Examining couriers' job satisfaction in instant delivery services

A structural equation model with multi-group analysis based on Maslow's hierarchy of needs theory

Lu, Miaojia; Liu, Rui; Correia, Gonçalo Homem de Almeida; Kavta, Kuldeep; Huang, Chengyuan

DOI
10.1016/j.rtbm.2025.101566

Publication date
2025

Document Version
Final published version

Published in
Research in Transportation Business and Management

Citation (APA)
Lu, M., Liu, R., Correia, G. H. D. A., Kavta, K., & Huang, C. (2025). Examining couriers' job satisfaction in instant delivery services: A structural equation model with multi-group analysis based on Maslow's hierarchy of needs theory. *Research in Transportation Business and Management*, *64*, Article 101566. https://doi.org/10.1016/j.rtbm.2025.101566

Research in Transportation Business & Management 64 (2026) 101566

Contents lists available at ScienceDirect

Research in Transportation Business & Management

journal homepage: www.elsevier.com/locate/rtbm

Examining couriers' job satisfaction in instant delivery services: A structural equation model with multi-group analysis based on Maslow's hierarchy of needs theory

Miaojia Lu [a,b], Rui Liu [a,b], Gonçalo Homem de Almeida Correia [c], Kuldeep Kavta [c], Chengyuan Huang [d,*]

[a] The Key Laboratory of Road and Traffic Engineering, Ministry of Education, Shanghai, China
[b] College of Transportation, Tongji University, 4800 Cao'an Road, Jiading District, Shanghai, China
[c] Department of Transport & Planning, TU Delft, 1 Stevinweg, 2628 CN Delft, Netherlands
[d] Urban Mobility Institute, Tongji University, Shanghai, 4800 Cao'an Road, Jiading District, Shanghai, China

ARTICLE INFO

Keywords:
Instant delivery
Job satisfaction
Maslow's hierarchy of needs theory
Structural equation model
Multi-group analysis

ABSTRACT

With the rapid growth of instant delivery services in China, the number of couriers is rising due to low entry barriers such as minimal educational requirements, flexible hours, and competitive salaries. However, the industry faces challenges like excessive workloads and high accident rates, which could reduce couriers' job satisfaction. While the literature on couriers' job satisfaction is extensive, the application of holistic needs-based theories remains unexplored, particularly through advanced quantitative methods. This study operationalizes Maslow's Hierarchy of Needs Theory (MHNT) as a multi-dimensional construct and incorporates it into a Structural Equation Modeling (SEM) framework to examine its hierarchical impact on job satisfaction. Additionally, it explores the impact of physical health, occupational discrimination, and new technologies on couriers' job satisfaction. To test the framework and derive a nuanced understanding of factors influencing courier job satisfaction, data from 490 couriers in Shanghai, China, and nearby areas was collected. To account for differences in employment types, the survey data was split into full-time and part-time courier groups, with a multigroup analysis conducted using a structural equation model. The results show differing factors influencing job satisfaction. Part-time couriers are significantly affected by compensation and working environment, while full-time couriers are, besides compensation and working environment, also influenced by career development. These findings enhance the understanding of work conditions and motivators for couriers across different employment types within the instant delivery sector, offering key insights to enhance courier job satisfaction and promote sustainable development of this business.

1. Introduction

Instant delivery refers to a fast delivery service provided by mobile apps or e-commerce platforms that utilize social logistics resources. This service offers point-to-point, non-stop, on-demand delivery for activities such as food delivery, immediate shopping, and urgent needs (Southern Plus, 2024). For example, in China, the scale of online food delivery customers reached 535 million in 2023 (China Internet Network Information Center, 2023). The order volume of China's instant delivery industry reached 40.88 billion in 2023, representing an increase of 89.9 % compared to 2020 (Sullivan, 2024). In 2022, 6.24 million couriers earned their income through Meituan, a prominent online instant delivery platform in China (Meituan Delivery, 2023). The job's appealing characteristics, including flexibility, a competitive salary, and minimal educational requirements, contribute to its high attractiveness (Municipal Bureau of Statistics, 2023; Zheng, Zhang, and Yang, 2020).

However, various issues have surfaced within this profession, such as a high accident rate, low hourly wages, and intense working conditions (Lai, 2020; Lin and Li, 2021; Qin, Wei, Zhang, and Ma, 2021; Yan, 2020). In 2023, China recorded 12,000 traffic violations related to instant

* Corresponding author.
E-mail addresses: miaojjialu@tongji.edu.cn (M. Lu), 2052617@tongji.edu.cn (R. Liu), G.Correia@tudelft.nl (G.H.A. Correia), K.Kavta@tudelft.nl (K. Kavta), chengyuanhuang@tongji.edu.cn (C. Huang).

https://doi.org/10.1016/j.rtbm.2025.101566
Received 12 October 2024; Received in revised form 19 November 2025; Accepted 21 November 2025
Available online 28 November 2025

delivery service couriers (Wuweitan, 2024). Additionally, while the legally defined standard workday in China is eight hours, couriers work approximately ten hours per day on average (Mao, Tian, and Liu, 2025). This reality highlights the widespread issue of unpaid or undercompensated overtime, a critical problem stemming from inadequate labor rights protection (Zhou, 2019). Furthermore, a survey conducted among non-resident couriers in Beijing revealed that these couriers face significant mental health risks, with violations of labor rights and occupational identity discrimination being key contributing factors (Li, Wang, and Luo, 2024), which could critically affect couriers' job satisfaction. Previous research shows that well-being plays a key role in enhancing couriers' delivery efficiency (Yu, Zhang, and Yun, 2024), while low job satisfaction is linked to decreased work motivation (Ma and Ye, 2019; Ye, De Vos, and Ma, 2020), potentially resulting in a decline in service quality. Moreover, low job satisfaction among couriers often results in high turnover rates in job permanency. A survey by XYZ Research (2024) found that over 60 % of couriers have less than one year of experience, and 26 % have been in the industry for 1–3 years (XYZ Research, 2024). This high turnover rate underscores the urgent need to enhance job satisfaction. Additionally, recruiting and training new couriers is both costly and time-consuming, particularly when the new hires are unfamiliar with the delivery area and company-specific requirements. Given the crucial role couriers play in ensuring fast and efficient instant delivery services, addressing their job satisfaction is a vital area of research. Increasing job satisfaction can help maintain couriers' motivation, thereby ensuring high-quality delivery services (Ma and Ye, 2019; Ye et al., 2020). Additionally, higher job satisfaction may attract new employees and alleviate employment pressures, contributing to societal stability and economic growth.

Various theoretical frameworks, including Middle-Range Theory, Grounded Theory, and Cognitive Appraisal Theory, have been employed to examine couriers' job satisfaction (Masorgo, Mir, and Hofer, 2023; Puram, Gurumurthy, Narmetta, and Mor, 2021). The Maslow's Hierarchy of Needs Theory (MHNT) includes five levels of needs including physiological needs, safety needs, love and belonging needs, esteem needs, and self-actualization needs. MHNT has been proven to be applicable to employee satisfaction studies, which indicates that this theory is also applicable to study couriers' job satisfaction, as couriers are also seen as employees for the instant delivery industry. However, MHNT has not been applied to couriers' job satisfaction, which could offer a framework to take into account couriers' inherent needs, and potentially identify factors affecting job satisfaction of these workers. Additionally, while some studies have addressed physical health issues of couriers in relation to job satisfaction (Li et al., 2024), they have not fully quantified the impact of these health issues. Occupational discrimination, which reflects couriers' social status and involves unfair treatment based on their job, has been mentioned but not thoroughly analyzed in terms of its impact on job satisfaction (Li et al., 2024). Furthermore, the rise of new technologies, such as autonomous delivery vehicles and drones, has not yet been examined for its potential effects on couriers' career development and job satisfaction. This represents a significant gap in the research, indicating a need for further investigation into how these technological advancements might influence job satisfaction in the instant delivery sector.

Additionally, studies assessing job satisfaction largely fail to differentiate between full-time and part-time couriers, despite significant differences in their working statuses. While one recent study by Kavta, Azadeh, Maknoon, Wang, and de Almeida Correia (2025) attempted to examine whether contract type (full-time/part-time) affects riders' preferences for route choice, it ultimately found no difference. The distinction, however, remains crucial: Full-time couriers typically work under formal contracts, adhere to specified hours, and benefit from social insurance, receiving structured remuneration that includes a base salary, commission, and bonuses, usually paid monthly. In contrast, part-time couriers operate flexibly, accepting orders only during their spare time. Their earnings are contingent upon daily completed orders and are often paid daily, and their insurance coverage is notably less comprehensive. These stark differences in employment conditions, work motivation, and life needs strongly suggest there should be significant variations in job satisfaction between the two groups, a divergence that has not been discussed or empirically explored in previous literature.

This paper considers the impact of those insufficiently studied factors, such as physical health, occupational discrimination, and the introduction of new technologies on job satisfaction, and analyzes the factors that have a significant impact on job satisfaction. MHNT is used to analyze couriers' job satisfaction from five levels of needs. And it investigates six factors—health condition, delivery environment, work environment, compensation, social status, and career development—each corresponding to one of the five dimensions of needs (physiological, safety, love and belonging, esteem, and self-actualization) as shown in Fig. 1. To explore the heterogeneity of couriers, the multi-group analysis is added into the analysis process. Employment type i.e., full-time and part-time, is considered as a main criterion for grouping the couriers and eventually finding different relationships in what concerns to the six factors.

The contributions of this study are therefore summarized as follows: 1) This study is one of the first attempts to analyze couriers' job satisfaction through the framework of MHNT. It offers fresh perspectives and directions for research and theoretical development in this area. 2) By considering the impacts of factors such as physical discomfort and health issues, social status, and the impact of emerging technologies (e.g., drones and autonomous delivery vehicles), this study provides a more comprehensive examination of the factors influencing couriers' job satisfaction. 3) Difference of job satisfaction between different groups, i.e., full-time couriers and part-time couriers are explored, which could meet the diverse occupational needs of couriers and promote social equity and inclusive employment.

