



**Worker exploitation in the Gig Economy: the case of Dark Kitchens**

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# Worker exploitation in the Gig Economy: the case of Dark Kitchens

## Abstract

**Purpose:** The emergence of dark kitchens in the restaurant industry is a contemporary phenomenon, arising most recently in the context of the so-called Gig Economy. This new business model flourished during the COVID-19 pandemic on a global scale. Despite their popularity, considerable negative publicity exists in the news related to poor working conditions. To highlight this new phenomenon, this paper explores the existing literature on worker exploitation in dark kitchens in the context of the Gig Economy.

**Design/Methodology/Approach:** A systematic literature review of hospitality and tourism databases generated 1430 articles, 18 of which met our inclusion criteria for the final analysis; and 1030 anecdotal sources, of which 47 were included. Thematic analysis was used to identify the key themes and summarize the findings to be used for further studies.

**Findings:** The popularity of dark kitchens as a business model is premised on the fact that it dramatically reduces the operational cost and increases productivity. On the other hand, the working conditions and contractual agreements of the gig workers in dark kitchens raise several questions from operational, legal and ethical perspective. These poor working conditions create the conditions for worker exploitation and further damage the sector's image.

**Practical implications:** this study advocates that companies and managers are responsible for implementing and monitoring fair working conditions in dark kitchens. The existence of poor working conditions increases employee turnover, and overall, affects the industry's reputation.

**Originality/Value:** This explorative study provides insights into the working conditions and contractual agreements in dark kitchens. Currently, there is no other study (empirical or conceptual) to shed light on the working practices. It is hoped that this study will trigger further discussion and empirical research on this field.

**Key Words** – Restaurant industry; Worker exploitation; Dark kitchens; Gig Economy; Systematic Literature Review

## Introduction

The restaurant industry has always been highly competitive, and over time new business models have emerged to improve operational efficiency and increase profit (Muller, 2018; Ritzer, 2013). The concept of 'ghost' kitchens (also known as 'cloud' and 'dark' kitchens) appeared in the mid-2010s as a response to the increased demand for off-premises orders and the rapid development of online food delivery platforms (Riviera, 2019). The phenomenal demand for food delivery services during the COVID19 pandemic has accelerated the development of this new business model as a major trend in the restaurant sector globally (Miller, 2021). According to Euromonitor (2019), delivery-only restaurants could be a US \$1 trillion business globally by 2030.

The concept was originally based on food production outsourcing, for independent and chain restaurants, to a kitchen that is not located on the restaurant's premises. The food orders reach the ghost kitchen through one of the available online delivery providers' app (ODP – i.e. Deliveroo, Uber Eats, etc). The host restaurant determines many prices; the ODP, ghost kitchen and host restaurant receive a fixed percentage from each menu item sale. The customers who use the app and order the food from the host restaurant are unaware of where the food is produced. Furthermore, some online

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2  
3 delivery platforms allow restaurants to sell their food under more than one brand name if they offer  
4 different menus (Eccles, 2021). This in practice means that the same menu can appear in more than  
5 one category on the app (i.e. Chinese, Thai, Greek, Italian, etc), which potentially is misleading for  
6 consumers who think that these are menu options from different restaurants. In addition, a ghost  
7 kitchen franchise can produce menu items for 12 to 20 brands using the same ingredients (Conrad,  
8 2021). This raises a several ethical issues for both consumers and providers (Tan *et al.*, 2021).  
9 Concerns are also raised regarding the working conditions in ghost kitchens, which hardly meet the  
10 minimum industry standards in terms of kitchen operations to maximise profit (Meddings, 2020). The  
11 emergence of ghost and dark kitchens can be viewed as one of the latest developments in the so-called  
12 'gig economy' (Popan, 2021). As a relatively new phenomenon, the gig economy has caused a major  
13 disruption for the labor market in a global scale and there are many voices that call for regulation and  
14 government intervention to alleviate phenomena such as exploitation, discrimination, and exclusion  
15 faced by the gig workers (Tan *et al.*, 2021).  
16  
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18 This paper presents the findings from a systematic literature review that serves as a background for an  
19 empirical study (Xiao and Watson, 2019). This paper aims to explore the concept of dark kitchens  
20 from an operational perspective, with a particular focus on the working conditions and contractual  
21 agreements for kitchen workers. This is a relatively new topic area, with only a limited number of  
22 empirical and conceptual studies currently available. By contrast, food delivery workers have received  
23 increasing attention in recent years (i.e. Lin *et al.*, 2020; Parwez, 2022; Ting and Ahn, 2022). People  
24 who work in the kitchens are part of the same gig-based food service economy, and yet they are  
25 invisible. Our paper responds to a call in the recent work by Ashton *et al.* (2022), who have  
26 established a research agenda and typology for ghost food productions, of which dark kitchens play a  
27 part. In this paper, Ashton *et al.* (2022) argue that there is a need to further explore the ghost food  
28 production, with a particular focus on the gig workers in ghost kitchens. Therefore, our paper is a first  
29 attempt to gather evidence on this contemporary issue.  
30  
31

