo et al., 2021).

Indeed, the quality of such technical components might influence the individual well-being performance of workers in terms of perceived stress and fatigue and their performance because they allow access to jobs/orders to a different extent and, thus, the social and economic sustainability of platform companies. However, most platform companies require workers to own their own transportation vehicles and do not set any norms regarding the type of vehicle and protective equipment to be used. Platform companies externalize such costs to workers and do not consider these elements in the assignment of orders and leave the burden to workers to accomplish their tasks with the means available. This aspect is connected to worker exploitation in two main ways: one is related to the generation of power imbalance between the workers and the platform companies and the other to the unsafe working conditions in which workers might be operating (Gutierrez-Huerter et al., 2023). Platform workers utilize privately owned vehicles (e.g., motorbike, scooter, bicycle) that often have different features affecting their ability to answer the platform company's on-demand requests (Mbare, 2023). The various attributes of the vehicle, such as its versatility in terms of the length of the route or the parcel size that can be facilitated, may affect a worker's ability to respond to the platform's on-demand requests. For example, a more versatile vehicle allows for an increase in the volume of orders delivered and speed of delivery (Van der Loo & Koopmans, 2019). Thus, workers who have available a motor vehicle are more versatile, with a positive impact on their individual performance in terms of speed and customer satisfaction. These workers might be a more valuable resource for the platform company and are in a better position in a "negotiation" compared with workers delivering orders with traditional bikes, thus reducing these more "advantaged".

workers' exploitation and stress. Second, the type of vehicle might be associated with the possibility of delivering more orders in less time. On the other hand, workers with nonmotor bikes might be required to work more hours for the same pay. Thus, the possibility of having a motor vehicle might reduce fatigue compared with workers delivering orders with traditional bikes, even if it might increase the risks of accidents (Cai et al., 2019). Similarly, platform workers may (or may not) adopt protective equipment while performing their jobs. Research in the health and safety field has shown that protective measures are crucial for a healthy and productive work environment (Veltri et al., 2013). In general, the literature shows that protective equipment can reduce accidents (Lutz et al., 2017) and improve workers' individual performance by increasing productivity and efficiency thanks to a more comfortable work environment (Bielecki, 2017; Tarvainen et al., 2020).

Subsequently, we propose that a technical subsystem characterized by motor vehicles and protective equipment

might be associated with decent working conditions that have positive impacts on both the social and economic sustainability of platform companies and hypothesize the following:

H1C Technical subsystems characterized by (a) motor transportation vehicles and (b) more protective equipment negatively influence delivery workers' individual perceived stress level.

H2C Technical subsystems characterized by (a) motor transportation vehicles and (b) more protective equipment negatively influence delivery workers' individual perceived fatigue level.

H3C Technical subsystem characterized by (a) motor transportation vehicles and (b) more protective equipment positively influence delivery workers' individual perceived individual performance level.

Figure 1a–c, summarize our hypotheses describing the relationship between working conditions in platform companies and workers' perceived individual outcomes.

Methodology

Questionnaire Design and Data Collection

To study the relationship between working conditions and workers' individual outcomes, we designed a structured survey. The survey was administered from March 31 to May 15, 2021, in person to workers delivering orders for the six most prominent last-mile food delivery companies across six major cities in Spain: Barcelona, Bilbao, Madrid, Sevilla, Valencia, and Zaragoza. The last-mile of the food delivery industry has experienced tremendous growth in the past three years in Spain. According to a recent survey (AEOC, 2021), 55% of Spanish households order food online at least one time per month, making this a relevant context in which to study platform last-mile delivery companies. Last-mile delivery platform companies started to appear in Spain in 2013. Their operations differ from those of conventional food delivery, which is managed by restaurants selling their own products and employing their own workforce for delivery. Platform companies do not have physical stores open to the public; rather, they operate exclusively through the internet. They deliver food from third-party clients, here independent restaurants or local stores, and from their own associates, such as ghost kitchens; in most cases, their workers are paid per order through the platform.

Our survey included questions related to workers' sociodemographic variables, work relationships and

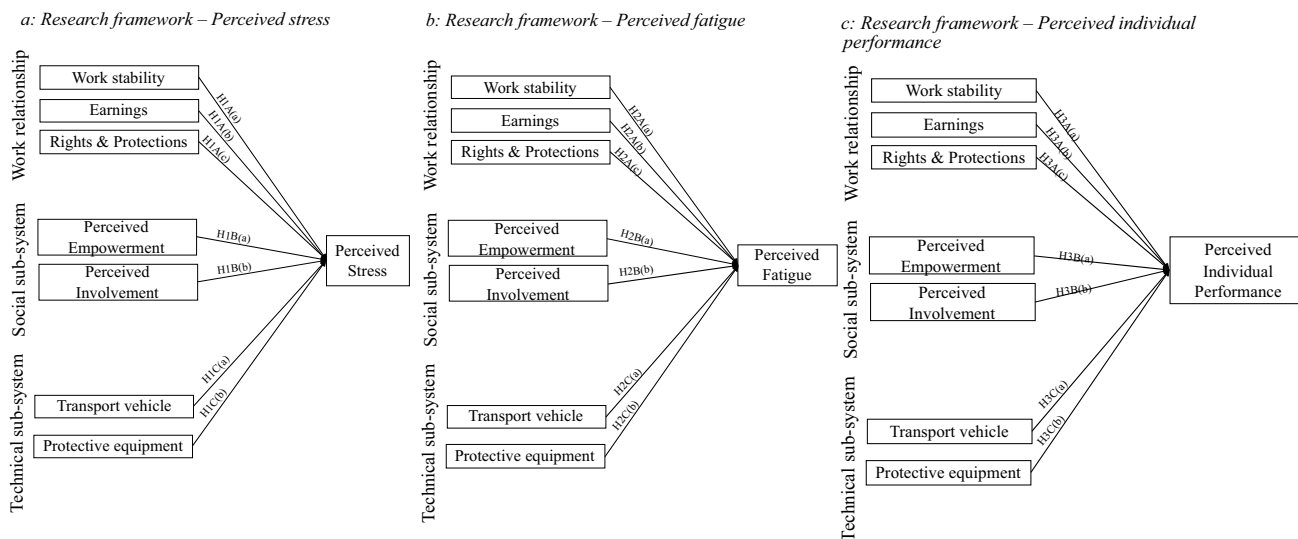


Fig. 1 **a** Research framework – perceived stress, **b** Research framework – perceived fatigue, **c** Research framework – perceived individual performance

arrangements of the social and technical subsystems, perceived individual performance, and well-being outcomes. Before administering the final version of the survey questionnaire, the survey was pre-tested with eight delivery workers to verify the clarity and the meaningfulness of the questions in the studied context. The main data collection was conducted through a market research agency. A member of the research team was in contact with the agency on a daily basis to coordinate the data collection process. To increase response rates, five €100 awards were assigned to the participants through a lottery. The anonymity of the responses was ensured because of the sensitivity of personal and work-related questions.

The process of collecting the data from the platform workers was as follows: First, we identified the main locations in each of the cities of interest where workers would stop while waiting to receive orders from platform companies (e.g., city centers and areas close to big restaurants). Because the platform companies do not necessarily know who their workers are because of a prevalent practice in Spain of obtaining worker’s platform accounts from the black market (Allievi, 2022), we found this sampling method the most appropriate to ensure a representative sample. The workers were approached in person and asked about their willingness to respond to the survey. We estimated that, on average, each worker had at least 12 min between deliveries, which was enough time to complete the survey, which took, on average, 10 min.

Once the data was collected and to ensure the robustness of our analysis, we cleaned the data. As the survey was conducted in person almost all the questionnaires were fully complete. Only two items (i.e., work stability and

protective equipment) in the whole data set had missing data (less than 15%). Only seven questionnaires coincided with missing data in both items. The distribution of items affected by missing data and the profile of respondents with missing data were examined compared to the overall sample and no systematic patterns and/or significant deviation from the overall average were observed. To preserve the overall distribution of the data, the replacement method based on central tendency statistics was adopted and missing values were substituted with average values.

We also checked for inconsistencies in data entry in case of open-ended questions. Specifically, we verified that protective equipment variables ranged from 0 to 4, and age was recorded as above 16 (the legal working age in Spain). No adjustments were required in this regard.

After completing the data cleaning process, the final dataset includes a total of 392 responses of paid-per-order last-mile food delivery workers in Spain. Table 1 provides an overview of the descriptive statistics of the sample used. Among the socio-demographic aspects considered, our sample accurately reflects the gender distribution prevalent in the last-mile delivery platform industry, which is characterized by a higher proportion of male riders compared to female riders (Arranz, 2020). This representation is crucial as it ensures that our findings are relevant and generalizable to the actual workforce in this industry.