The remainder of the study is organized as follows. Section 2 presents a literature review, including three parts: factors influencing couriers' job satisfaction, theories and methods applied in couriers' job satisfaction studies, and the application of MHNT in employees' behavior studies. Section 3 introduces the research methodology, including the survey design and hypotheses corresponding to the structural equation model (SEM), and the multi-group analysis (full-time vs part-time). Section 4 presents the results and discussion, including descriptive results and the model assessment. Section 5 lists the key contributions of this study, emphasizing the research findings and their significance. It also discusses the limitations of the study and suggests potential directions for future research.

2. Literature review

This section reviews the factors affecting courier's job satisfaction, and summarizes theories and methods used in prior research to study the

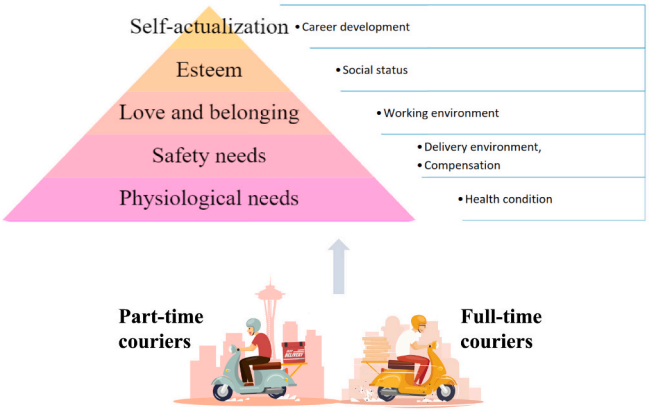

Fig. 1. Framework of this study.

job satisfaction of these workers. It also examines the specific application of MHNT in studies on employees' job satisfaction.

2.1. Factors related to couriers' job satisfaction

When considering the impact of health conditions on job satisfaction, factors such as mental stress, sleep problems, and feeling tired while working are taken into account (Zhang et al., 2022). When examining the impact of the environment on couriers' satisfaction, factors such as road infrastructure, law enforcement cameras, other non-motorized vehicles, and weather conditions are important (Ngoc, Nishiuchi, Nhu, and Huyen, 2022; Papakostopoulos and Nathanael, 2021; Zhang et al., 2022). The investigated road infrastructure elements include speed humps, medians and guard rails, road markings, traffic signals, irregular-shaped intersections and damaged road pavements. Riding habits have been mentioned multiple times in previous studies as well, which includes factors such as running a red light, using a mobile device while riding, smoking while riding, and wearing a helmet, among others (Ngoc et al., 2022; Papakostopoulos and Nathanael, 2021; Wang et al., 2021). The delivery pressure reflected by daily distance driven and daily working hours are also important factors in measuring couriers' satisfaction (Ngoc et al., 2022). Some scholars have also considered the impact of income and benefits on satisfaction, such as perceived sufficiency of income and accident insurance (Ngoc et al., 2022; Papakostopoulos and Nathanael, 2021; Zhang et al., 2022). In terms of couriers' emotions, Zhang et al. (2022) considered factors such as the surrounding green environment on mood, the width of non-motorized lanes on mood, customer complaints and punishment by traffic police. Concerns about client behavior were expressed by 27.2 % of couriers, underscoring its impact on the level of respect shown toward them, as revealed in a survey by Papakostopoulos and Nathanael (2021). Some studies have also explored the relationship between cycling safety and courier satisfaction. Zhang et al. (2022) examined the impact of riding perception, delivery attributes, built environment, and demographic variables on the delivery travel satisfaction of electric two-wheeler couriers. Safety was found to positively contribute to delivery travel satisfaction.

Table 1 summarizes disparate findings on couriers' job satisfaction, yet the relative contribution of each factor to job satisfaction remains ambiguous. To impose conceptual order, the previously studied variables are grouped into seven intuitive themes: health condition, built environment, habits, pressure, income and benefits, emotions, and esteem. This parsimonious classification clarifies the multidimensional nature of courier satisfaction and informs the selection of indicators in the present study.

Table 1
Factors potentially influencing couriers' job performance/satisfaction.

Items	Factors	Reference
Health condition	Mental stress, sleep problems, feeling tired while working.	Zhang et al. (2022)
Built environment	Road infrastructure: the number of speed humps, lack of median and guard rails, lack of road marking, lack of traffic signal, irregular-shaped intersection, narrow lanes, limited visibility, damaged road pavements.	Ngoc et al. (2022)
	Physically separated facility, roadside parking, other non-motorized vehicles, bus pitting, law enforcement cameras at intersections.	Zhang et al. (2022)
	Road condition, weather condition, vehicle condition, unsafe lane splitting.	Papakostopoulos and Nathanael (2021)
Habits	Traffic violation, using mobile while driving, drinking history, smoking while driving.	Ngoc et al. (2022)
	Speed >20 km/h, riding against traffic, riding in the motor vehicle lane, running a red light, not waiting behind the white line, using a cell phone when riding, using a windshield during winter, wearing a helmet, use of reflectors.	Wang et al. (2021)
	Driving the wrong way on one-way streets, driving with one hand, driving on pedestrian zones, driving without wearing helmet, running a red light.	Papakostopoulos and Nathanael (2021)
Pressure	Delivery pressure, suffered stress from driving, number of return trips, daily driving distance, daily assigned orders, have no time to take a rest, working over 8h, working full-time.	Ngoc et al. (2022); Kavta et al. (2025)
	Workloads: mental demands, physical demands, temporal demands	He et al. (2021)
Income and benefits	Perceived sufficiency of income	Ngoc et al. (2022)
	Income increasing, facilitating the daily life	Zhang et al. (2022)
	Accident insurance, payment methods, tip income	Papakostopoulos and Nathanael (2021)
Emotions	The surrounding green environment on mood, the width of non-motorized lanes on mood, route planning generated by navigation, payment deducted by the delivery platform for overtime, customer complaints or bad reviews, punishment by traffic police	Zhang et al. (2022)
	Anxiety, anger, altruism, riding feedback, riding confidence	He et al. (2021)
Esteem	Client behavior	Papakostopoulos and Nathanael (2021)

2.2. Theories and methods applied in couriers' job satisfaction studies

Previous studies examining couriers' working conditions have employed various theoretical frameworks, such as the Middle-Range Theory, the Cognitive Appraisal Theory, and the Grounded Theory (Chen, Tian, Deng, Zhou, and Huang, 2022; Masorgo et al., 2023; Puram et al., 2021). These theories offer insights into couriers' work experiences from different perspectives. The Middle-Range Theory facilitates the integration of logistics-related factors and mechanisms, making it suitable for examining causal relationships within specific research contexts (Craighead, Ketchen Jr, and Cheng, 2016; Merton, 1968; Pinder and Moore, 1980; Stank, Pellathy, In, Mollenkopf, and Bell, 2017; Wowak, Craighead, Ketchen Jr, and Connelly, 2022). The Cognitive Appraisal Theory focuses on how individuals evaluate and respond to the outcomes of their interactions or exchanges (Lazarus, 1991). The Grounded Theory emphasizes the systematic generation of theory from empirical data through iterative coding and constant comparison, aiming to explain social processes and human interactions as they emerge from participants' lived experiences (Corbin and Strauss, 1990; Glaser and Strauss, 2017). For instance, Puram et al. (2021) developed a grounded model of courier challenges encompassing four core categories: operational, customer-related, organizational, and technological issues.

However, these existing theories exhibit limitations in systematically deconstructing the complex, multi-dimensional nature of couriers' job satisfaction. The Middle-Range Theory's strong emphasis on context-specific variables can lead to fragmented, non-generalizable explanations. The Cognitive Appraisal Theory attributes satisfaction solely to individuals' subjective interpretations, overlooking the objective, hierarchical foundation of human needs. The Grounded Theory, meanwhile, is less adept at exploring the latent, higher-level social or growth needs that may influence long-term motivation.

2.3. Maslow's hierarchy of needs theory

To overcome these limitations and provide a more holistic and structured framework for analyzing courier motivation, we adopt MHNT. Maslow (1954) proposed that motivation arises from a hierarchy of fundamental human needs, which are typically conceptualized as a

five-tier pyramid. The five categories of goals, often referred to as fundamental human needs, include: 1) Physiological Needs: These are the most basic requirements for survival, including the need for air, food, water, rest, and shelter. In an employment context, this translates primarily to the need for a livable wage and reasonable working hours. 2) Safety Needs: Once physiological needs are met, the need for security and protection becomes dominant. This encompasses physical security, financial security, health, and well-being. For couriers, this is highly relevant to job security, physical safety from traffic/accidents, and protection from unfair treatment. 3) Love and Belonging Needs (Social Needs): These needs involve the desire for interpersonal relationships, affection, friendship, and a sense of community. In the workplace, this relates to teamwork, positive relationships with peers and supervisors, and feeling like a valued part of the organization. 4) Esteem Needs: These needs encompass the desire for self-respect, achievement, competence, independence, and the respect of others. In a professional setting, this is tied to recognition, status, job title, and a sense of accomplishment. 5) Self-Actualization Needs: This represents the highest level of the hierarchy—the realization of one's full potential and personal growth. For employees, this involves opportunities for skill development, creative work, challenging tasks, and career advancement that allow them to maximize their abilities.

MHNT has been widely applied in various fields, such as education, consumer behavior, healthcare, technology, and entrepreneurship (Abbas, 2020; Čížek, 2012; Cui, Wang, Chen, Wen, and Han, 2021; Duygun and Şen, 2020; Gross, Novey, and Triskett, 2022; Hsieh, 2023; Poirier and Devraj, 2019). It provides valuable insights into human motivation and behavior, helping professionals to understand and address the diverse needs of individuals and groups across different domains. Meanwhile, the application of MHNT in managing and motivating employees has been well-established. For instance, studies by Benson and Dundis (2003) in healthcare, and Jerome (2013) in general business, highlight MHNT's ongoing relevance in addressing contemporary workforce concerns and enhancing employee engagement and performance. Crucially, research by Ștefan, Popa, and Albu (2020) demonstrated that meeting higher-order needs (like esteem and self-actualization) is strongly associated with higher levels of professional performance. Given that couriers are essential employees operating in a high-stress environment, this extensive literature confirms the theory's significant relevance in understanding couriers' diverse needs and job satisfaction.