## 32 Literature Review

### 33 *Delivery models and the relationship to dark kitchens*

34  
35 Dark kitchens are linked with the food delivery and take away sector, as part of the restaurant industry  
36 (Table I). Delivery and takeaway as a food distribution channel first appeared in the U.S. four decades  
37 ago. In 1984, Domino's Pizza introduced the "30-minute delivery pledge" that promised another pizza  
38 or a full refund to customers who weren't satisfied with the food or service. Domino's withdrew this  
39 scheme almost ten years later, after a \$79 million court judgment (Knight-Ridder, 1993). Delivery and  
40 take-away were readily adapted as a key component of the restaurant offerings; their popularity was  
41 mainly due to convenience and price from the customers' perspective and the lower operational costs  
42 (compared to traditional 'bricks and mortars' restaurants) for operators (Muller, 2018). Another key  
43 milestone was the launch of the first ODP in October 1995, from two Stanford graduates who created  
44 in the U.S. the online platform [Waiter.com](http://Waiter.com) (Corcoran, 2000). The online food delivery today is a  
45 multi-million segment of the global restaurant industry, with an estimated value of more than US\$150  
46 billion (Ahuja *et al.*, 2021), with almost half of this revenue being generated in China (Statista, 2021).  
47  
48  
49

50 **Table I:** Delivery kitchen models' definitions

51  
52 *Insert Table I here*

53  
54 **Source:** adapted from Cotah (2018)

55  
56 The intense competition and continuous evolution of online food delivery have led to the emergence  
57 of different models with distinctive characteristics. Muller (2018) identifies eight different models of  
58 online food delivery in relation to the kitchen type and ownership (Figure 1). 'The Independent' is the  
59 basic model where the restaurant controls the entire process (receiving the order by phone or the  
60

Internet, producing and delivering the food). In this model, the restaurant absorbs all the incurred costs and revenues generated from this process. While this model is popular, it is not always successful with independent restaurants and local chains (Muller, 2018). The second model refers to the so called ‘cloud kitchens’; these are takeaway and food delivery outlets that do not provide dine-in facilities (Choudhary, 2019). Domino’s originally introduced the concept 35 years ago in the U.S, by creating an extended network of franchised outlets that could offer only delivery and take away options (Keesling, 2020). This business model ensures that the restaurant chain can reach a large or mega customer base that covers a city, region, or an entire country. The parent company (franchisor) controls the ordering and food production process through sophisticated online platforms that utilise A.I cutting-edge technology; the production and delivery of the food take place locally in one of the franchised outlets. This model can be effective for medium to large scale chain-restaurants that utilise franchises as their main expansion strategy (Muller, 2018).