To gain a deeper understanding of our sample’s composition and the various work relationship typologies related to all three studied dimensions (i.e., work stability, earnings, and rights and protections), we have included the results of a cluster analysis in Appendix A.

Table 1 Sample descriptives (n=392)

Variable	Frequency	Percentage
<i>Gender</i>		
Female	54	13.78
Male	338	86.22
<i>Education</i>		
Primary	29	7.40
Secondary	109	27.81
Post-secondary	161	41.07
Graduate and post-graduate	87	22.19
<i>Continent of origin</i>		
America	50	12.80
Europe	342	87.20
<i>Main occupation</i>		
Yes	331	84.44
No	61	15.56
<i>Household financial situation</i>		
Never have problems	118	30.10
Only sometimes	178	45.41
Frequent	96	24.49
<i>Drivers' preference for increased orders</i>		
Yes	352	89.80
No	40	10.40
Variable	Mean	SD
Age	30.54	8.65
Perceived likelihood of finding a similar or better job	2.96	1.27

Measures

To explore the impact of the different dimensions regarding working conditions in last-mile delivery platform companies on perceived individual well-being and performance, we have included the below independent, dependent, and control variables.

Independent variables refer to work relationship, social and technical sub-systems of the platform companies.

Work relationship. To measure work relationships, we follow the dimensions identified by Campbell and Price (2016) and include the following indicators adapted by the authors building on Kreshpaj et al. (2020):

- **Work stability:** approximated using a 5-point Likert scale reporting the length of duration of the work relationship between the worker and platform company (1: 2–3 months, 2: 3–6 months, 3: 6–12 months, 4: 12–24 months, 5: > 24 months).

- **Earnings:** measured using a 5-point Likert scale considering the monthly net earnings of the worker from the platform company (1: €500; 2: €500–700; 3: €700–900; 4: €900–1100; 5: > €1100).
- **Rights and protections:** measured using a single item that captures the possibility of claiming better working conditions without reprisal from the platform company. The item was measured on a 5-point Likert scale (ranging from 1 for “Not at all possible” to 5 for “To a very large extent”).

The frequencies for the three abovementioned indicators of work relationships can be found in Table 2.

Social subsystem. We measured the social subsystem of work arrangements in terms of the following:

- o *Perceived empowerment* is measured with three indicators adapted by the authors from the conceptualization by Jabagi et al. (2019) to assess the extent to which the worker perceives the delivery platform company allows them to decide on the quantity of working hours, as well as when and how fast to work. The items were measured on a 5-point Likert scale (ranging from 1 for “Not at all” to 5 for “To a very large extent”).
- o *Perceived involvement* is measured with three items adapted by the authors from the conceptualization by Jabagi et al. (2019) that assess the extent to which the worker perceives the delivery platform company considers the opinions of workers in different dimensions. The items were measured on a 5-point Likert scale (ranging from 1 for “Not at all” to 5 for “To a very large extent”).

Table 3 shows the questionnaire items and the descriptive statistics for the social subsystem components.

Technical subsystem. The technical subsystem of work arrangements is related to the following:

- o *Transportation vehicles* are a binary variable that distinguishes between motor transportation vehicles and nonmotor transportation vehicles.
- o *Protective equipment*, which ranges from 0 to 4, captures the number of obligatory items of equipment carried by the worker (i.e., helmets, vests, gloves, and vehicle lights).

These dimensions have been identified based on Castillo et al. (2021) and the presence of such elements have been reported by the interviewer conducting the survey. Tables 4 and 5 show the descriptive statistics for the technological components.

Dependent variables refer to perceived individual outcomes, which include two well-being variables and a performance variable:

Table 2 Frequencies for work stability, earnings and rights and protections

Work stability				Earnings				Rights and protections			
1	2–3 months	66	16.8%	1	0–500€	63	16.1%	1	Not at all	147	37.5%
2	3–6 months	78	19.9%	2	500–700€	114	29.1%	2	To some extent	72	18.4%
3	6–12 months	111	28.3%	3	700–900€	104	26.5%	3	To a good extent	85	21.7%
4	12–24 months	54	13.8%	4	900–1100€	43	11.0%	4	To a great extent	54	13.8%
5	> 24 months	39	9.9%	5	> 1100€	68	17.3%	5	To a very large extent	34	8.7%
Missing		44	11.2%	Missing		0	0.0%	Missing		0	0.0%
Total		392	100%	Total		392	100%	Total		392	100%

- o *Perceived stress* captures the perceived stress level of the worker and is measured with three items from Godard (2001). These items were measured on a 5-point Likert scale (ranging from 1 for “Not at all” to 5 for “To a very large extent”).
- o *Perceived fatigue* captures the perceived fatigue level of the respondent and is measured with a single item from Godard (2001). The item was measured on a 5-point Likert scale (ranging from 1 for “Not at all” to 5 for “To a very large extent”).
- o *Perceived individual performance* captures the perceived individual performance level of the respondent and is conceptualized according to Berg et al. (2018) and measured with four items. These items were measured

on a 5-point Likert scale (ranging from 1 for “Not at all” to 5 for “To a very large extent”).

Table 3 provides the survey questions and descriptive statistics of the latent variables that measure the dependent variables. In addition, Table 6 includes questions and the sources of all items included in this study.

Furthermore, because some of the measures included in our analysis were self-reported and perceptual measures, additional tests were performed to test the reliability of our data. In the survey, we asked platform workers to provide the evaluation score assigned to them by the platform company. Indeed, the platform companies in our sample assign an evaluation score to each worker and communicate it to

Table 3 Measurement assessment for latent variables

		Mean	SD	Loading	Cronbach α	CR	AVE
<i>Perceived Empowerment</i>							
Item 1	To what extent does the platform company allow you to determine your working hours?	3.54	1.59	0.878	0.73	0.85	0.66
Item 2	To what extent does the platform company allow you to decide when you work (mornings, evenings, weekdays, etc. ...)?	3.70	1.55	0.892			
Item 3	To what extent does the platform company allow you to determine the pace of your work?	3.53	1.46	0.636			
<i>Perceived Involvement</i>							
Item 1	To what extent does the platform company consider your opinion on improving the delivery process?	2.26	1.33	0.779	0.76	0.86	0.67
Item 2	To what extent does the platform company consider your opinion regarding the restaurant?	2.25	1.41	0.872			
Item 3	To what extent does the platform company consider your opinion about the clients?	2.33	1.41	0.806			
<i>Perceived Stress</i>							
Item 1	Is your job stressful?	3.06	1.40	0.765	0.64	0.81	0.58
Item 2	In your job, do you often face problems over which you have little control?	2.50	1.36	0.778			
Item 3	Do you feel unable to continue working in your current position?	2.05	1.25	0.739			
<i>Perceived Individual Performance</i>							
Item 1	On time orders rate	4.29	0.72	0.632	0.73	0.83	0.56
Item 2	Time elapsed from receiving the order to delivering it to the client	4.18	0.83	0.709			
Item 3	Customer satisfaction level regarding the delivery condition (meal temperature, packaging, etc.)	4.26	0.65	0.843			
Item 4	Overall customer satisfaction level	4.31	0.66	0.788			

Table 4 Descriptives: transportation vehicle

Transportation vehicle	<i>n</i>	%
Non motor	213	54.3
Motor	179	45.7
Total	392	100

Table 5 Descriptives: protective equipment

Protective equipment	<i>N</i>	%
0	36	9.2
1	89	22.7
2	80	20.4
3	73	18.6
4	57	14.5
Missing	57	14.5
Total	392	100

the worker via the app. This score is a value usually ranging from 0 to 100 and is calculated according to each platform's method based on delivery performance and customer satisfaction. For each worker, we compared the score ratio received by the worker and the worker's self-reported Likert scale measures of perceived individual performance (i.e., on-time orders rate and overall customer satisfaction level). The results of the Spearman's rank correlation showed significant correlations between the workers' evaluation scores assigned by the platform and the perceived on-time orders rate Likert scale measure ($r_s = 0.185$; $p < 0.001$) and the scores and overall customer satisfaction level Likert scale measure ($r_s = 0.137$; $p < 0.005$). Thus, we consider the information provided by the platform workers as being reliable.

The following control variables were included in our analysis because they could affect our individual outcome variables:

- The age and gender of the respondents were included because they might affect well-being aspects such as fatigue and performance, because of the physical nature of the job.
- Workers' preference for receiving more orders measured as a binary variable (i.e., Yes or No) because this might represent the amount of work and affect perceived well-being and individual performance.
- Perceived likelihood of finding a similar or better job (measured as a Likert scale from 1 to 5, where 1 indicates not at all likely, and 5 very likely) because this might proxy if a worker does not have any other option than the platform work, hence affecting their perceived well-being and individual performance.