Compared to the theories previously applied to courier working conditions, MHNT offers distinctive conceptual advantages. Its framework systematically encompasses a full spectrum of human needs, ranging from basic physiological and safety needs (e.g., income, physical safety) to higher-order social and growth needs (e.g., respect, self-actualization). This structure provides a holistic perspective for integrating disparate factors influencing job satisfaction, thereby overcoming the limitations inherent in the Middle-Range Theory's narrow context-specific focus and the Cognitive Appraisal Theory's overly subjective orientation. The hierarchical organizational logic of MHNT allows diverse factors such as income instability, road safety concerns, social recognition, and career development to be systematically incorporated within a unified framework. Furthermore, unlike the inductive Grounded Theory, MHNT provides an a priori conceptual model, guiding researchers to proactively identify and explore potentially neglected higher-level needs among couriers (e.g., occupational dignity and career value), thus enabling a more comprehensive analysis of occupational well-being.

However, the theory also has limitations, as its hierarchical order is overly rigid and overlooks the intersectionality and flexibility in the sequence of needs across different cultures or individuals (Hofstede, 1984; Tay and Diener, 2011). While acknowledging documented criticisms regarding the theory's Western-centrism and limited cross-cultural validation (Hofstede, 1984; Tay and Diener, 2011), recent evidence confirms that the five needs resonate meaningfully with Chinese adults (Taormina, Gao, and Kuok, 2022), supporting its applicability in the present context.

3. Methodology

3.1. Constructs

Based on the previous studies and the MHNT framework, six constructs belonging to five levels of needs are considered in this study which is depicted in the conceptual diagram in Fig. 2. Moreover, for taking into account couriers' heterogeneity, employment type i.e., full-time and part time work, is used as a criterion for distinguishing the couriers.

Based on the five levels of MHNT and considering the specific context of instant delivery couriers in China, the constructs associated with each level are identified. The details of each level including the definitions, related studies, and the proposed hypotheses are presented below.

Physiological needs represent the foundational level in MHNT, encompassing essential biological requirements for survival, such as food, water, shelter, sleep, and overall physical well-being (Maslow, 1954). Given the current social environment where basic needs like food and accommodation for couriers are mostly met, this study focuses on their physical well-being. Jin, Wang, Zhou, and Liu (2024) verify that deteriorating health (increased probability of common diseases and poorer self-rated health) mediates the negative effect of longer working hours on couriers' job satisfaction; Lin (2022) further report that high-level fatigue is prevalent among delivery workers and is associated with lower satisfaction. Specifically, this study investigates whether couriers are experiencing occupational diseases such as lumbar spine problems, cervical spine problems, or gastrointestinal diseases, to assess the fulfillment of their physiological needs. The discomfort and health problems associated with these conditions are likely to negatively impact job satisfaction. Thus, in this study, physiological needs are operationalized through the assessment of health condition. The following hypothesis is proposed:

H1. Health condition has a significant negative impact on the job satisfaction of Couriers.

Safety needs, as articulated by (Maslow, 1954), encompass protection from physical harm, danger, and threats, along with the presence of a stable and secure environment. For couriers, safety needs are defined as their perception of safety and security during the delivery process and other aspects of their work. Factors influencing the safety needs include the delivery environment (He et al., 2021; Ngoc et al., 2022; Papakostopoulos and Nathanael, 2021; Puram et al., 2021; Wang et al., 2021; Zhang et al., 2022) and compensation, which encompass company policies and welfare measures designed to ensure employee living security (Ștefan et al., 2020). In this study, safety needs are operationalized through two constructs: delivery environment, and compensation. The following two hypotheses are proposed:

H2. Delivery environment has a significant negative impact on the job satisfaction of Couriers.

H3. Compensation has a significant positive impact on the job satisfaction of Couriers.

Love and belonging needs encompass the formation of relationships, the experience of love and intimacy, the establishment of friendships, and the sense of belonging to a community or social group (Maslow, 1954). In the context of the work of couriers, this level of needs is addressed based on their working environment. Key aspects of the working environment include the flexibility of working hours, work comfort, and interpersonal relationships. Research indicates that a more supportive and fulfilling working environment can significantly enhance couriers' job satisfaction (Ngoc et al., 2022; Nguyen, Pojani, Nguyen-Phuoc, and Thi, 2023; Papakostopoulos and Nathanael, 2021; Zhang

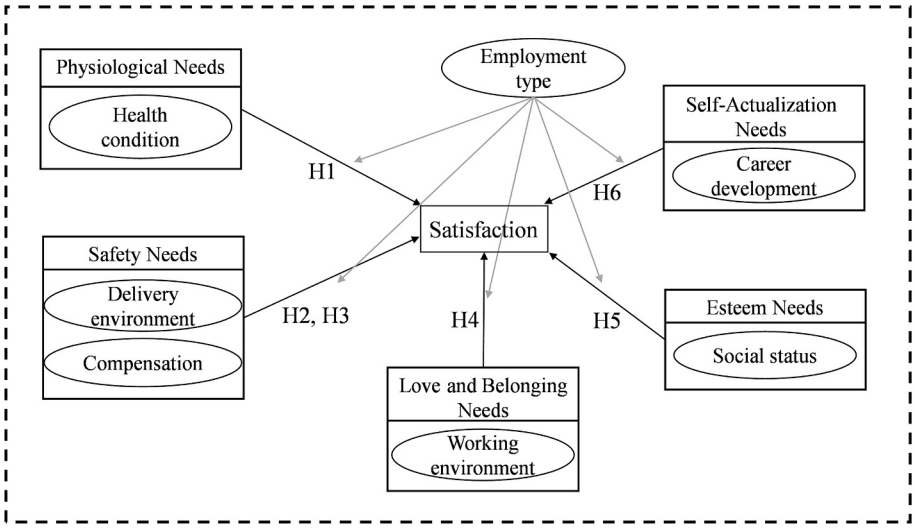

Fig. 2. Conceptual model for job satisfaction of Couriers.

et al., 2022). Based on this understanding, the following hypothesis is proposed:

H4. : Working environment has a significant positive impact on the job satisfaction of Couriers.

Esteem needs involve gaining self-respect, developing self-esteem, achieving a sense of accomplishment, and receiving recognition and respect from others (Maslow, 1954). In relation to esteem needs, this study explores couriers' perceptions of their social status, focusing on attitudes from both customers and restaurant staff, as well as the couriers' sense of recognition and appreciation. Empirical evidence indicates that perceived fairness and recognition significantly enhance courier job satisfaction, as feeling respected by customers and organizations fulfills core psychological needs (Imran, Ghazwan, and Firmansyah, 2025; Pang, Fang, Wang, Mi, and Su, 2023). Couriers' job satisfaction is likely to be higher when they feel respected. Therefore, the following hypothesis is proposed:

H5. Social status has a significant negative impact on the job satisfaction of Couriers.

Self-actualization needs represent the highest level in MHNT, defined as the desire for personal growth, fulfillment, and reaching one's full potential (Maslow, 1954). This level involves pursuing meaningful goals, engaging in creative activities, and aligning one's actions with personal values and aspirations. In relation to self-actualization needs, this study examines couriers' perceptions of their career development. The study explores how opportunities for future development and a sense of recognition for the value and importance of their work impact job satisfaction. When couriers feel that they have meaningful career development and that their contributions are valued, their job satisfaction is likely to improve. The process of providing instant delivery services can bring a sense of achievement to couriers by helping others (Shi and Li, 2023). For example, during the COVID-19 pandemic, couriers who delivered essential food and medicine were praised and appreciated by the public. Therefore, the following hypothesis is proposed:

H6. Career development has a significant positive impact on the job satisfaction of Couriers.

3.2. Survey design

For testing the hypothesis referred to above, a questionnaire was designed and structured in two main parts. The first part gathered basic demographic information, including gender, age, education level, average daily working hours, and average daily delivery distance. The second part of the questionnaire focused on job satisfaction, assessed using a five-point Likert-type scale ranging from "strongly disagree" (1) to "strongly agree" (5). The questions in this section were designed based on the conceptual framework outlined in Fig. 2, with specific indicators and references detailed in Table 2.

The survey was conducted primarily in Shanghai during November and December in 2023, utilizing both online and offline methods. In the pre-survey phase, questionnaires were distributed at dispatch stations for couriers, and feedback and suggestions from the couriers regarding the questionnaire were collected. A total of 33 questionnaires were gathered for this pre-survey. The feasibility of the survey was assessed by evaluating the quality of the questionnaire. Based on the feedback from the couriers and practical considerations, specific questions were adjusted to improve the survey's effectiveness and relevance.

The revised questionnaire was uploaded to the Sojump website, generating a QR code for distribution. The formal survey was administered through two channels. First, the QR code was provided to couriers, who completed the questionnaires during their free time. Simultaneously, the questionnaires were sent to delivery platform managers, who encouraged and supervised couriers to participate in the survey. The sample size required to achieve adequate representativeness from a given population has been established at 300 for good representativeness and 500 for very good representativeness (Comrey and Lee, 2013). Alternatively, adequate sample size can be determined through maintaining a minimum 20:1 ratio between sample size and the number of model parameters requiring statistical estimation (Kline, 2023). The 490 valid responses obtained in this study satisfy both criteria, ensuring sufficient statistical power for the subsequent analyses.