The following two models (‘Ghost kitchens’ and ‘Virtual restaurants’) are affiliated with order-only restaurants (Filloon, 2018). The two models are complimentary to each other, and three key main components identify them: 1) there is no ‘dine-in’ or ‘take-away’ option which is translated to significantly lower operation costs; 2) instead of hiring delivery employees, third-party delivery companies are used, through a partnership or agreement; and 3) by utilising the flexibility that the ODP provides, one kitchen can produce multiple menu items from different cuisines. Some studies (e.g. Miller, 2021; Muller, 2018; Shenker, 2021) suggest that these two models pose a threat to traditional ‘dine-in’ restaurants, due to their very low operational and labor costs, flexibility in terms of the menu and the options provided to customers and the fact that there is no option to ‘eat-in’. One of the most famous ghost kitchens, due to the media attention received, was the New York-based delivery-only restaurant Ando, started by celebrity chef David Chang in 2016. Ando was sold to Uber Eats in early 2018 (Dai, 2018). This takeover is indicative of a relatively new market trend that grows exponentially (Isaac and Yaffe-Bellany, 2019); all the major ODPs (i.e. GrubHub, Meituan, Uber Eats, Deliveroo, Waimai) established their virtual restaurants brands. This was a major disruption of the restaurant delivery business on the global scale (Khan, 2020). This business model is known as ‘Dark Kitchen’; it can be defined as “a space created by an OPD, to facilitate the lowest cost per delivery mile from restaurant kitchen to the highest density of users” (Muller, 2018, p.13). According to Meddings (2020), the main difference compared to cloud kitchens is that in this case ODPs create small groups (clusters) of virtual restaurants that are sourced by a single production site. As a business model is highly efficient and profitable, for example, renting space in kitchen-shared facilities in London can be as low as £1,500 a month compared to the expensive high street commercial sites (Bradshaw, 2019). The maximum optimisation of staff and the dramatic reduction of labor costs are other benefits for dark kitchen operators. According to Jim Collins, chief executive of Kitchen United, “most quick-service restaurant chains employ 30 to 50 people.....in our facility, we have designed the service stack so they only need two people per shift. It cuts their labor cost by 75-80 per cent.” (Bradshaw, 2019). Despite the profound advantages of this business model for the investors and consumers, concerns are raised related to the working environment and conditions, discussed in the following sections.

### Figure 1: Kitchen models for food delivery

*Insert Figure 1 here*

**Source:** adapted from Muller (2018), p.4

### *Worker exploitation in the hospitality industry*

Worker (or labor) exploitation is recognised as a form of human trafficking (FRA, 2019) and refers to internationally criminalised practices that include poor working conditions and underpayment. From a people management perspective, worker exploitation is often a ‘grey area’ where it is challenging to identify the criminal threshold limits. According to Loyens and Paraciani (2021) this phenomenon is