Table 1 provides the descriptive statistics for the control components.

Data Analysis and Results

To test our research model, we employed partial least squares (PLS) algorithm estimation for the following reasons: First, the objective of our paper is to provide an overview of the last-mile delivery workers' situation and evaluate possible ethical implications. In this sense, PLS is a valuable tool for data exploration to identify patterns in relationships (Peng & Lai, 2012). Second, it is a nonparametric technique; hence, it does not assume specific data distribution (Peng & Lai, 2012; Sancha et al., 2016). This is especially important for us because, in our model, the normality assumption is not met for all variables. Third, it allows for the handling of mixed data types (i.e., combinations of noncategorical and categorical variables), which is the case in our model (Ajamieh et al., 2016). Finally, in our model, perceived empowerment, involvement, stress, and performance variables are measured using multiple indicators. PLS allows for analyzing the relationships between latent variables and observed indicators (Benitez & Hu, 2020). The estimations of the p values associated with the coefficients were calculated using nonparametric resampling techniques. The PLS analysis was conducted using WarpPLS (Kock, 2023a). To enrich this analysis, we conducted an Importance-Performance Map Analysis (IPMA) (Ringle & Sarstedt, 2016) through MS Excel, primarily aimed at identifying areas for improvement from a managerial standpoint. Specifically, the IPMA extends the results of PLS-SEM by also taking the performance of each construct into account. Prior to conducting hypothesis testing and the IPMA, we conducted an analysis to assess the adequacy of the measures using multiple indicators that is detailed in the next section.

Measurement Assessment

To assess the adequacy of the scales used to measure our constructs, we first examined convergent validity by evaluating the factor loadings of the measures on their respective constructs. As shown in Table 3, all loadings ranged between 0.637 and 0.891, surpassing the threshold value of 0.6 and, hence, supporting convergent validity. Next, the reliability of the scales was evaluated using Cronbach's alpha coefficient and composite reliability (CR). All constructs exhibited values greater than 0.60 for Cronbach's alpha and greater than 0.70 for CR, indicating high reliability (Fornell & Larcker, 1981). Then, we evaluated the average variance extracted (AVE) as a summary of convergence. All AVE values exceeded the 0.5 threshold, providing additional support for convergent validity. Finally, we compared the square root

Table 6 List of measurement sources

Variable		Item Source	Respondent
<i>Work stability</i>			
Item 1	How long have you worked for the specified main company? (1: 2–3 months, 2: 3–6 months, 3: 6–12 months, 4: 12–24 months, 5: > 24 months)	Adapted from Kreshpaj et al. (2020)	Worker
<i>Earnings</i>			
Item 1	Please select the range of net monthly income you earn from working as a delivery driver (1: €500; 2: €500–700; 3: €700–900; 4: €900–1100; 5: > €1100)	Adapted from Kreshpaj et al. (2020)	Worker
<i>Rights and protection</i>			
Item 1	To what extent are you able to demand better working conditions without being exposed to reprisals by the company? (5-point Likert scale)	Adapted from Kreshpaj et al. (2020)	Worker
<i>Perceived Empowerment</i>			
To what extent does the platform company allow you to: (5-point Likert scale)			
Item 1	... determine your working hours?	Adapted from Jabagi et al. (2019)	Worker
Item 2	... decide when you work (mornings, evenings, weekdays, etc. ...)?		Worker
Item 3	... determine the pace of your work? (5-point Likert scale)		Worker
<i>Perceived Involvement</i>			
To what extent does the platform company consider your opinion on: (5-point Likert scale)			
Item 1	... improving the delivery process?	Adapted from Jabagi et al. (2019)	Worker
Item 2	... regarding the restaurant? (5-point Likert scale)		Worker
Item 3	... about the clients? (5-point Likert scale)		Worker
<i>Transportation vehicle</i>			
Item 1	Which mode of transportation do you use the most to deliver for the main company?	Adapted from Castillo et al. (2021)	Worker/Interviewer
<i>Protective Equipment</i>			
Item 1	What protective equipment is the rider wearing?	Adapted from Berg et al. (2018)	Interviewer
<i>Perceived Stress</i>			
To what extent do you agree with the following statements? (5-point Likert scale)			
Item 1	Is your job stressful?	Godard (2001)	Worker
Item 2	In your job, do you often face problems over which you have little control?		Worker
Item 3	Do you feel unable to continue working in your current position?		Worker
<i>Perceived Fatigue</i>			
To what extent do you agree with the following statements (5-point Likert scale)			
Item 1	After work, all you want to do is rest	Godard (2001)	Worker
<i>Perceived Individual Performance</i>			
How would you evaluate your work of the last four weeks in terms of: (5-point Likert scale)			
Item 1	On time orders rate	Adapted from Berg et al. (2018)	Worker
Item 2	Time elapsed from receiving the order to delivering it to the client		Worker
Item 3	Customer satisfaction level regarding the delivery condition (meal temperature, packaging, etc.)		Worker
Item 4	Overall customer satisfaction level		Worker

of the AVE for each construct with the correlations among constructs. In all cases, the square root values of the AVE were greater than the correlations among the constructs, thus supporting discriminant validity. In addition, to verify that questions associated with each latent variable were correctly understood by the respondents, we also tested the heterotrait-monotrait (HTMT) ratio. All HTMT values were below the suggested threshold of 0.90 ($p < 0.001$) (Henseler et al., 2015), pointing toward confirming the validity of our measures. Table 7 shows the abovementioned results.

The path coefficient estimations may be biased if multicollinearity is present. To assess the potential effects of multicollinearity, the variance inflation factor (VIF) between constructs was checked. In our analysis, the minimum and maximum VIFs between the constructs were 1.03 (*Age* and *Perceived Individual Performance*) and 1.32 (*Work stability* and *Perceived Fatigue*), respectively, which were below the suggested threshold of 5, indicating that multicollinearity was not an issue in our study (Chin, 1998). Finally, we addressed the potential threat of common method variance (CMV) through both a priori and a posteriori measures. In the questionnaire design phase, we positioned the dependent variables after independent variables to mitigate consistency artifacts (Podsakoff et al., 2003). Additionally, we conducted a posteriori checks for CMV using full collinearity VIFs. These VIFs, first proposed by Kock (2023b) and Kock and Lynn (2012), offer a more conservative and superior alternative to traditional tests, such as exploratory and confirmatory factor analyses. According to a rule of thumb, VIFs of 3.3 or lower suggest the absence of multicollinearity in the model and no common method bias (Kock, 2023b). Therefore, based on the results from our VIFs, CMV was not a threat to our results.

Path Relationship Estimation

Three distinct models were implemented to examine the impact of the different dimensions of working conditions (i.e., work relationships, social, and technical subsystems) at the same time within the platform-based last-mile delivery industry on individual outcomes (i.e., perceived stress,

perceived fatigue, and perceived individual performance), as shown in Table 8.

The first model includes perceived stress as the dependent variable. H1A posited that higher levels of (a) work stability, (b) earnings, and (c) rights and protections will lead to higher levels of well-being (i.e., lower levels of perceived stress). The results provide partial support for H1A. Although earnings ($\beta = -0.092$; p value = 0.032) and rights and protections ($\beta = -0.109$; p value = 0.014) lead to lower levels of perceived stress, higher levels of work stability increase the perceived stress levels ($\beta = 0.163$; p value < 0.001). In relation to the social subsystem components, H1B also posits a negative effect on perceived stress. Thus, based on our results, H1B is partially supported. Indeed, (a) perceived empowerment is statistically negatively related to perceived stress ($\beta = -0.185$; p value < 0.001), but the effect of (b) perceived involvement is not statistically significant ($\beta = -0.046$; p value = 0.178). Finally, H1C is not supported because none of the components in the technical subsystem is statistically significantly related to perceived stress, as shown in Table 8.