3.3. Data analysis methods

The theoretical framework established through MHNT and the corresponding hypotheses are empirically tested using SEM. The connection between MHNT and SEM is operationalized by treating each need level as a latent variable in the model. As illustrated in Fig. 2, the five levels of needs (e.g., Physiological, Safety) are represented by their corresponding constructs (e.g., Health Condition, Delivery Environment and Compensation). These latent constructs, which are not directly observable, are measured by multiple observed indicators derived from the survey (see Table 2). The SEM analysis then tests the hypothesized paths (H1-H6) from these constructs to the ultimate outcome, job satisfaction. This approach allows the researchers to statistically verify whether fulfilling the needs at each level of Maslow's hierarchy, as

Table 2
Constructs, indicators, and supporting references.

MHNT	Constructs	Indicators	Source
Physiological needs	Health condition (HC)	HC1: I often feel physically uncomfortable. HC2: This job brings me a lot of physical discomfort and health problems, such as back pain, neck problems, stomach issues, and eye-related ailments.	Zhang et al. (2022); Huang (2024); Hu (2022); Jin et al. (2024); Lin (2022)
Safety needs	Delivery environment (DE)	DE1: Large traffic volumes affect my delivery. DE2: Parked vehicles along the roadside affect my delivery. DE3: The width of non-motorized lanes affects my delivery.	Ngoc et al. (2022); Zhang et al. (2022); Papakostopoulos and Nathanael (2021); Puram et al. (2021)
Safety needs	Compensation (CM)	CM1: I'm satisfied with the incentive policies at work. CM2: I accept the dis-incentive policy implemented at work. CM3: I'm satisfied with the social security provided at work.	Ngoc et al. (2022); Zhang et al. (2022); Papakostopoulos and Nathanael (2021); Puram et al. (2021)
Love and belonging needs	Working environment (WE)	WE1: I think the working environment is quite comfortable. WE2: I get along well with my colleagues and superiors. WE3: I have adequate time for rest during work (e.g., between each delivery and have individual mealtimes).	This study; Zhang et al. (2022)
Esteem needs	Social status (SS)	SS1: I feel that customers often treat me badly. SS2: I feel that the restaurant staff often treat me badly. SS3: I feel discriminated against when I wear takeout work clothes.	Papakostopoulos and Nathanael (2021); Puram et al. (2021); Pang et al. (2023); Imran et al. (2025)
Self-actualization needs	Career development (CD)	CD1: I believe I will realize my potential and value in the job of a courier. CD2: I believe I can have further long-term development in this position in the future, for example I could move on to a more senior position. CD3: Although there are currently emerged delivery technologies such as autonomous delivery, convenient and cost-effective delivery services still rely on my contributions.	This study; Puram et al. (2021)

measured by the study's indicators, has a significant impact on couriers' job satisfaction, thereby providing empirical evidence for the theoretical framework.

The suitability of SEM for this analysis stems from its unique capabilities as a comprehensive statistical technique. Integrating factor analysis and linear regression from traditional multivariate methods, SEM is specifically designed to identify, estimate, and validate causal models (Wu, 2009). SEM enables the simultaneous examination of all relationships within a model and can analyze both observed and latent variables, while accounting for measurement errors in observed variables (Hair, 2009). The analysis consists of two stages: measurement model assessment and structural model assessment. The measurement model focuses on the reliability, validity, and consistency of measurement indicators, while the structural model evaluation focused on assessing the relationships between latent variables and the overall fit of the model with the data. The measurement model evaluation involves four steps. The first step is to evaluate the reliability of the measurement indicators using Cronbach's alpha and Composite Reliability (CR), with both metrics adhering to a threshold of 0.70. This threshold ensures that the measurement instruments demonstrate internal consistency and stability (Fornell and Larcker, 1981; Hair, 2009). Secondly, convergent validity is assessed by calculating the Average Variance Extracted (AVE), with a threshold of 0.50 set to confirm that the indicators effectively capture the intended constructs. Additionally, factor loadings are required to exceed 0.5 to ensure that each indicator accurately represents its corresponding construct (Hair, 2009). Thirdly, discriminant validity is examined to ensure that different latent variables are distinct and independent. This is achieved by comparing the correlations between measurement indicators and other latent variables. For robust discriminant validity, the square root of the AVE for each construct must exceed the correlation coefficients between constructs (Hair, 2009). The final step involves evaluating the model fit and construct validity using Confirmatory Factor Analysis (CFA). The standards for assessing model fit and construct validity are derived from established guidelines and previous research (Chen, Curran, Bollen, Kirby, and Paxton, 2008; Cheung, Zhang, Wang, Hsu, and Manu, 2022; Golob, 2003; Hu and

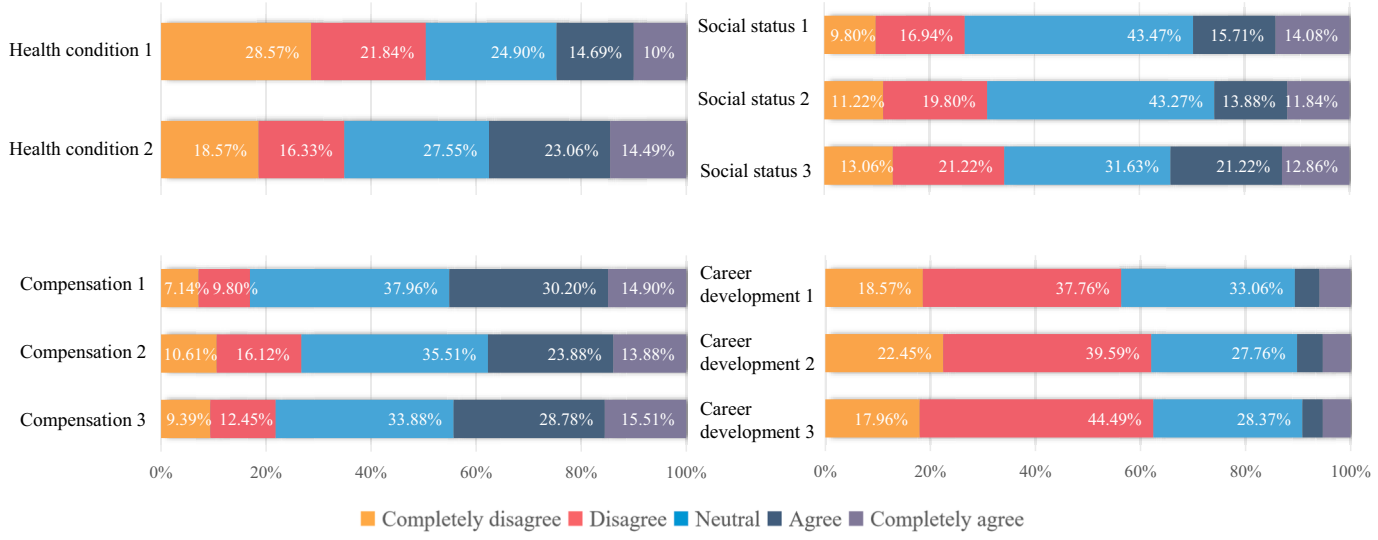

Fig. 3. Details of health condition, compensation, social status and career development.

Table 3
Reliability and convergent validity data for full-time couriers.

Indicators	Cronbach's alpha	Factor loading	P	CR	AVE	$\sqrt{AVE}$
Health condition1	0.827	0.870		0.828	0.707	0.841
Health condition2		0.810	***			
Delivery environment1	0.885	0.819		0.890	0.731	0.855
Delivery environment2		0.949	***			
Delivery environment3		0.789	***			
Working environment1	0.877	0.827		0.882	0.713	0.844
Working environment2		0.829	***			
Working environment3		0.876	***			
Compensation1	0.910	0.872		0.911	0.773	0.879
Compensation2		0.867	***			
Compensation3		0.899	***			
Social status1	0.918	0.863		0.920	0.794	0.891
Social status2		0.948	***			
Social status3		0.860	***			
Career development1	0.870	0.900		0.870	0.691	0.831
Career development2		0.822	***			
Career development3		0.767	***			

Table 4
Reliability and convergent validity data for part-time couriers.

Indicators	Cronbach's alpha	Factor loading	P	CR	AVE	$\sqrt{AVE}$
Health condition1	0.772	0.785		0.773	0.631	0.794
Health condition2		0.803	***			
Delivery environment1	0.889	0.874		0.890	0.730	0.854
Delivery environment2		0.833	***			
Delivery environment3		0.855	***			
Working environment1	0.888	0.866		0.894	0.738	0.859
Working environment2		0.835	***			
Working environment3		0.876	***			
Compensation1	0.891	0.822		0.892	0.735	0.857
Compensation2		0.852	***			
Compensation3		0.896	***			
Social status1	0.855	0.825		0.860	0.672	0.820
Social status2		0.880	***			
Social status3		0.749	***			
Career development1	0.866	0.814		0.867	0.685	0.827
Career development2		0.841	***			
Career development3		0.827	***			

Bentler, 1999; Schermelleh-Engel, Moosbrugger, and Müller, 2003). The SEM evaluation is performed by analyzing path coefficients and *p*-values to assess both direct and indirect relationships between latent variables and couriers' job satisfaction. A hypothesis is deemed supported if the p-value is less than 0.05, signifying a statistically significant impact of the construct on couriers' job satisfaction.

Additionally, this study incorporates a multi-group analysis to determine whether there are statistically significant differences between the two groups of couriers (full-time and part-time). Measurement invariance test is conducted to verify if the model constructed in this study can accurately and consistently measure the same constructs or factors under different groups. Measurement invariance test involves the construction of three distinct models: 1) Unconstrained Model: In this model, all parameters are allowed to vary freely without any constraints, serving as the baseline for comparison; 2) Structural Covariance Model: This model constrains the covariances of measurement coefficients and structural paths to be equal across different groups. This helps assess whether the relationships between variables are consistent across the groups; 3) Measurement Residual Model: This model imposes constraints on measurement coefficients, covariances of structural paths, and measurement residuals to be equal across groups. This model provides a more stringent test of group invariance by ensuring that not only the structural relationships but also the measurement residuals are consistent between groups. The significance of differences in chi-square values between each constrained model and the unconstrained model is examined to evaluate whether there are statistically significant variations between the models. This analysis helps determine if there are meaningful differences in job satisfaction between part-time and full-time couriers. The data analysis in this study was performed using AMOS 26.0 software package with maximum likelihood estimation.