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2  
3 surrounded by moral and legal ambiguity, as there are blurred boundaries between those who can and  
4 cannot be identified as a victim. The European Union Agency for Fundamental Rights (FRA, 2019,  
5 p.10) defines worker exploitation as “*work situations that deviate significantly from standard working*  
6 *conditions as defined by legislation or other legal instruments, concerning in particular*  
7 *remuneration, working hours, leave entitlements, health and safety standards and decent treatment.*”  
8 In the UK, these practices fall under the Modern Slavery Act (2015) with similar legislation existing  
9 also in the US. ILO (2017) reveals that worker exploitation and modern slavery are now more intense  
10 than at any other time in human history, across many service and production industries, including  
11 restaurant and food services, domestic work, agriculture, nail bars, and car washes. In these sectors,  
12 vulnerable groups such as minorities and migrants are preferred for lower-ranked and often manual  
13 jobs that need little or no specialisation (Mooney and Baum, 2019). According to Stead (2020)  
14 migrants are cheaper to employ, demonstrate a hard-work ethic, are easy to control, and are malleable;  
15 these characteristics makes it easier for employers to manipulate and exploit the migrant workforce.  
16  
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18 It is argued that the hospitality industry’s structural characteristics, such as low labor costs, weak  
19 unionisation, and poor working practices, create the conditions for ill or unfair treatment and  
20 eventually exploitation of its workers (Ioannou and Dukes, 2021). According to French (2018), the  
21 sheer breadth of activities, the differentiated size and location of workplaces in the hospitality  
22 industry, seasonal employment patterns, and the nature of work itself create a complex and  
23 problematic sector to regulate. Lashley (2021) describes the working environment in hospitality as  
24 “neo-slavery” based on the above-described conditions. In this context, head chefs in commercial  
25 kitchens have been accused of mistreating young chefs and kitchen workers by using bullying and  
26 violence (physical and emotional) as part of the occupational culture and the new members’  
27 socialisation (i.e. Burrow *et al.*, 2015; Giousmpasoglou *et al.*, 2022). In addition, work in commercial  
28 kitchens is also characterised by low pay and worker exploitation in global scale. Low pay was found  
29 to be responsible for issues such as low productivity (Tongchaiprasita and Ariyabuddhiphongs, 2016),  
30 low employee satisfaction (Chuang *et al.*, 2009), increased employee turnover (Liu-Lastres *et al.*,  
31 2023) and employee burnout (Kang *et al.*, 2010).  
32  
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34 Underpay and wage theft are the most commonly reported forms of hospitality worker exploitation on  
35 the global scale. Large domestic and international hospitality chains have repeatedly failed to comply  
36 with the national minimum wage (NMW) legislation. In the UK, amongst the 43 hospitality  
37 companies named for non-compliance with the NMW, underpaying 5,726 workers a total of £460,459  
38 (BEIS, 2018); the top three offenders were Wagamama, Marriott Hotels, and TGI Fridays. A number  
39 of wage-theft cases with the involvement of celebrity chefs, have been in the news occasionally in the  
40 past decade. In the UK, chef Michel Roux Jr paid kitchen staff well below the average minimum  
41 wage. In Australia, a wage theft case, involved Heston Blumenthal’s fine-dining restaurant in  
42 Melbourne; a leaked administrator’s report after the restaurant’s liquidation found that the sum of  
43 underpaid salaries over a period of four years reached the amount of A\$4.5 million (Schneiders and  
44 Millar, 2018). Other cases in Australia’s hospitality industry of worker exploitation, include George  
45 Calombaris (a former Master Chef judge) underpaying by A\$7.8 million, and Shannon Bennett’s Vue  
46 de monde restaurant accused of forcing employees up to 30 hours per week unpaid overtime  
47 (Robinson and Brenner, 2020). In the US, celebrity chef Mario Batali has been sued twice, in 2010  
48 and 2017, for paying restaurant workers under minimum wage, withholding staff tips and unfair  
49 dismissals (Plagianos, 2017). Another case, of a not-so-publicized legal dispute, which saw more  
50 than 150 of Geoffrey Zakarian’s (TV chef and restaurateur) former employees taking him to court in  
51 a class action lawsuit in 2011 (Fox, 2011). Wage theft in the hospitality industry is not exhausted on  
52 the above examples; nevertheless, these cases indicate the staff exploitation phenomenon on a global  
53 scale.  
54  
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### 56 *Gig Economy and the de-humanisation of work*

57 The Gig Economy is a contemporary phenomenon that emerged in the aftermath of the 2008 global  
58 economic crisis (Myhill *et al.*, 2021); it can be defined as the sum of markets that “match providers to  
59 consumers on a gig (or job) basis in support of on-demand commerce” (Donovan *et al.*, 2016, p.1).  
60

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2  
3 According to ILO (2021), a gig is a temporary, often ad-hoc employment contract (or 'gig'), sourced  
4 through digital cloud-based platforms. As part of their typical work pattern, gig workers enter into  
5 formal agreements with on-demand companies (such as Deliveroo and Uber Eats) to provide services.  
6 The gigs are requested and monitored through a cloud-based platform; gig workers access the  
7 platform through a smartphone application, minimising face-to-face contact with the company. In  
8 contrast to traditional work, gig work consists of temporary work engagements, where the worker is  
9 paid only for the job or project that is assigned to them; this is what El Hajal and Rowson (2021) call  
10 the 'Uberisation' of work.  
11