The second model considers perceived fatigue as the dependent variable. H2A posits a negative relationship between work relationship components and perceived fatigue. Thus, based on our results, H2A is partially supported. Although (a) work stability has a negative and significant association with on perceived fatigue ($\beta = -0.086$; p value = 0.043), (b) earnings ($\beta = 0.033$; p value = 0.257) and (c) rights and protections ($\beta = -0.036$; p value = 0.237) are not statistically significant. H2B, which also expects a negative association between the social subsystem components and perceived fatigue, is partially supported. Indeed, (a) perceived empowerment is significantly negatively associated with perceived fatigue ($\beta = -0.077$; p value = 0.061), but the association between (b) perceived involvement and perceived fatigue is not significant ($\beta = -0.042$; p value = 0.204). Finally, H2C, which posits a negative relationship between the technical subsystem and perceived fatigue, is supported. The results show that, when workers use a (a) motor transportation vehicle, perceived fatigue levels are lower ($\beta = -0.072$; p value = 0.075). In addition, the

Table 7 Discriminant validity analysis

	Perceived Empowerment	Perceived Involvement	Perceived Stress	Perceived Indiv. Perf
Perceived Empowerment	(0.81)*	0.092	0.210	0.134
Perceived Involvement	-0.011	(0.82)	0.105	0.076
Perceived Stress	-0.142	-0.059	(0.76)	0.247
Perceived Indiv. Perf	0.088	0.012	-0.166	(0.75)

*(Square roots of AVE shown in the diagonal)

Values above the diagonal correspond to HTMT ratios

Values below the diagonal correspond to Pearson correlations coefficients

Table 8 Path relationships

Dependent variable: perceived stress (R^2 : 9%)		Std. β coeff		p value	
Control variables					
Preference to receive more orders (1 = Yes)					
		- 0.062			0.107
Possibility of similar job					
		0.058			0.124
Age					
		- 0.019			0.354
Gender (1 = Male)					
		- 0.014			0.387
Hyp		Independent variables		Hypothesis testing	
H1A	Work relationship	a. Work stability	0.163	< 0.001***	Not supported
		b. Earnings	- 0.092	0.032**	H1A. Partially supported
		c. Rights and protections	- 0.109	0.014**	Supported
H1B	Social Sub-system	a. Perceived Empowerment	- 0.185	< 0.001***	Supported
		b. Perceived Involvement	- 0.046	0.178	H1B. Partially supported
H1C	Technical Sub-system	a. Transportation vehicle (1 = Motor)	- 0.012	0.403	Not supported
		b. Protective equipment	0.017	0.369	Not supported
		- 0.020	0.345		Not supported
Dependent variable: perceived fatigue (R^2 : 4%)					
Control variables					
Preference to receive more orders (1 = Yes)					
		0.025			0.313
Possibility of similar job					
		0.001			0.489
Age					
		0.090			0.037**
Gender (1 = Male)					
		0.019			0.353
Hyp		Independent variables		Hypothesis testing	
H2A	Work relationship	a. Work stability	- 0.086	0.043**	Supported
		b. Earnings	0.033	0.257	H2A. Partially supported
		c. Rights and protections	- 0.036	0.237	Not supported
H2B	Social Sub-system	a. Perceived Empowerment	- 0.077	0.061*	Not supported
		b. Perceived Involvement	- 0.042	0.204	Supported
H2C	Technical Sub-system	a. Transportation vehicle (1 = Motor)	- 0.072	0.075*	H2B. Partially supported
		b. Protective equipment	- 0.066	0.095*	Not supported
					Supported
Dependent variable: perceived individual performance (R^2 : 8%)					
Control variables					
Preference to receive more orders (1 = Yes)					
		0.072			0.075*

Table 8 (continued)

Dependent variable: perceived individual performance (R^2 : 8%)		Control variables		
		Std. β coeff	p value	
	Possibility of similar job	0.017	0.367	
	Age	0.009	0.428	
	Gender (1 = Male)	0.115	0.011	
Hyp	Independent variables	Std. β coeff	p value	
H3A	Work relationship	a. Work stability	- 0.197	< 0.001***
		b. Earnings	0.096	0.028**
		c. Rights and protections	0.084	0.046**
H3B	Social Sub-system	0.078	0.059*	
	Technical Sub-system	- 0.013	0.397	
H3C	a. Transportation vehicle (1 = Motor)	- 0.040	0.211	
	b. Protective equipment	- 0.020	0.345	
				Hypothesis testing
				Not supported
				Partially supported
				Supported
				Supported
				Supported
				Not supported
				Not supported
				Not supported

Significance levels: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

higher the level of (b) protective equipment worn, the lower the perceived fatigue level ($\beta = -0.066$; p value = 0.095). For perceived fatigue, the control variable of age is positive and significant ($\beta = 0.090$; p value = 0.037); the older the rider, the higher the level of perceived fatigue.

The third model includes perceived individual performance as the dependent variable. According to the results, (a) work stability ($\beta = -0.197$; p value < 0.001), (b) earnings ($\beta = 0.096$; p value = 0.028), and (c) rights and protections ($\beta = 0.084$; p value = 0.046) have a statistically significant impact on perceived individual performance. These results provide partial support for H3A because earnings and rights and protections are positively associated with perceived individual performance, but work stability is negatively associated with perceived performance. H3B posits a positive effect between the social subsystem components and perceived individual performance. Our results provide partial support for H3B because, although (a) perceived empowerment shows a positive and significant effect ($\beta = 0.078$; p value = 0.059), the effect of (b) perceived involvement is not significant ($\beta = -0.013$; p value = 0.397). Finally, our results do not provide support for H3C because the considered indicators for the technical subsystem do not show a statistically significant effect. In the case of perceived individual performance, the control variables of preference ($\beta = 0.072$; p value = 0.075) and gender ($\beta = 0.115$; p value = 0.011) show a statistically significant impact. These results suggest that, when delivery workers prefer to receive more orders, perceived performance is higher. This might be related to the fact that, to receive more orders, workers should provide continuity and availability to accept and deliver orders and a certain level of performance (Jabagi et al., 2019). In addition, delivery workers who identify themselves as men also show higher perceived performance levels.

To evaluate the predictive power and generalizability of our PLS model, we conducted a PLSpredict analysis in accordance with the guidelines of Danks et al. (2017) and Shmueli et al., (2016, 2019). We performed tenfold cross-validation to generate out-of-sample RMSE and MAE statistics for both the linear model (LM) and the PLS model, focusing on the key target construct indicators. For this analysis, the Q^2 predictive statistic must be greater than or equal to 0. All items, except Item 1 in Perceived Stress, met this requirement. Although Item 1 satisfies the measurement assessment criteria and there are no multicollinearity issues in our study, future research could use these results to enhance the predictive power of this scale.

As shown in Table 9, the indicators meeting the Q^2 predictive threshold demonstrate a significant improvement in the predictive power of the PLS model compared to the LM benchmark. This supports the use of the predictive PLS algorithm over more parsimonious techniques. All differences between LM and PLS values are positive, indicating

lower RMSE or MAE for the predictions generated by the PLS model. This results in a slight improvement in predictive power, with increases of 0.19% and 0.81%, underscoring the overall predictive relevance of the model.

Importance-Performance Map Analysis

In addition, to identify the areas where managerial action can yield the most significant improvements in terms of perceived stress, fatigue and individual performance, we conduct the IPMA (Hair et al., 2017; Ringle & Sarstedt, 2016). Before initiating the analysis, we checked that two conditions were satisfied: First, indicators must share the same direction in terms of their meaning and second, the outer weights should not be negative (Hair et al., 2017). Table 3 confirms that both conditions are fulfilled so elaborated a map for each dependent variable (i.e., perceived stress, fatigue and individual performance).

The results of the IPMA can be seen in Table 10 and plotted in Figs. 2, 3 and 4. These results were derived by incorporating all independent variables considered in our model. In each map, non-significant variables are depicted without color filling. The aim is to identify those variables that hold considerable importance compared to the others in affecting the dependent variable and yet exhibit comparatively lower performance thereby highlighting areas where platform companies can invest to improve workers' individual well-being and performance outcomes. The positive and negative importance values of our independent variables—related to the positive and negative influence they have on the dependent variables—led us to interpret them as absolute values.

The IPMA for perceived stress (see Table 10; Fig. 2) indicates that among lower performing significant variables work stability, followed by rights and protections, and earnings, are the variables with the highest importance in absolute values. The high importance value of the effect of rights of protections and earnings associated to

the reduction of perceived stress highlights that increasing them can contribute the most to improving this dimension of workers' individual well-being. Instead, in the case of work stability, the results imply that the longer an individual works as a delivery worker the more this contributes to increase the level of perceived stress. Thus, investing in work stability as relationship duration per se does not contribute to reduce perceived stress and can be counterproductive. On the other side, perceived empowerment has a high importance value and at the same time a high performance value meaning that this variable is already providing benefits for delivery workers in terms of reduced perceived stress.

The IPMA for perceived fatigue (see Table 10; Fig. 3), shows that transportation vehicle and work stability are the ones with highest importance in absolute values among lower performing significant variables. Hence, by improving on these two areas perceived fatigue levels can be reduced. On the other side, perceived empowerment and protective equipment are important variables that already provide benefits for delivery workers in terms of reduced perceived fatigue.

Finally, the IPMA for the construct perceived individual performance (see Table 10; Fig. 4), shows that work stability, earnings and rights and protections are the variables with the highest importance and lower performance values. Enhancements in workers' perceived individual performance outcomes can be attained by platform companies through taking actions aimed at improving earnings and the level of rights and protections for delivery workers. Instead, investing in work stability as relationship duration per se can have negative effects on workers' individual performance. In addition, perceived empowerment is an important variable that already shows a high performance value.