4. Results and discussion

4.1. Descriptive data analysis

The descriptive analysis was conducted based on the survey results. Most respondents were male, accounting for 74.9 %, while females accounted for 20.41 %. Additionally, 4.69 % of respondents preferred not to disclose their gender. In a survey report on the sustainable career development of couriers published by the Beijing News in 2020 (Liang, 2020), male couriers accounted for 87 %, while female couriers accounted for 13 %. Some studies suggest that in the post-pandemic context, due to economic pressures and an increase in female unemployment, more women are likely to engage in instant delivery work (Sun, Zhao, and Zhang, 2021). The largest proportion of couriers falls within the age range of 25 to 34 years, accounting for 44.49 %. Young and middle-aged being the main force of couriers is consistent with several relevant social surveys (Liang, 2020; SouthernMetropolisDaily, 2021; Yang, Gao, Wang, and Wang, 2022).

Some representative constructs including health condition, compensation, social status, and career development are shown in Fig. 3. It is clear from the questionnaire answers that respondents have diverse opinions about how healthy they should be. In the sample just 24.69 % report feeling uncomfortable at work, whereas over 50 % report finding their employment to be comfortable. A medical ailment, such as lower back pain, cervical spine issues, gastrointestinal issues, etc., was mentioned by nearly 40 % of couriers. Three aspects of compensation are covered in this study: social security, dis-incentives policies, and incentive programs. The percentage of couriers who are happy with social security and incentive policies is 44.29 % and 45.1 %, respectively. Additionally, the proportion of couriers who agree with the punitive policies is lower, at 37.76 %. To assess the social status of couriers, three factors were measured: "poor treatment from customers", "poor treatment from restaurant staff", and "discrimination against me when wearing work clothes". A few couriers agree with the three types of discrimination mentioned above, with corresponding percentages of 29.79 %, 25.72 %, and 34.08 %, respectively. Career development is perceived and measured as well. Only approximately 10 % of riders agreed that they can realize their potential and achieve long-term advancement in courier work, and fewer than 10 % believed that cost-effective delivery services will continue to rely on their contributions.

4.2. Data assessment and measurement model assessment

Prior to model assessment, normality tests confirmed that all observed variables met the assumptions for SEM analysis, with skewness and kurtosis coefficients remaining within acceptable thresholds (detailed results in **Appendix A**). This validates the use of maximum likelihood estimation for the subsequent analyses. The reliability and validity data for full-time and part-time couriers are presented in Table 3 and Table 4, respectively. All Cronbach's alpha and CR values exceed 0.70, indicating strong internal consistency for both groups. The AVE values range from 0.691 to 0.794 for full-time couriers and from 0.631 to 0.738 for part-time couriers, all of which are above the recommended threshold of 0.50. These values confirm the validity of the constructs measured. Additionally, factor loadings range from 0.767 to 0.949 for full-time couriers and from 0.749 to 0.896 for part-time couriers, all exceeding the minimum threshold of 0.50. These results from Table 3 and Table 4 support the establishment of convergent validity, demonstrating strong agreement among the indicators that measure the same construct.

The value of $\sqrt{AVE}$ is presented on the diagonal in Table 5 and Table 6, and the correlation coefficients are presented below the diagonal. It can be observed that the square root of AVE is greater than the correlation coefficients between the construct and other constructs. This demonstrates the discriminant validity of the measurement model, indicating that each construct is distinct from the others.

Table 7 presents the results of the confirmatory factor analysis (CFA), which uses multiple indicators to evaluate the goodness of fit and construct validity of the measurement model. The results indicate that all fit indices for the proposed model exceed the recommended thresholds, demonstrating that the model exhibits a strong fit to the data. This suggests that the measurement model is robust and aligns well with the theoretical framework and empirical data.

Furthermore, Table 8 presents the differences in chi-square values and degrees of freedom between each model and the unconstrained model, with the "*p*-value" indicating the statistical significance of these differences. And Table 8 shows that both the structural covariance model and the measurement residual model exhibit significant differences in chi-square values compared to the unconstrained model, with *p*-values less than 0.05. These findings indicate significant variations between the models, suggesting that there are notable differences between the part-time and full-time courier groups.

4.3. Structural model assessment

The results of the structural model assessment include path coefficients and p-values, as shown in Table 9 and Table 10. Only when the p-value is less than 0.05, the construct is considered to have a significant impact on job satisfaction, thereby supporting the corresponding hypothesis. For full-time couriers, the satisfaction of compensation (H3), working environment (H4), and Career development (H6) show significant positive effects on job satisfaction. Specifically, compensation ($p < 0.001$) and working environment ($p < 0.05$) have a significant positive impact on job satisfaction for both part-time and full-time couriers. Career development ($p < 0.05$) only significantly affect job satisfaction for full-time couriers. For both two types couriers, health condition, delivery environment, and social status are all proved as non-significant factors. The significance of constructs affecting couriers' job satisfaction can be assessed through the standardized path coefficients in Table 9 and Table 10.

4.4. Implication of the results and discussion

Health condition is defined as a need belonging to the physiological needs level, and delivery environment belongs to the safety needs level. The results presented in Tables 9 and 10 demonstrate that health condition and delivery environment do not significantly influence job satisfaction for both part-time and full-time couriers. For part-time couriers, given their limited working hours and lower exposure to occupational risks, part-time couriers' satisfaction is less closely tied to these two factors. For full-time couriers, most of them appear to normalize physical strain and traffic-related challenges as routine occupational hazards, as well, 44.49 % of surveyed couriers aged 25–34 expressed limited concern regarding health issues.

For the second needs level, i.e., safety needs, the other factor

Table 5
Discriminant validity for full-time couriers.

	Health condition	Delivery environment	Working environment	Compensation	Social status	Career development
Health condition	0.841					
Delivery environment	−0.309	0.855				
Working environment	0.000	0.352	0.844			
Compensation	0.030	0.243	0.721	0.879		
Social status	0.524	−0.349	−0.298	−0.323	0.891	
Career development	0.370	−0.500	−0.377	−0.283	0.561	0.831

Table 6
Discriminant validity for part-time couriers.

	Health condition	Delivery environment	Working environment	Compensation	Social status	Career development
Health condition	0.794					
Delivery environment	−0.379	0.854				
Working environment	−0.076	0.378	0.859			
Compensation	0.090	0.182	0.691	0.857		
Social status	0.370	−0.336	−0.363	−0.383	0.820	
Career development	0.462	−0.611	−0.404	−0.16	0.539	0.827

Table 7
Summary table of overall fit statistics for the unconstrained model.

Indices	CMIN	DF	CMIN/DF	NFI	IFI	TLI	CFI	GFI	AGFI	RMSEA
Standards	–	–	<3	>0.9	>0.9	>0.9	>0.9	>0.9	>0.7	<0.05
Results	456.890	224	2.040	0.924	0.960	0.944	0.959	0.909	0.860	0.046

Table 8
Invariance test table.

Model	△CMIN	△DF	p-value
Measurement weights	23.454	17	0.135046
Structural covariance	58.761	38	0.016908
Measurement residual	105.045	56	7.94E-05

Table 9
Path coefficients and corresponding *p*-values for part-time couriers.

Hypothesis	Path	Coef.	P	Result
H1	Job satisfaction<—Health condition	0.069	0.345	Rejected
H2	Job satisfaction<—Delivery environment	−0.153	0.082	Rejected
H3	Job satisfaction<—Compensation	0.464	<0.001	Supported
H4	Job satisfaction<—Working environment	0.219	0.048	Supported
H5	Job satisfaction<—Social status	0.11	0.254	Rejected
H6	Job satisfaction<—Career development	0.078	0.525	Rejected

compensation shows the significant effects on the job satisfaction of both part-time and full-time couriers. Among part-time couriers, compensation demonstrates a significant positive effect on job satisfaction. This can be explained through the lens of self-determination theory, which posits that gig workers, similar to part-time couriers, satisfy their needs for autonomy, competence, and relatedness through flexible work arrangements and relatively substantial income (Pichault and McKeown, 2019). The significant effect of compensation on full-time couriers' job satisfaction is theoretically expected, as financial rewards represent a fundamental driver of work motivation for most individuals. Compensation is an important factor of individual labor rewards, and it can meet basic living needs and provide a sense of security. The substantial positive impact of compensation suggests that enhanced salary and welfare benefits are likely to attract more individuals to the courier profession.

The factor of working environment, which falls under the category of love and belonging needs, significantly influences the job satisfaction of both full-time and part-time couriers. In this study, the working environment encompasses aspects such as sense of belonging, flexibility, and relationships with colleagues. A positive and supportive team atmosphere enhances couriers' sense of belonging and identity. Supportive interactions among team members, along with managerial care and support, positively impact couriers' psychological well-being and thereby increase job satisfaction. Couriers (both full-time and part-time) tend to work individually, and a lack of interaction and social support among colleagues can lead to feelings of loneliness. Working environment that provides community support or teamwork opportunities increases job satisfaction for couriers.

The fourth level of needs is esteem needs, which is represented by the factor social status in this study, while this factor has not been proven to have a significant effect. The non-significance of social status further indicates that the part-time couriers are less sensitive to external evaluations and more concerned with immediate economic returns and better working environment. For full-time couriers, although social status theoretically represents esteem needs, it does not significantly affect satisfaction, likely due to couriers' modest expectations and the persistence of discriminatory stereotypes surrounding this occupation.