12  
13 The Gig Economy has brought significant changes to the employment patterns found in the developed  
14 capitalist nations; this phenomenon is widely described as precarious work (Harvey *et al.*, 2017). Li *et*  
15 *al.* (2022) describe precarious work as the uncertain, unstable, and insecure work environment in  
16 which employees bear the risks of work (as opposed to businesses or the government) and receive  
17 limited social benefits and statutory protections. The precarious work arrangement that characterises  
18 the Gig Economy is not new; worker exploitation is synonymous with capitalism and goes back to the  
19 sixteenth century (De Ruyter and Brown, 2019). The new element that constitutes the Gig Economy  
20 as a distinctive contemporary phenomenon is the use of sophisticated technology to control  
21 productivity, the workflow, and the workers themselves (Popan, 2021). Furthermore, precarious work  
22 has become an integral part of the fast-food and delivery restaurant industry on a global scale.  
23 Ioannou and Dukes (2021) argue that the inability of legislation to fully capture the needs of the  
24 hospitality gig workers leads to a series of micro-breaches at work that challenges the established  
25 work practices and patterns that full time employees enjoy (i.e. different types of leave, health care,  
26 pension schemes, etc.). A few recent studies have explored precarious work in different hospitality  
27 and catering sectors (i.e. Kearsey, 2022; Lin *et al.*, 2020; Li *et al.*, 2022; Myhill *et al.*, 2021), but none  
28 of these have focused on dark kitchens.  
29

30  
31 The digital transformation of labor poses some unique challenges for the contemporary world of  
32 work, according to Larsson and Teigland (2020). These challenges were predicted three decades ago  
33 by the sociologist George Ritzer (1993) in his seminal work "*The McDonaldization of Society.*"  
34 Building on Max Weber's theory of rationality and bureaucracy, Ritzer defines McDonaldization as  
35 "*the process by which principles of the fast-food restaurant are coming to dominate more and more*  
36 *sectors of American society as well as of the rest of the world*" (Ritzer, 2013, p.1). The  
37 McDonaldization concept has begun a global phenomenon in different sectors such as education,  
38 leisure and travel, media, health care, religion as well as society itself (Bohm, 2006).  
39 McDonaldization is based on four principles: efficiency, calculability, predictability, and control  
40 (Table II). The successful application of this concept depends heavily on the use of nonhuman  
41 technologies (i.e. artificial intelligence – AI) and machines to control the human workers (Ritzer,  
42 2013, p.102-103); this results in increased productivity and lower operating costs. In gig economy  
43 terms, work is controlled and directed by algorithm-based online platforms, usually accessed by  
44 workers from their smartphone via apps (El Hajal and Rowson, 2021). The selection and management  
45 of the workforce, as well as the minimum quality standards for services provided or products  
46 produced, are determined and managed by the companies owning these platforms (i.e. Deliveroo,  
47 Uber, Upwork, etc). This 'pay-as-you-go' approach to temporary gig working contracts excludes  
48 benefits such as pension schemes, holiday and parental leave and health insurance (Popan, 2021).  
49 Furthermore, the platform-based algorithmic control mechanisms can have detrimental effects on  
50 workers such as social isolation, working unsocial and irregular hours, overwork, sleep deprivation,  
51 exhaustion, and low pay (Wood *et al.*, 2019).  
52  
53

54 **Table II:** The four principles of McDonaldization

55 *Insert Table II here*

56  
57 **Source:** adapted from Ritzer (2013)  
58  
59  
60

Based on the above, it can be argued that the gig economy pushes the four McDonaldization principles (Table II) to the limits. Efficiency and calculability are pushed to the maximum using sophisticated A.I software that maximises the output (i.e. number of dishes produced per hour). This is achieved by quantifying work, with repetitive and predictable tasks and the absence of meaningful employee input. The worker becomes part of the food production line; in this sense, gig workers are turned into what Ritzer (2013, pp.102-103) calls 'human robots.' In addition, the algorithmic management of work (Rosenblat, 2018) through the platforms in use (i.e. Deliveroo, Uber Eats, etc.) enhances digital control and discipline. The idea of tight worker control is not new, and it stems from the principles of Scientific Management introduced by Frederick W. Taylor (1911). In a post-modern application of as the so-called Taylorism (Wagner-Tsukamoto, 2007), workers voluntarily become 'wage slaves' (El Hajal and Rowson, 2021). In many instances, it is not possible for gig workers to choose when and how long to work because if they refuse a gig too often, they may no longer be offered any in the future and, in effect, will be fired (Lee *et al.*, 2015). It is, therefore, argued that the elusive view of 'freedom of choice' and flexibility on behalf of the gig workers, is supporting the employees' efforts to reduce labor costs and avoid hiring employees with full benefits, especially during times of economic turmoil and uncertainty (Taylor *et al.*, 2017). In this way, the gig economy is seen as a tool exacerbating gig worker exploitation in contemporary work settings (Lashley, 2021).