Adopting a transversal view, IPMA results show that work stability is a variable with a relatively high importance on which platform companies could invest more but with

Table 9 PLS predict results

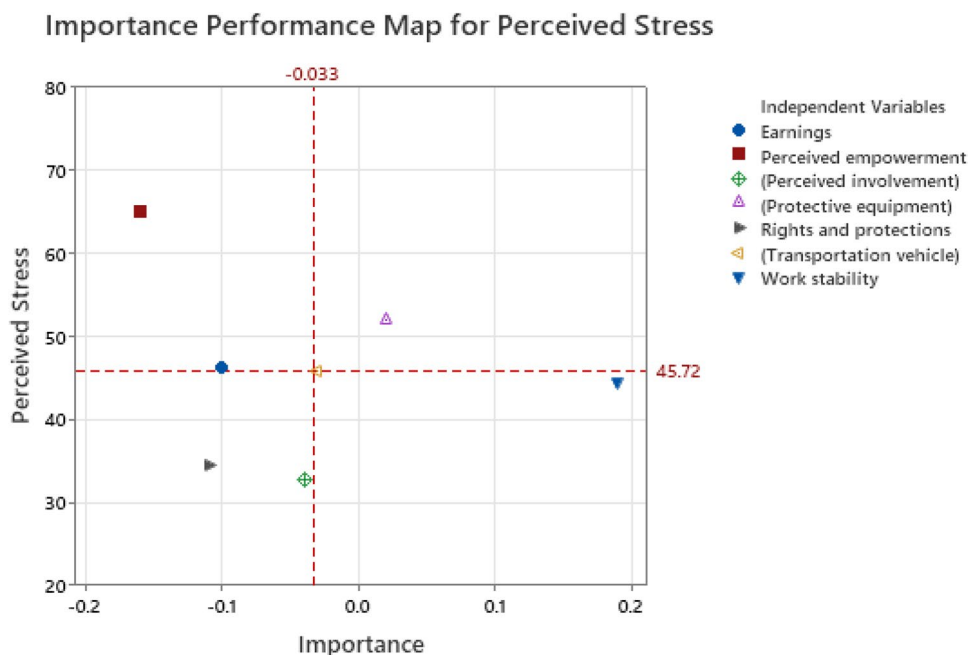
Key target construct ⁽¹⁾	Indicators	Q2 predictive	PLS-Predict		LM-Predict		LM-PLS		(LM-PLS/PLS)%	
			RMSE ⁽²⁾	MAE ⁽²⁾	RMSE	MAE	RMSE	MAE	RMSE	MAE
Perceived stress	Item 1	− 0.006	1.404	1.219	1.412	1.224	0.005	0.005	0.36%	0.41%
	Item 2	0.028	1.344	1.185	1.352	1.181	0.008	− 0.004	0.60%	− 0.34%
	Item 3	0.026	1.238	1.021	1.248	1.022	0.010	0.001	0.81%	0.10%
Perceived fatigue	Item 1	0.008	1.141	0.955	1.143	0.957	0.002	0.002	0.18%	0.21%
Perceived individual performance	Item 1	0.011	0.721	0.596	0.724	0.599	0.003	0.003	0.42%	0.50%
	Item 2	0.014	0.822	0.645	0.826	0.647	0.004	0.002	0.49%	0.31%
	Item 3	0.005	0.648	0.523	0.651	0.524	0.003	0.001	0.46%	0.19%
	Item 4	0.010	0.655	0.558	0.660	0.558	0.005	0.000	0.76%	0.00%

⁽¹⁾ Analysis performed considering significant predictors

⁽²⁾ Based on the symmetry of the predicted error distributions, the values in black should be interpreted

Table 10 Importance-performance analysis

Independent variables	Perceived stress		Perceived fatigue		Perceived Ind. performance	
	Importance	Performance	Importance	Performance	Importance	Performance
Work stability	0.19	44.40	- 0.08	44.40	- 0.11	44.40
Earnings	- 0.10	46.11	0.03	46.11	0.05	46.11
Rights and protections	- 0.11	34.44	- 0.03	34.44	0.04	34.44
Perceived Empowerment	- 0.16	64.87	- 0.06	64.70	0.03	64.02
Perceived Involvement	- 0.04	32.61	- 0.03	31.15	- 0.01	37.84
Transportation vehicle	- 0.03	45.66	- 0.17	45.66	- 0.05	45.66
Protective equipment	0.02	51.94	- 0.06	51.94	- 0.01	51.94
<i>Mean</i>	-0.03	45.72	-0.06	45.48	-0.01	46.34
Dependent variable performance	36.837		73.023		78.33	

Fig. 2 IPMA for perceived stress

contradictory effects on the three dependent variables as it reduces perceived fatigue but also increases perceived stress and reduces perceived individual performance. On the other side, perceived empowerment is a relevant variable that is already providing positive impacts on all three dependent variables.

Discussion

Our research provides valuable insights into a recent, growing, and underexplored area of business ethics and management research on the corporate sustainability of delivery platform companies and worker exploitation. Specifically, in the business ethics literature, working conditions in platform companies are often characterized as exploitative and benefiting company short-term profitability at the expenses

of workers (e.g., Srnicek, 2016), thus characterizing a trade-off between economic and social sustainability. Indeed, technological and societal developments have led to a rise in the last-mile delivery platform business model that is compelling from a business perspective because it provides an efficient way to connect restaurants, customers, and potential workers (Pourrahmani & Jaller, 2021) but, at the same time, is related to ethical concerns regarding workers exploitation discussed in the literature, in mass media, and by policymakers (Winby et al., 2018).

In the present paper, we have investigated working conditions and whether a paradigm characterizing decent working conditions in such an industry might be in line with an instrumental view of corporate sustainability in relation to socio-economic trade-offs. Specifically, our research set out to explore the following: *What is the relationship between working conditions in platform companies and*

Fig. 3 IPMA for perceived fatigue

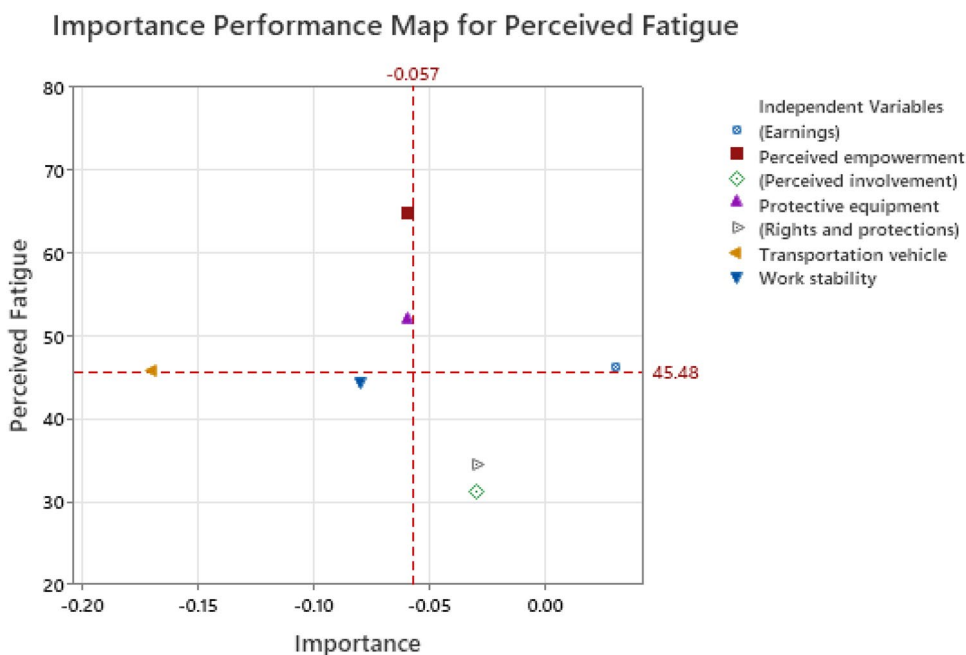
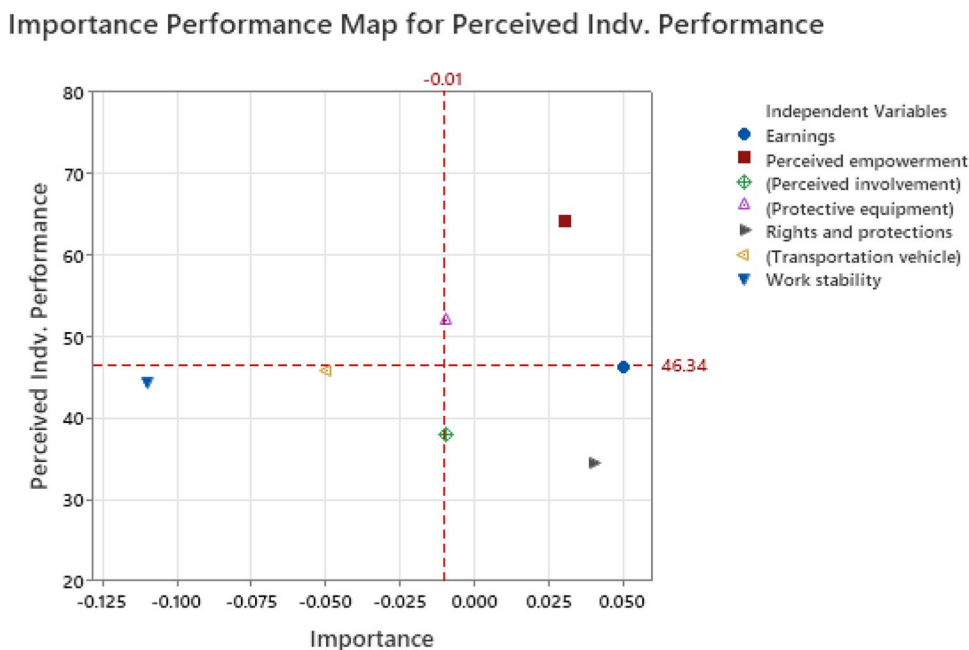