This study found a positive effect of career development which belongs to self-actualization needs level on full-time couriers' job satisfaction, with insignificant effect on that of part-time couriers. This finding may reflect the nature of part-time employment and the configuration of couriers' needs. Part-time employees typically prioritize flexible schedules, immediate income, and supportive work environments rather than long-term career advancement. Among full-time couriers, perceiving that their job enables them to realize their potential and personal value is associated with higher organizational commitment and job satisfaction. Opportunities for advancement delineate the vertical career trajectory available to couriers. Progression to team manager or dispatcher roles, as well as transfers to other internal positions, provides pathways that support long-term development. When couriers perceive that effort and accumulated experience can translate into promotion, motivation and organizational loyalty rise, which in turn enhances job satisfaction. The impact of emerging technologies on couriers' job indicates the sustainability of the occupation and the ongoing needs of society. Even as technology advances, the role is unlikely to be fully replaced and continues to hold distinctive social value, which helps stabilize job satisfaction.

Table 10
Path coefficients and corresponding p-values for full-time couriers.

Hypothesis	Path	Coef.	P	Result
H1	Job satisfaction<—Health condition	−0.001	0.986	Rejected
H2	Job satisfaction<—Delivery environment	0.101	0.11	Rejected
H3	Job satisfaction<—Compensation	0.488	<0.001	Supported
H4	Job satisfaction<—Working environment	0.237	0.008	Supported
H5	Job satisfaction<—Social status	0.088	0.186	Rejected
H6	Job satisfaction<—Career development	0.177	0.012	Supported

The findings observed here diverge from the strict sequential progression assumed by Maslow's Hierarchy of Needs Theory (MHNT). While Deckers (2018) and Rojas, Méndez, and Watkins-Fassler (2023) note that different needs often coexist or intersect rather than being satisfied sequentially, our specific pattern is plausibly shaped by cultural differences, inspired by the work of Mousavi and Dargahi (2013) and Wittwer (2019). Under conditions of economic pressure and within a collectivist cultural orientation, couriers in China tend to prioritize compensation and the working environment over concerns related to health and delivery environment. This priority structure contrasts sharply with patterns observed in Euro-American contexts, which are typically characterized by higher individualism and a stronger orientation toward personal autonomy. Workers in those contexts often place greater emphasis on self-directed work and the intrinsic dimensions of job satisfaction (Kitayama and Markus, 1991; Oyserman, Coon, and Kemmelmeier, 2002; Schwartz, 2006). Therefore, this deviation from Maslow's sequential assumption can be reasonably attributed to cultural differences, suggesting the observed pattern is contextually appropriate and theoretically meaningful within the Chinese cultural setting.

5. Conclusions

This study provides novel insights into the factors affecting couriers' job satisfaction. This is especially timely and relevant in a context of a growing e-commerce around the world. MHNT is utilized for the first time in this research to analyze courier job satisfaction, and multi-group analysis is utilized to explore the difference between full-time couriers and part-time couriers. Existing theories, including Middle-Range Theory, Cognitive Appraisal Theory, and Grounded Theory, offer limited leverage on the multilayered nature of couriers' job satisfaction. They tend to fragment explanation, privilege subjective appraisal, or undertheorize higher-order motives. MHNT is advanced as an integrative scaffold that spans physiological and safety through social and growth needs and maps key constructs, including income instability, health risks, road safety, social recognition, and career development, into a coherent hierarchy. Therefore, the framework is proposed in this study for analyzing job satisfaction, including five levels, i.e., physiological needs, safety needs, love and belonging needs, esteem needs, and self-

actualization needs. The application of this theory to courier job satisfaction enables a better understanding of couriers' delivery behaviors. Furthermore, couriers are categorized into part-time or full-time groups, and the findings reveal that the key factors influencing job satisfaction differ substantially between these two categories. It can be concluded that job satisfaction among part-time couriers is primarily shaped by safety needs and social belonging, represented in this study by compensation and working environment, both of which exert significant positive effects. For full-time couriers, compensation, work environment, and career development emerge as critical determinants of satisfaction. The key difference between the two groups lies in the role of career development, which reflects self-actualization needs and demonstrates significance only for full-time couriers.

These findings provide actionable insights for platforms aiming to enhance the job satisfaction of both full-time and part-time couriers. Improving courier satisfaction helps sustain motivation, maintain service quality, and support the recruitment of new employees (Zhang et al., 2022), thereby ensuring the sustainable development of the instant delivery industry. Governments should encourage platforms to improve welfare protection systems, refine reward and punishment mechanisms, and establish fair and transparent salary system for all couriers, and enhancing facilities and resources, optimizing working conditions, and fostering a positive team atmosphere. For full-time couriers, particular attention should be paid to their needs for self-actualization through recognition, promotion pathways, and training for roles in emerging technologies such as autonomous vehicles and drones.

This study acknowledges certain limitations that can be addressed in future research. First, the survey was conducted in Shanghai. Although the survey results align closely with demographic data from nationwide surveys, it is necessary to have a larger coverage area and a larger sample size for a more comprehensive understanding of couriers' job satisfaction in China. Furthermore, this study is based exclusively on data collected in the Chinese context, and does not account for couriers' job satisfaction behaviors that may arise in different cultural settings. Cultural variations can significantly influence how individuals perceive, express, and prioritize the hierarchical needs defined by MHNT. In addition, due to variations in institutional systems across different countries and platforms (Scheele, Im, and Leschke, 2023), courier satisfaction may be influenced differently. To enhance the generalizability and cultural robustness of the proposed model, future research should incorporate multi-country and multi-city comparative studies. By collecting data across diverse national and urban contexts, researchers can better examine how cultural differences and regional variations influence the model's applicability, thereby providing a more comprehensive understanding of the framework's cross-cultural validity and boundary conditions.

CRediT authorship contribution statement

Miaojia Lu: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Rui Liu:** Writing – review & editing, Writing – original draft, Software, Methodology, Investigation. **Gonçalo Correia:** Writing – review & editing, Resources, Project administration. **Kuldeep Kavta:** Writing – review & editing, Resources, Project administration. **Chengyuan Huang:** Writing – review & editing, Supervision, Methodology, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This work was supported in part by the Funds for International Cooperation and Exchange of the National Natural Science Foundation of China [72361137005], as well as by the JPI-ERANET and the NWO through the SINERGI Project. The authors gratefully acknowledge the support provided by these funding bodies.

Appendix A

Table A.1
Summary table of normality test for data structure.

Variables	Skewness		c.r.		Kurtosis		c.r.	
	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time
Satisfaction	−0.241	−0.549	−1.454	−3.688	−0.327	−0.037	−0.989	−0.124
CP1	0.328	0.844	1.983	5.671	0.069	0.388	0.21	1.305
CP2	0.632	0.831	3.816	5.586	0.196	0.427	0.591	1.435
CP3	0.515	1.028	3.113	6.912	0.505	0.868	1.525	2.917
SS1	−0.129	0.031	−0.778	0.206	0.029	−0.786	0.088	−2.642
SS2	−0.134	−0.112	−0.811	−0.754	0.129	−0.771	0.389	−2.59
SS3	0.075	−0.075	0.451	−0.505	−0.537	−1.05	−1.623	−3.527
CM1	−0.166	−0.553	−1.004	−3.715	−0.242	−0.102	−0.73	−0.343
CM2	−0.088	−0.23	−0.529	−1.547	−0.503	−0.776	−1.519	−2.608
CM3	−0.263	−0.372	−1.59	−2.499	−0.422	−0.652	−1.273	−2.19
WE1	−0.494	−0.701	−2.987	−4.709	−0.194	−0.213	−0.586	−0.715
WE2	−0.809	−1.102	−4.886	−7.404	0.933	1.515	2.82	5.091
WE3	−0.484	−0.676	−2.923	−4.542	0.146	−0.104	0.442	−0.35
DE1	−1.05	−1.112	−6.344	−7.471	1.379	1.13	4.166	3.797
DE2	−0.781	−1.036	−4.718	−6.96	0.535	0.734	1.616	2.466
DE3	−0.877	−1.039	−5.3	−6.985	0.674	0.536	2.035	1.801
HC1	−0.435	−0.299	−2.629	−2.007	−0.924	−1.022	−2.79	−3.434
HC2	0.015	0.136	0.09	0.914	−1.123	−1.022	−3.393	−3.433
Multivariate					111.044	153.627	30.621	47.126

Appendix B

Survey on Job Satisfaction of Instant Delivery Service Couriers

Dear Sir/Madam,

Hello! We are the Intelligent Logistics Research Team at Tongji University. We would like to invite you to participate in our study, which aims to investigate the satisfaction of couriers. Your insights are crucial for understanding couriers' riding behavior and assessing current related policies.

This questionnaire is divided into three sections.

Section 1: Personal Information.

Section 2: Satisfaction Survey.

We kindly request your assistance in completing this questionnaire, which will take approximately 10–15min of your time. Rest assured that all your responses will be treated with strict confidentiality, and the survey results will be presented only in aggregated form for statistical purposes.

Your support and feedback are highly appreciated! If you have any questions or concerns, please feel free to contact: HCYuann@163.com.

1. Investigator ID: [Fill in the blank]

_____.

Part 1: Survey on Couriers' Personal Information.

2. Gender: [Single-choice question]
○Male.
○Female.
○Prefer not to say.

3.Age: [Single-choice question]
○Under 18 years old.
○18–24 years old.
○25–34 years old.
○35–44 years old.
○45–54 years old.
○55 years old and above.

4. Education level: [Single-choice question]
○Elementary school or below.
○Junior high school.
○High school.
○Bachelor's degree.
○Master's degree.

5.Marital status: [Single-choice question]
○Single.
○Married without children.
○Married with one child.
○Married with two children or more.
○Divorced without children.
○Divorced with children.
○Widowed.

6. How many people are there in your current household, including yourself? [Single-choice question]
○1
○2
○3
○4
○5
○6
○7 or more.
○Prefer not to disclose.

7. Length of time living in your current city: [Single-choice question]
○Less than 1 year.
○1–3 years.

○4–6 years.
○More than 6 years.
○Local resident.

8. How long have you been working as a courier? [Single-choice question]
○Less than 6 months.
○6 months to 1 year.
○1 year to 2 years.
○2 years or more.