## Methodology

To study the phenomenon of dark kitchens, a systematic - qualitative - literature review (Grant and Booth, 2009) was conducted. Although, it is a method introduced in medical science, this methodological approach has recently been used in business research providing reliable findings with conclusions that can be unbiased (Snyder, 2019). This method is replicable, objective, scientific and rigorous for conducting an exhaustive review of the literature (Snyder, 2019). More specifically, a systematic literature review was conducted to identify, critically evaluate, and present worker exploitation in cloud/ghost/dark kitchens in the context of the service economy (Dewey and Drahota, 2016). In designing the review, the limited number of empirical studies on the topic was considered. Hence, given the paucity of empirical research or any studies on the working conditions in dark kitchens, the search included studies from the wider hospitality industry and the gig economy. The purpose of the study guided the actual review. The process followed for sources selection for the systematic literature review is demonstrated in Figure 2.

**Figure 2:** Systematic literature review sources' selection

*Insert Figure 2 here*

*At the first stage*, a pilot test was conducted with the use of the inclusion criteria (see Figure 4). In order to finalize the research questions, two of the authors performed parallel independent assessment of the existing studies and data. They individually studied the information and then after discussions, reached a consensus on the research questions and what the authors would extract from the articles. The final research questions were:

1. What are the existing working conditions in dark kitchens globally?
2. What are the existing terms of employment in dark kitchens?

The work was then divided between the two, and they finalised the sources used and their content with frequent communication. This process contributed to the credibility of the data collection and analysis (Lincoln and Guba, 1985). Xiao and Watson (2019) propose that we should push the knowledge frontier, but we cannot do it unless we know where the frontier is. For this purpose, the breadth and depth of the existing body of work was explored to identify gaps in the literature and allow for suggestions for future research. At this stage, the researchers used the Scopus, Science Direct, and EBSCO databases. The choice of these databases was made purposefully, as they are

1  
2  
3 known to be the largest and most popular multidisciplinary online databases for scientific research  
4 (Tavakoli and Wijesinghe, 2019). During the first stage, 195 articles were identified, but they were all  
5 rejected in the screening process as they did not provide any information relevant to the working  
6 conditions and employment circumstances in dark kitchens.  
7

8  
9 Following the poor results of the first attempt (Figure 2), Google Scholar was used for *the second*  
10 *stage*; the produced results focused mainly on the gig economy with limited reference to dark  
11 kitchens. The second stage identified 1430 articles, out of which 20 were included (see Figure 4)  
12 (academic journal articles: 16, conference papers: 3, and a book: 1). It should be noted that none of  
13 the identified academic sources focused on worker exploitation in Dark Kitchens, which clearly  
14 confirms the lack of empirical research in this field. As this is a new phenomenon with limited  
15 empirical evidence available, it was decided to proceed to the final *third stage* using the generic  
16 Google search focused on “News”, to obtain information from non-academic sources. One thousand-  
17 and thirty (1030) non-academic sources were identified, out of which 47 met the inclusion criteria.  
18 The information regarding the nature of work and working conditions in dark kitchens emerged from  
19 the press (i.e. newspapers and sectoral magazines), industry and government reports as well as  
20 industry-related blogs. The process followed for the systematic literature review and the data analysis  
21 is illustrated in Figure 3.  
22