Fig. 4 IPMA for perceived individual performance



perceived individual workers' well-being (i.e., stress and fatigue) and performance? The underlying hypothesis of our research was that decent working conditions in terms of work relationships and social and technical subsystems might help overcome ethical concerns associated with the last-mile delivery platform business model—here regarding worker exploitation (Fieseler et al., 2019; Winby et al., 2018)—hence contributing to platform companies' social and economic sustainability. The present study allowed us to identify the key aspects of platform working conditions that are crucial to its functioning, providing a more nuanced

perspective in terms of the ethical implications of this business model and corporate sustainability, raising questions for future research to answer.

A first element we considered in terms of working conditions is the work relationship between the worker and platform company. In line with previous studies suggesting that the context in which platform workers operate is often exploitative (Fieseler et al., 2019; Winby et al., 2018), the data in our sample show that, in more than 70% of the known cases, workers have a work relationship shorter than one year with the platform company, more than 80%

of workers have earnings lower than the minimum salary in Spain (despite more than 80% of them considering this as their main occupation), and about 50% of the workers experience limited rights and protections (see Table 1). In such a context, we tested whether the characteristics of work relationships usually applied in a traditional job context (i.e., stable relationship, higher earnings, and rights and protections (Campbell & Price, 2016; Muntaner, 2018)) might benefit both workers and companies in terms of social and economic sustainability in the platform context. Our results show that these aspects of work relationships only partially apply in the context of platform work in which there are independent workers interacting with an algorithm. In our research model, we posited that a decent work relationship is based on work stability, higher earnings, and rights and protections and that this might lead to a win–win situation for both workers and platform companies, creating a positive impact on workers' well-being and performance. Accordingly, in the case of higher earnings and rights and protections, we observed workers' perceived lower stress and better individual performance. These two elements of work relationships are key to addressing worker exploitation in terms of distributive and procedural (un)justice identified in the literature on business ethics (Fieseler et al., 2019; Ahsan, 2021). Indeed, higher earnings might help platform workers have a share in the transaction with the platform companies that rewards them in a more just way for their work and also for the “unpaid” part of their job (Pulignano et al., 2023). In addition, our results show that decent earnings allow the workers to reduce their perceived stress but also be more motivated to perform better, thus benefiting both the social and economic sustainability of platform companies.

The other key aspect of worker exploitation in the work relationship between workers and platforms identified in the literature is the lack of rights and protections, which can lead to several abuses against workers, such as late payments and unclear engagement rules (Fieseler et al., 2019). Instead, when rights and protections are present in the work relationship, workers are better protected against unilateral decisions that might be taken by the platform and applied through the algorithm, which is often seen in a position of power. Our results show that assuring such rights and protections helps workers reduce their perceived stress and perform better because they are more committed to the platform (Guest, 2004).

At the same time, we have identified that, contrary to our hypothesis, higher work stability in platform companies comes at a cost for both the workers and associated companies. We have found that, in contradiction with traditional work contexts in platform companies, longer work relationships are associated with perceived higher stress and lower individual performance. A more fine-grained approach is needed when analyzing the ethical implications of the

worker–platform work relationship and its consequences for corporate sustainability. Thus, the traditional view of longer work relationships being associated with better individual outcomes, such as well-being and a committed workforce with better performance (Campbell & Price, 2016; Muntaner, 2018), needs to be revised in the context of platform companies and independent workers. The positive association between work stability and perceived stress might be related to the fact that the longer duration of the work relationship between the worker and platform company is not because of a longer contractual relationship as in the traditional job context but to continuous “orders.” Indeed, in the case of platform companies, workers are independent, and the longer duration of the work relationship between the worker and the platform company is gained through constant and continuous transactions between the individual worker and platform company. Several authors suggest that, to receive more orders, platform workers are requested to stay available for long hours and every day and show a consistent track of successful deliveries (Jabagi et al., 2019); in other words, the more past deliveries, the more new orders will be received. This phenomenon is defined as a lock-in mechanism (or enforced dependence) and is related to the reputation systems used by the platform algorithm to assign orders to independent workers (Berg et al., 2018). This lock-in effect is in line with the definition of worker exploitation because workers are not free to decide for whom to work and when. Such lock-in effect limits workers' ability to move to another platform (as the sharing economy would instead suggest) and also limits their professional growth, making them feel trapped. Thus, in the context of independent work controlled through an algorithm, the long-term relationship for a worker is exploitative, with negative consequences for individual workers' perceived stress and performance and, thus, on the social and economic sustainability of platform companies. In the case of long-term workers in the context of platform companies, decent work might require the setup of an employment relationship. This approach would require platform companies to prioritize their workers and accept possible trade-offs between their economic performance in favor of social sustainability because they would be required to change their business model to match orders with an internal pool of workers and internalize the costs of flexibility. Platform companies need to find ways to make a long-term relationship more sustainable because these stable workers are crucial in providing a stable offer to platform customers (Bai et al., 2019; Cachon et al., 2017). Previous research suggests that a stable base of workers, along with some spot workers, is the most viable solution for a platform company to optimize flexibility and cost performance (Cachon et al., 2017).

Thus, to achieve corporate sustainability, different types of workers (i.e., independent workers and employed

workers) might be needed in platform companies. This may bring into question a universal definition of decent work and trade-off management in the case of platform companies and their workers and make worker exploitation contextual to the specific cases. Corporate sustainability in platform companies would then be the result of a series of actions with both win–win situations and conflicts. Such a view would be aligned with an integrative view of corporate sustainability (rather than instrumental as initially proposed in this paper), which posits that “firms need to pursue different sustainability aspects simultaneously—even if they seem to contradict each other” (Gao & Bansal, 2013; Hahn et al., 2011).

Furthermore, we have analyzed working conditions in terms of a social subsystem defined as worker perceived empowerment and involvement. The results show that the level of perceived empowerment and involvement of the sampled workers are quite limited (the average value of perceived empowerment on a scale from 1 to 5 is 3.59, and the average perceived involvement is 2.28), which is in line with previous studies suggesting limited freedom in terms of work schedule and interaction of the workers with the platforms in relation to feedback and requests (Ahsan, 2021; Hickson, 2023). Thus, in terms of the social subsystem, the work environment aligns with the concept of worker exploitation and interactional (un)justice advanced by previous literature (Freisler et al., 2019; Ahsan, 2021). In line with our research model, we have found that a social subsystem characterized by empowerment could be a way to overcome worker exploitation (Gutierrez-Huerter et al., 2023), which means being able to decide when and how to work (opposed to limited autonomy), and to provide benefit to both workers and platform companies. Thus, the idea of a flexible work model for workers in line with the sharing economy seminal idea seems indeed to be beneficial for both workers and companies and their corporate sustainability (Cachon et al., 2017). Instead, perceived involvement is not significantly related to our outcome variables. This might be because of the limited observed variance regarding such aspect and also because of the short duration of the relationship between most of the workers and companies characterizing our sample. It might well be that, in the case of long-term relationships, such an aspect is more relevant because it would be key to fuel the relationship (Fieseler et al., 2019).