9. Which delivery mode do you belong to? [Single-choice question]
○Part-time.
○Full-time.

10. What is your courier rank? (The bracketed examples are for reference only.) [Single-choice question]
○Rank 1 (Bronze, Silver, etc.)
○Rank 2 (Gold, Platinum, etc.)
○Rank 3 (Diamond, Master, etc.)
○Rank 4 (Legend, King, etc.)

11. Number of days you work per week: [Single-choice question]
○1
○2
○3
○4
○5
○6
○7

12. Average daily working hours on weekdays: [Single-choice question]
○6h or less.
○6–8h.
○8–10h.
○10–12h.
○12h or more.

13. Monthly income range (in Chinese Yuan): [Single-choice question]
○2000 or below.
○2000–4000.
○4000–6000.
○6000–8000.
○8000–10,000.
○10,000 or above.

14. Monthly disposable income of your household (in Chinese Yuan)
Reference: Disposable income = Total household income – Income tax paid – personal social security contributions – recorded subsidies. [single-choice question]
○Below 5000.
○5000–10,000.
○10,000-20,000.
○Above 20,000.

15. Average number of deliveries per day: [Single-choice question]
○Below 20 orders.
○20–30 orders.
○30–40 orders.
○40–50 orders.
○50–60 orders.
○Above 60 orders.

16. Average distance traveled per day on your vehicle: [Single-choice question]

○Below 10km.
○10–20km.
○20–30km.
○30–50km.
○50–100km.
○Above 100km.

17. Your average cycling speed is: [Single-choice question]
○10–20km/h.
○21–30km/h.
○31–40km/h.
○41–50km/h.
○Above 50km/h.
○Not sure.

Part 2: Job satisfaction Survey

18. Please evaluate the following questions regarding your health condition. [Matrix scale question]

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I often feel physically uncomfortable.	○	○	○	○	○
This job brings me a lot of physical discomfort and health problems, such as back pain, neck problems, stomach issues, and eye-related ailments.	○	○	○	○	○

19. Please evaluate the following questions regarding the delivery environment. [Matrix scale question]

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Large traffic volumes affect my delivery.	○	○	○	○	○
Parked vehicles along the roadside affect my delivery.	○	○	○	○	○
The width of non-motorized lanes affects my delivery.	○	○	○	○	○

20. Please evaluate the following questions about the working environment [Matrix scale question]

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think the working environment is quite comfortable.	○	○	○	○	○
I get along well with my colleagues and superiors.	○	○	○	○	○
I have adequate time for rest during work (e.g. between each delivery and individual meal times).	○	○	○	○	○

21. Please evaluate the following questions about compensation [Matrix scale question]

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I'm satisfied with the incentive policies at work.	○	○	○	○	○
I accept the dis-incentive policy implemented at work.	○	○	○	○	○
I'm satisfied with the social security provided at work.	○	○	○	○	○

22. Please evaluate the following questions about your social status [Matrix scale question]

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel that customers often treat me badly.	○	○	○	○	○
I feel that the restaurant staff often treat me badly.	○	○	○	○	○
I feel discriminated against when I wear takeout work clothes.	○	○	○	○	○

23. Please evaluate your opinion on the following questions about career development [Matrix scale question]

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe I will realize my potential and value in the job of a courier.	○	○	○	○	○
I believe I can have further long-term development in this position in the future, for example I could move on to a more senior position.	○	○	○	○	○
Although there are currently emerged delivery technologies such as autonomous delivery, convenient and cost-effective delivery services still rely on my contributions.	○	○	○	○	○

24. Please evaluate your satisfaction with this job [single choice]

○Very satisfied
○Quite satisfied
○Neutral
○Quite dissatisfied
○Very dissatisfied

Data availability

Data will be made available on request.

References

Abbas, J. (2020). Service quality in higher education institutions: Qualitative evidence from the students' perspectives using Maslow hierarchy of needs. *International Journal of Quality and Service Sciences, 12*(3), 371–384. https://doi.org/10.1108/ijqss-02-2020-0016

Benson, S. G., & Dundis, S. P. (2003). Understanding and motivating health care employees: Integrating Maslow's hierarchy of needs, training and technology. *Journal of Nursing Management, 11*(5), 315–320. https://doi.org/10.1046/j.1365-2834.2003.00409.x

Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., & Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in RMSEA test statistic in structural equation models. *Sociological Methods & Research, 36*(4), 462–494.

Chen, T., Tian, D., Deng, P., Zhou, E., & Huang, J. (2022). Study on instant delivery service riders' safety and health by the effects of labour intensity in China: A mediation analysis. *Frontiers in Public Health, 10*. https://doi.org/10.3389/fpubh.2022.907474

Cheung, C. M., Zhang, R. P., Wang, R., Hsu, S.-C., & Manu, P. (2022). Group-level safety climate in the construction industry: Influence of organizational, group, and individual factors. *Journal of Management in Engineering, 38*(1), Article 04021080.

China Internet Network Information Center. (2023). The 52nd Statistical Report on China's Internet Development. https://www.cnnic.cn/NMediaFile/2023/0908/MAIN1694151810549M3LV0UWOAV.pdf.

Čížek, P. (2012). The application of Maslow's hiearchy of needs to the entrepreneur's motivation-the example from region Pardubice. In *Scientific papers of the University of Pardubice. Series D, Faculty of Economics and Administration. 24 (2/2012)*.

Comrey, A. L., & Lee, H. B. (2013). *A First Course in Factor Analysis*. Psychology Press.

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative Sociology, 13*(1), 3–21.

Craighead, C. W., Ketchen, D. J., Jr., & Cheng, L. (2016). "Goldilocks" theorizing in supply chain research: Balancing scientific and practical utility via middle-range theory. *Transportation Journal, 55*(3), 241–257.

Cui, L., Wang, Y., Chen, W., Wen, W., & Han, M. S. (2021). Predicting determinants of consumers' purchase motivation for electric vehicles: An application of Maslow's hierarchy of needs model. *Energy Policy, 151*. https://doi.org/10.1016/j.enpol.2021.112167

Deckers, L. (2018). *Motivation: Biological, Psychological, and Environmental*. Routledge.

Duygun, A., & Şen, E. (2020). Evaluation of consumer purchasing behaviors in the COVID-19 pandemic period in the context of Maslow's hierarchy of needs. *PazarlamaTeorisi ve Uygulamaları Dergisi, 6*(1), 45–68.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Glaser, B., & Strauss, A. (2017). *Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge.

Golob, T. F. (2003). Structural equation modeling for travel behavior research. *Transportation Research Part B: Methodological, 37*(1), 1–25.

Gross, H., Novey, D. A., & Triskett, J. L. (2022). Maslow's hierarchy of needs applied to guide teaching and learning. In *Schoolchildren of the COVID-19 Pandemic: Impact and Opportunities* (pp. 1–19). https://doi.org/10.1108/978-1-80262-741-120221001

Hair, J. F. (2009). *Multivariate Data Analysis*.

He, Y., Sun, C., Huang, H., Jiang, L., Ma, M., Wang, P., & Wu, C. (2021). Safety of micro-mobility: Riders' psychological factors and risky behaviors of cargo TTWs in China. *Transportation Research Part F: Traffic Psychology and Behaviour, 80*, 189–202. https://doi.org/10.1016/j.trf.2021.04.001

Hofstede, G. (1984). The cultural relativity of the quality of life concept. *Academy of Management Review, 9*(3), 389–398.

Hsieh, H.-S. (2023). Understanding post-COVID-19 hierarchy of public transit needs: Exploring relationship between service attributes, satisfaction, and loyalty. *Journal of Transport & Health, 32*. https://doi.org/10.1016/j.jth.2023.101656

Hu, L.t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55.

Hu, Y.-j. G., & Le-ning. (2022). Research on employment creation effect and employment substitution effect of digital economy. *Reform 2023, 2022*(4), 42–54. http://reform.cqass.net.cn/upfiles/2024/07/2024071709291272075.pdf.

Huang, Z. (2024). Research on Occupational Injury Protection for Workers in New Employment Formats: A Case Study of Meituan Takeaway Riders. *Sustainable Development, 14*(10), 2393–2401. https://doi.org/10.12677/sd.2024.1410271