Third, we show that the majority of the workers had a nonmotor vehicle (54.3% of workers in Table 4) and that a good portion of them did not use or use protective equipment to a limited extent (see Table 5). Thus, such workers might be struggling with delivering the quantity of orders in a certain amount of time and might be exposed to health and safety risks, which is in another aspect of worker exploitation (Gutierrez-Huerter et al., 2023). Indeed, our results show that the technical subsystem, motor transportation vehicles and protective equipment, might help

to reduce the physical effort of delivery workers. Instead, no significant relationship was observed in terms of perceived stress and individual performance. It might be that having a motor vehicle is also associated with higher risks of accidents and lower flexibility in the presence of traffic generating stress and limiting delivery performance (Cai et al., 2019; Van der Loo & Koopmans, 2019). Thus, a motor transportation vehicle is not necessarily better or worse than a nonmotor vehicle in terms of perceived stress and individual performance. However, it is also evident that, in the context of limited access to motor vehicles and protective equipment, platform work might result in higher exploitation as worker perceived fatigue might lead to the consumption of the human capital available for the platform company, with negative consequences for social sustainability first and then later for economic sustainability as well (Gutierrez-Huerter et al., 2023). When studying corporate sustainability and the working conditions in platform companies, such technical elements should be taken into consideration because it is key to understand the working conditions. Future research might extend our study by considering the relationship between the technical subsystem and safety aspects, such as injuries or ergonomics aspects (Cai et al., 2019) not included in the present study. Another aspect that can be considered by future studies is the decision of platform companies to outsource the provision of the transportation vehicle, which can reduce costs but might put workers at risk due to higher fatigue, thus damaging social sustainability.

Finally, we contribute to the discussion in the business ethics literature on worker exploitation in platform companies and the corporate sustainability of these digital platform businesses (Fieseler et al., 2019; Jabagi et al., 2019) by proposing different approaches for defining decent working conditions for different types of workers. Specifically, we show that not all workers are equal in the understanding of the ethical and corporate sustainability implications of platform work: some workers have a longer relationship with platform companies while others might not. This is important from both workers’ and companies’ perspectives. Based on our analysis, some elements of decent work benefit both workers and companies, such as decent earnings, rights, and protections and a social subsystem characterized by empowered workers. At the same time, this business model is also associated with stressful and low-performing situations, such as in the case of workers with longer work relationships with the platform company. Indeed, these workers are, on the one hand, receiving higher earnings and fair treatments in terms of rights and protections (see Table 14 in Appendix A), but on the other hand, they are also more stressed and perform worse. A possibility for a platform company is to balance social and economic sustainability by adopting a dual workforce management model for short- and long-term workers

by assuring decent work for both. Shorter-term independent workers might be used to manage moments of peak demand and offering decent rewards and the possibility to negotiate their pay, rights and protections and freedom (Hiknos, 2023). Indeed, it might well be the case that a platform company worker is a student working occasionally to get extra savings, even if the majority is represented by migrants or people with limited options to find other job opportunities (Moncef et al., 2021; Nguyen et al., 2023). If flexibility is achieved by both workers and companies, this will provide decent working conditions and benefits for the platform companies that are able to manage possible fluctuations in their demand thanks to these workers. At the same time, long-term workers, on which the success of the last-mile delivery platform business model seems to be built as they provide a stable workforce (Cachon et al., 2017), should be recognized as employees acknowledging the tensions that might emerge between the worker perspective and the platform perspective in case of long-term relationships. At the same time, it will be important to monitor that the dual workforce system does not generate frictions and a divide between short and long-term workers that might negatively impact the organizational climate and the company reputation.

These findings and contributions also provide several implications for platform companies: it is important to know that, in the presence of high percentages of exploitative working conditions, platform companies might experience lower than optimal performance results both in terms of social and economic sustainability. With this being the case, we suggest that firms reconsider the working conditions of their workers to offer decent working conditions that can benefit both workers and companies. Indeed, we find that decent work relationships that are characterized by higher earnings and rights and protections are positively associated with workers' well-being and individual performance, benefiting both workers and companies. As shown in the IPMA, investing to increase earnings and rights and protections can generate relevant benefits for platform workers and companies, as they are currently under leveraged. Indeed, this situation was quite rare in our sample and often associated with the fact that the worker had a longer relationship with the platform company. Longer relationships seem difficult to achieve, happening only in a few of the cases in our sample and being related to higher stress and lower performance, possibly because of the negative effects of the lock-in mechanisms put in place by platform companies to ensure a minimum stable base of workers available to satisfy customer requests (Bai et al., 2019). Thus, platform companies should consider increasing the wages paid to platform workers and the rights and protections for short-term independent workers to gain benefits related to both social (i.e., worker well-being) and economic sustainability (i.e., individual performance). In addition, we suggest that a dual workforce

management model for decent working conditions should be applied in platform companies to address ethical concerns and socio-economic trade-offs: on the one hand, the more stable workers should have an employment relationship with stable contracts and earnings and rights and protections; on the other hand, some workers should remain independent and be connected to the platform via spot transactions for occasional collaborations during periods of peak demand. However, to have decent working conditions, the latter group of workers should be able to decide when and how to work for the platform company because empowerment is key for them and their worker well-being. Indeed, the IPMA shows that perceived empowerment is highly important for performance achievement and continued investments can benefit both perceived well-being and individual performance. Otherwise, these workers might be assimilated into the so-defined "false self-employed worker" who does not actually have the freedom to decide how to organize their work (i.e., the ability to reject orders and freely choose the schedules without penalties and negotiate the pricing of the service to some extent) but would be working as employees without sharing the same benefits (Olias, 2020).

These findings also have implications for policymakers: we illustrate that platform companies often set up exploitative work relationships for their workers, which has negative impacts on perceived well-being and individual performance and is worrisome in terms of ethical and social implications for the future of work. Governments in several European countries and the European Commission are actively searching for national and cross-national legislation frameworks regarding working conditions for last-mile delivery companies. The rules and regulations of the labor market from a policy perspective are only now trying to catch up and regulate this market (European Commission, 2021). In Spain, the "Riders' law" was approved in September 2021, requiring last-mile delivery platform companies to employ their workers through a formal contract, including the provision of a regular salary and workers' rights and protection. However, so far, this law has limited application because some platform companies are trying to demonstrate the self-employed status of workers while others have decided to pay penalties for noncompliance rather than update their arrangements with riders in accordance with the law (Oliás, 2020). Likewise, some platform companies preferred to go out of business rather than providing employment status to their workers because this was not economically viable for them (Ahsan, 2021; Steer et al., 2021). To address such a socio-economic trade-off, legislators could consider putting in place the proposed dual workforce management model and define clear rules about what type of work relationships to set up and guarantee decent working conditions for both groups of workers. In the case of more stable workers, this can be achieved by defining formal employment contracts,

and in the case of independent workers, this can be achieved by assuring a social subsystem characterized by empowerment and autonomy to organize their own work. Additional analysis in the current study shows that higher earnings and higher rights and protections are mostly present in association with high work stability (see the *Complete work relationship* cluster in Appendix A). Thus, the authorities should be vigilant that such conditions are offered to spot independent workers and that such status should be considered only for occasional collaborations, not for continuous ones.

Conclusion

The present research provides some initial insights into the working conditions in which last-mile delivery platform workers are embedded and their consequences on the corporate social sustainability of platform companies. A novel aspect of our research is that we directly surveyed the platform workers, thus conceptualizing the work relationship, social and technical subsystems, and outcomes from an individual perspective, with implications on the social and economic sustainability of platform companies. We propose a dual workforce management model for creating decent working conditions that positively affect the well-being and individual performance of platform workers and, in turn, social and economic sustainability for platform companies.

Despite several contributions, the present study suffers from possible limitations. First, in the current study, we have focused on the direct relationship between different dimensions of working conditions (i.e., work relationship, social subsystem, and technical subsystem). Future studies might consider extending our findings by investigating the interaction between such dimensions. Indeed, it may be that the social subsystem and technical subsystem might interact between them and the work relationship, balancing each other's effects and optimizing the overall work context.

Second, the principal unit of analysis of the present research was the worker. Future research could combine the individual worker and company levels of analysis. For such a project, the company level may require a longitudinal perspective. It could well be that the individual implications for organizational performance are delayed and that multiple unobserved factors may influence the strength and time of this delay (Fisher & Connelly, 2017). In addition, in the present study, individual outcomes (subjective and objective) were self-reported by the workers. In future studies, it might be interesting to engage with platform companies and ask them to provide individual and company-based objective performance measures. Given the current public opinion landscape in which platform companies are often blamed by the media for working conditions and new regulations are appearing, companies may not be incentivized to participate

in such studies. However, increased data availability, transparency, and collaboration with researchers could ameliorate this tension. Future studies might also consider implications related to the composition of the platform company's workforce, in terms of gender diversity and age distribution, since our results regarding control variables indicate a significant effect on worker's perceived well-being and individual performance.