Imran, U. D., Ghazwan, M. F., & Firmansyah, F. (2025). The effect of recognition and appreciation on employee motivation and performance. *Economics and Digital Business Review, 6*(1), 1–18.
Jerome, N. (2013). Application of the Maslow's hierarchy of need theory; impacts and implications on organizational culture, human resource and employee's performance. *International journal of business and management invention, 2*(3), 39–45.
Jin, T., Wang, T., Zhou, S., & Liu, D. (2024). Long working hours and job satisfaction in platform employment: An empirical study of on-demand delivery couriers in China. *Applied Research in Quality of Life, 19*(3), 1197–1223.
Kavta, K., Azadeh, S. S., Maknoon, Y., Wang, Y., & de Almeida Correia, G. H. (2025). Estimating the value of safety against road crashes: A stated preference experiment on route choice of food delivery riders. *Transportation Research Part C: Emerging Technologies, 179*, Article 105272.
Kitayama, S., & Markus, H. R. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 98*(2), 224–253.
Kline, R. B. (2023). *Principles and Practice of Structural Equation Modeling*. Guilford Publications.
Lai, Y. (2020). Food Delivery Riders: Trapped within the System. https://baijiahao.baidu.com/s?id=1677231323622016633&wfr=spider&for=pc.
Lazarus, R. S. (1991). *Emotion and Adaptation*. Oxford University Press.
Li, Z., Wang, Y., & Luo, Y. (2024). Labor rights violations, occupational identity discrimination, and mental health risks among delivery riders: A mental health survey of non-Beijing migrant delivery riders in Beijing. *China's Circulation Economy*, 1–13. https://link.cnki.net/urlid/11.3664.F.20240124.1551.002.
Liang, X. (2020). *Survey Report on the Sustainable Development of Food Delivery Riders' Profession*. The Beijing News. https://www.bjnews.com.cn/detail/160516354415025.html.
Lin, M. (2022). Psychological health correlation of express delivery workers' occupational stress in the information logistics environment. *Frontiers in Psychology, 13*, Article 975387.
Lin, Y., & Li, Y. (2021). The role of psychological capital and perceived organizational support in the relationship between occupational stress and overwork: A survey of food delivery riders in Beijing. *China's Circulation Economy, 35*(4). http://qikan.cqvip.com/Qikan/Article/Detail?id=7104283563.
Ma, L., & Ye, R. (2019). Does daily commuting behavior matter to employee productivity? *Journal of Transport Geography, 76*, 130–141.
Mao, A.-L., Tian, C.-M., & Liu, C.-X. (2025). The association between workloads and health hazard among delivery riders in China. *Frontiers in Public Health, 13*, Article 1603087.
Maslow, A. (1954). *Motivation and personality* (p. 1). New York, S-ll PP: NY: Harper.
Masorgo, N., Mir, S., & Hofer, A. R. (2023). You're driving me crazy! How emotions elicited by negative driver behaviors impact customer outcomes in last mile delivery. *Journal of Business Logistics, 44*(4), 666–692. https://doi.org/10.1111/jbl.12356
Meituan Delivery. (2023). 2022 Meituan Rider Rights Protection Social Responsibility Report. https://www.meituan.com/newsroom/rider-protection.
Merton, R. K. (1968). *Social Theory and Social Structure*. Simon and Schuster.
Mousavi, S. H., & Dargahi, H. (2013). Ethnic differences and motivation based on Maslow's theory on Iranian employees. *Iranian Journal of Public Health, 42*(5), 516.
Municipal Bureau of Statistics. (2023). *(2023-08-28). Research Report on the Working and Living Conditions of Food Delivery Riders* (p. 004). https://doi.org/10.28325/n.cnki.nhbra.2023.001684
Ngoc, A. M., Nishiuchi, H., Nhu, N. T., & Huyen, L. T. (2022). Ensuring traffic safety of cargo motorcycle drivers in last-mile delivery services in major Vietnamese cities. *Case Studies on Transport Policy, 10*(3), 1735–1742. https://doi.org/10.1016/j.cstp.2022.07.004
Nguyen, M. H., Pojani, D., Nguyen-Phuoc, D. Q., & Thi, B. N. (2023). What if delivery riders quit? Challenges to last-mile logistics during the Covid-19 pandemic. *Research in Transportation Business & Management, 47*, Article 100941.
Oyserman, D., Coon, H. M., & Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin, 128*(1), 3.
Pang, Q., Fang, M., Wang, L., Mi, K., & Su, M. (2023). Increasing couriers' job satisfaction through social-sustainability practices: Perceived fairness and psychological-safety perspectives. *Behavioral Sciences, 13*(2), 125.
Papakostopoulos, V., & Nathanael, D. (2021). The complex interrelationship of work-related factors underlying risky driving behavior of food delivery riders in Athens, Greece. *Safety and Health at Work, 12*(2), 147–153. https://doi.org/10.1016/j.shaw.2020.10.006
Pichault, F., & McKeown, T. (2019). Autonomy at work in the gig economy: Analysing work status, work content and working conditions of independent professionals. *New Technology, Work and Employment, 34*(1), 59–72.
Pinder, C. C., & Moore, L. F. (1980). The resurrection of taxonomy to aid the development of middle range theories of organizational behavior. In *Middle Range Theory and the Study of Organizations* (pp. 187–211). Springer.
Poirier, T. I., & Devraj, R. (2019). Pharmacy in an improved health care delivery model using Maslow's hierarchy of needs. *American Journal of Pharmaceutical Education, 83*(8), 7627.
Puram, P., Gurumurthy, A., Narmetta, M., & Mor, R. S. (2021). Last-mile challenges in on-demand food delivery during COVID-19: Understanding the riders' perspective using a grounded theory approach. *The International Journal of Logistics Management, 33*(3), 901–925. https://doi.org/10.1108/ijlm-01-2021-0024
Qin, H., Wei, Y., Zhang, Q., & Ma, L. (2021). An observational study on the risk behaviors of electric bicycle riders performing meal delivery at urban intersections in China. *Transportation Research Part F: Traffic Psychology and Behaviour, 79*, 107–117.
Rojas, M., Méndez, A., & Watkins-Fassler, K. (2023). The hierarchy of needs empirical examination of Maslow's theory and lessons for development. *World Development, 165*, Article 106185.
Scheele, L., Im, Z. J., & Leschke, J. (2023). Unpredictable and non-transparent working conditions?: Riders in the food-delivery sector in six EU countries. https://research-api.cbs.dk/ws/portalfiles/portal/96089865/laura_scheele_et_al_eusocialcit_working_paper_march_2023.pdf.
Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online, 8*(2), 23–74.
Schwartz, S. (2006). A theory of cultural value orientations: Explication and applications. *Comparative Sociology, 5*(2–3), 137–182.
Shi, X., & Li, J. (2023). Key factors for instant logistics platforms to attract and retain couriers: An analysis based on online comments. *Research in Transportation Business & Management, 50*, Article 101031.
Southern Plus. (2024). "Instant Delivery" Being Mentioned in the State Council Meeting: What Signals Does It Send?. https://baijiahao.baidu.com/s?id=1788931901283441015&wfr=spider&for=pc.
SouthernMetropolisDaily. (2021). Current Situation of Food Delivery Riders: Low Coverage of Work Injury Insurance, Repeated Violations of Traffic Safety Regulations. https://www.sohu.com/a/448324713_161795.
Stank, T. P., Pellathy, D. A., In, J., Mollenkopf, D. A., & Bell, J. E. (2017). New frontiers in logistics research: Theorizing at the middle range. *Journal of Business Logistics, 38*(1), 6–17.
Ștefan, S. C., Popa, Ș. C., & Albu, C. F. (2020). Implications of Maslow's hierarchy of needs theory on healthcare employees' performance. *Transylvanian Review of Administrative Sciences, 59 E*, 124–143. https://doi.org/10.24193/tras.59E.7
Sullivan, F. (2024). 2024 China On-Demand Delivery Industry Trends White Paper. https://img.frostchina.com/attachment/17430912/d7ZgTYBSpJL47Fy8RmrMdD.pdf.
Sun, P., Zhao, Y., & Zhang, Q. (2021). Platforms, gender, and labor: Gender performance of "female delivery riders". *Journal of Women's Studies, 6*. http://qikan.cqvip.com/Qikan/Article/Detail?id=7106191576.
Taormina, R. J., Gao, J. H., & Kuok, A. C. (2022). Measuring specific traditional Chinese values in relation to satisfaction of the five Maslow needs. *Psychological Thought, 15*(1), 132.
Tay, L., & Diener, E. (2011). Needs and subjective well-being around the world. *Journal of Personality and Social Psychology, 101*(2), 354.
Wang, Z., Neitzel, R. L., Zheng, W., Wang, D., Xue, X., & Jiang, G. (2021). Road safety situation of electric bike riders: A cross-sectional study in courier and take-out food delivery population. *Traffic Injury Prevention, 22*(7), 564–569. https://doi.org/10.1080/15389588.2021.1895129
Wittwer, J. (2019). How Does Maslow's Hierarchy of Needs Stack Up Across Cultures. https://successacrosscultures.com/2019/04/19/how-does-maslows-hierarchy-of-needs-stack-up-across-cultures/.
Wowak, K. D., Craighead, C. W., Ketchen, D. J., Jr., & Connelly, B. L. (2022). Food for thought: Recalls and outcomes. *Journal of Business Logistics, 43*(1), 9–35.
Wu, M. (2009). *Structural Equation Modeling: Operations and Applications of AMOS*.
Wuweitan. (2024). The Contradictory Path of Food Delivery Platforms: Who Is Responsible for the Safety of Delivery Riders?. https://baijiahao.baidu.com/s?id=1788676351939142647&wfr=spider&for=pc.
XYZ Research. (2024). Insights Report on Online Delivery Drivers Employment in 2024. https://baijiahao.baidu.com/s?id=1802359730906651619.
Yan, D. (2020). Research on labor compensation protection in platform employment: A case study of food delivery riders. *China's Human Resources Development, 37*(2). http://qikan.cqvip.com/Qikan/Article/Detail?id=7101097288.
Yang, X., Gao, X., Wang, J., & Wang, F. (2022). Study on the Current Situation and Social Protection Issues of Food Delivery Riders. https://www.jingjinjicn.com/skwx_3j/initDatabaseDetail?contentId=6464236&siteId=46&contentType=literature.
Ye, R., De Vos, J., & Ma, L. (2020). Analysing the association of dissonance between actual and ideal commute time and commute satisfaction. *Transportation Research Part A: Policy and Practice, 132*, 47–60.
Yu, D., Zhang, J., & Yun, G. (2024). Delivery riders' safety and delivery efficiency in on-demand food delivery industry: The moderating role of monitoring algorithms. *Research in Transportation Business & Management, 55*, Article 101143.
Zhang, F., Ji, Y., Lv, H., Zhang, Y., Blythe, P., & Fan, J. (2022). Travel satisfaction of delivery electric two-wheeler riders: Evidence from Nanjing, China. *Transportation Research Part A: Policy and Practice, 162*, 253–266. https://doi.org/10.1016/j.tra.2022.06.001
Zheng, Q., Zhang, S., & Yang, W. (2020). Analysis of individual employment motivation in the gig economy: A case study of food delivery riders in Beijing. *Journal of Chinese Labor Relations College, 34*(5). http://qikan.cqvip.com/Qikan/Article/Detail?id=7103029731.
Zhou, Z. (2019). Unraveling the mystery of food Delivery riders' identity from the perspective of "capital". *Journal of Chinese Labor Relations College, 33*(1), 56–64. https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3UzIwMjMxMjI2EhBnY2xseXNqMjAxOTAxMDA3Ggh1NzR5M2U2Nw%3D%3D.