Another limitation of our research is that we focused solely on Spain. Although Spain is a long-term member of the European Union, labor rights and conditions vary across countries. Companies have adopted similar labor and operating practices across countries and regions. Nevertheless, we surveyed workers who were connected to platforms operating across countries, such as Deliveroo, Glovo, and Uber Eats. It would be interesting to understand how these global platforms adopt their practices across various regions and identify what work relationships are set up in contexts with different labor laws and employment rules, as well as how these discrepancies might affect their work organization.

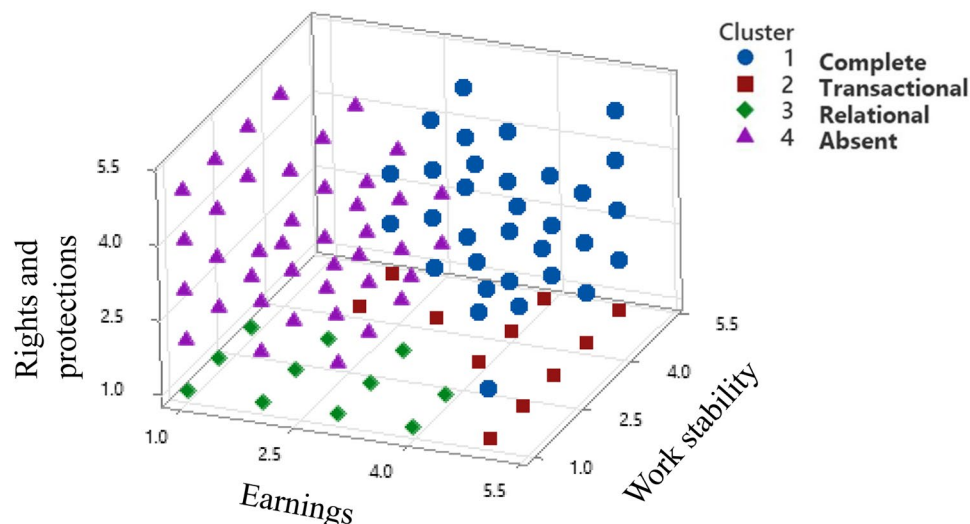
Finally, although the coefficient of determination (R^2) in our model is relatively low, it is important to recognize the inherent complexity and variability specifically regarding our study by considering the sensitive topic and individual respondents. The nature of the studied phenomenon involves numerous unobservable factors (such as the individual situation of each respondent), making it challenging to explain a substantial proportion of the variation using the selected variables. Thus, it is essential to interpret the findings within the context of the inherent complexity of social systems.

Nevertheless, despite these limitations, the present research furthers our understanding of the working conditions in platform-based last-mile delivery companies by advancing an empirical and holistic perspective (i.e., including work relationships and social and technical components) on the platform-worker relationship and providing a nuanced perspective of its ethical implications.

Appendix A: Analysis of the Typologies of Work Relationships

We run a cluster analysis using SPSS to identify the work relationship typologies present in our sample, combining the dimensions of work stability, earnings, and rights and protections. The frequencies for the three abovementioned indicators of work relationships can be found in Table 2. These indicators share information, as shown by the Spearman's correlation coefficients in Table 11. This indicates that there is an underlying structure for these indicators, with redundant information that has greater power in generating clusters of work relationship typologies. Before conducting the analysis, we identified the relevant components

Fig. 5 PCA biplot



by implementing a nonlinear principal component analysis (NLPCA). Given that the work relationship concept includes ordinal variables with scales that are not comparable, NLPCA was run while accounting for nonlinear relationships. The obtained solution, which can be found in Table 12, indicated that there were two principal dimensions describing the work relationship construct. The NLPCA's output was comparable to the principal component analysis output and included the reporting and analysis of several elements. First, the eigenvalues indicated that the variance accounted for (VAF). The total VAF across the two dimensions was 85.3%, with a clearly dominant first dimension (VAF: Dimension 1 = 49.4%, Dimension 2 = 35.9%). Thus, the two selected dimensions explained about 85% of the variance in the three ordinal variables, indicating a good fit. That is, at least 85% of the variance in a quantified variable was explained across the principal dimensions. The centroid coordinates illustrate the variable–dimension relationship and help assign meaning. As shown in Table 12, Dimension 1 mainly captured information about work stability and earnings, while Dimension 2 drew from rights and protections.

The criterion variables used for the cluster analysis were the two dimensions obtained in the NLPCA, with Dimension 1 capturing work stability and earnings and Dimension 2 relating to rights and protection. The NLPCA solution already presents a natural grouping into four different clusters, as observed in Fig. 5.

Following this observed grouping, we performed a cluster analysis in two steps. First, we applied a hierarchical clustering algorithm (Ward's method) using Euclidian distance as a dissimilarity measure of workers' distances to confirm the four naturally identified groups in the previous NLPCA analysis. Ward's agglomerative clustering method is based on a classical sum-of-squares criterion that produces groups that

Table 11 Spearman's rank correlation coefficient

	Work stability	Earnings	Rights and protections
Work stability	1	0.422**	0.154**
Earnings	0.422**	1	0.109*
Rights and protections	0.154**	0.109*	1

**Correlation is significant at the 0.01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Table 12 NLPCA results

Variables	Variance accounted for (VAF)		
	Dimension 1	Dimension 2	Total
Earnings	0.802	0.003	0.805
Work stability	0.675	0.032	0.707
Rights and protections	0.005	1.044	1.049
Active total	1.482	1.078	2.560
% explained variance	49.4%	35.9%	85.3%

minimize within-group dispersion at each binary fusion. We identified the partition of the work relationships detected in previous NLPCA analysis and then used the centroid of the

Table 13 K-means initial and final centroids

Cluster	Initial centroids		Final centroids	
	Dimension 1	Dimension 2	Dimension 1	Dimension 2
1	1.5055	0.1728	1.3536	0.6813
2	0.3642	-1.6239	0.9018	-1.3987
3	-0.3140	1.0068	-0.6419	0.8368
4	-0.9787	-1.0181	-0.5676	-1.2931

Table 14 Median criterion variables across clusters and pairwise post hoc analysis

Criterion variables	Cluster 1 (complete)	Cluster 2 (transactional)	Cluster 3 (relational)	Cluster 4 (absent)	Total sample	K-W test <i>p</i> value
Work stability	4 (2,3,4)	3 (1,3,4)	2 (1,2)	2 (1,2)	3	0.000
Earnings	5 (3,4)	4 (3,4)	2 (1,2)	2 (1,2)	3	0.000
Rights and protections	3 (2,4)	1 (1,3)	3 (2,4)	1 (1,3)	2	0.000
Cluster size	83	46	162	101	392	

four worker groups as the starting approximation for subsequent nonhierarchical K-means to maximize the homogeneity within the groups and heterogeneity between the groups. The initial and final centroids are shown in Table 13, corresponding to four clusters with sizes of 83, 46, 162, and 101.

Given the ordinal nature of the criterion variables, Table 14 reports their median values and the results of the nonparametric Kruskal–Wallis (K–W) tests. All criterion variables were significantly statistically related to cluster membership. In addition, Table 14 reports a pairwise comparison of the criterion variables across clusters. Clusters 1 and 2 included workers with higher levels of work stability and earnings. These two clusters varied according to the level of rights and protection, being lower for Cluster 2. Cluster 1 was formed by workers with higher levels of work stability (Med = 4), earnings (Med = 5), and rights and protections (Med = 3). Thus, we consider these workers to have a *complete work relationship*. In contrast, Cluster 2 exhibited a *transactional work relationship*, given the lower level of the rights and protections criterion variable (Med = 1). Clusters 3 and 4 showed lower levels of work stability and earnings. They differed in their levels of rights and protection, being higher in Cluster 3 (Med = 3), which we defined as showing a *relational work relationship*. Finally, Cluster 4 included workers with lower levels in all criterion variables (i.e., work stability [Med = 2], earnings [Med = 2], and rights and protection [Med = 1]), resulting in an *absent work relationship*.

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Declarations

Conflict of interest There is no potential conflicts of interest in this study.

Research Involving Human Participants and/or Animals This research required to conduct a series of interviews and a survey involving last-mile delivery platform workers in Spain. The ethical committee of the authors’ institution (ESADE Business & Law School) has evaluated and approved the study design. Specifically, the Committee for the Use of Human Subjects in Research (CUHSR), in its meeting of 9th Decem-

ber 2020, has reviewed the research proposal presented by Annachiara Longoni, and full ethical approval has been granted. The ESADE Business & Law school approval number for this study is 041/2020. In case additional information is needed, we can provide it.

Informed Consent eWork/Crowdwork—Participant Informed Consent Form: The purpose of this study is to investigate working conditions in the context of last mile delivery industry. This study is being conducted by Dr. Annachiara Longoni, ESADE Business & Law School. This project has received ethical approval from the Research Ethics Committee of Esade (CUHSR Protocol Number: 2020_041).

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