23 **Figure 3:** Systematic Literature Review process and data analysis

24  
25 *Insert Figure 3 here*  
26

27 **Source:** Adapted from Snyder (2019) and Xiao and Watson (2019)  
28

29  
30 Figure 3 clearly shows three steps in the process of the systematic literature review. *Planning* was  
31 focused on the scope of the review and the identification of the search strategy. As discussed  
32 previously the research questions were finalised at the (pilot) first stage of the search process. The  
33 keywords used were precise, but inclusive at the same time to ensure appropriateness (Xiao and  
34 Watson, 2019). *Keywords* used in all stages comprised any combination of “cloud kitchen”, “ghost  
35 kitchen”, “dark kitchen”, “gig economy” and “worker exploitation”. The screening process was based  
36 on specific *inclusion and exclusion criteria* as illustrated in Figure 4 including among others the  
37 sources to be written in English, describe the working environment and conditions in dark kitchens,  
38 (i.e. recruitment, contracts, background etc.), any duplications were excluded, and any sources from  
39 before 2014 (when the concept of dark/ghost/cloud kitchens was introduced). *Conducting* included the  
40 search process as described in figure 2 and the data extraction. Journals published by reputable  
41 publishers were considered as high-quality research, and hence were included in the study. The  
42 sources included for this study covered media or organisations beyond the hospitality industry, such  
43 as the generic business press, social science-related publications, government agencies, and local  
44 authorities. Only few high-quality reports and well-cited sources were included for quality purposes.  
45 In all cases, the abstract or introduction were read to check if they met the criteria and to decide  
46 whether they would be included in the literature review. Thematic analysis (as discussed in the  
47 following) was performed to identify the key themes that would respond to the research questions and  
48 the purpose of this study. *Reporting* was the final step in the process. Based on the themes that  
49 emerged from the data analysis the key findings were discussed.  
50

51 **Figure 4:** Inclusion and exclusion criteria

52  
53 *Insert Figure 4 here*  
54  
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56

### 57 *Data Analysis*

58 The multidisciplinary nature of this study of dark kitchens and work exploitation is suitable for  
59 investigating this contemporary phenomenon in diverse socio-cultural contexts from different  
60 perspectives (Bryman, 2016; Spencer and Taylor, 2004). Thematic analysis is a flexible method,



widely used in social sciences (Braun and Clarke, 2006). Thematic analysis was employed in this study, to identify and analyse the dark kitchen workers' experiences, perspectives, attitudes, and expectations, individually and collectively, to identify commonalities and eventually create themes based on repeated patterns (King *et al.*, 2019). As demonstrated in Figure 3, Braun and Clarke's (2006) six-phased framework for thematic analysis was used. At the beginning the authors familiarized themselves with the data in the final list of included publications. Notes were taken, which were discussed between the two authors for clarifications, and finalising the publications to be used. These notes were useful at organising the data in a systematic way and at pre-setting codes. Open coding was used as the pre-set codes were further developed through the coding process. Each author coded their allocated sources and then discussion took place to finalize the codes and identify themes. Latent thematic analysis was performed, and two analytical themes were developed from data screening based on the research questions (Xiao and Watson, 2019), and on the underlying ideas, assumptions that could be theorised and shape the content of the data (Braun and Clarke, 2006). This method of data analysis, provided a simplistic and sequential process (Grbich, 2012) with clear steps for the researchers to follow, aiding in creating in-depth analysis of the collected data. Emphasis on the social and structural context that influence workers in dark kitchens experiences were explored and respective themes were identified and named, which provided knowledge on the socially constructed phenomenon of work exploitation (Clarke and Braun, 2017). To provide a thorough analysis direct data extracts were included to explain the theme's importance and highlight the data set's key features.

## Findings

Working conditions in commercial kitchens have always been challenging (Giousmpasoglou *et al.*, 2022), especially in casual and quick-service restaurants as well as catering providers. The pressure to reduce operational (and more specifically labor costs) to increase the profit margin often hurts kitchen workers. If viewed from a gig economy perspective (Popan, 2021), the dark kitchen business model raises questions regarding two fundamental issues: the working conditions and contractual agreements for the dark kitchen workers. These issues also appear as the emerging themes of this study and are discussed below.

### *Working conditions in dark kitchens*

Dark kitchens are usually situated inside warehouses or windowless prefabricated structures (such as shipping containers) on industrial estates or car parks (Figure 5), often in undesirable areas where the rent is significantly lower than the high street commercial spaces (Payne, 2021; Shapiro, 2022). The larger dark kitchen production sites, which amalgamate many brands, tend to be located on the edges of cities, away from residential areas (Pratty, 2021). Shenker (2021) provides the following description for one of these sites:

*The Deliveroo Editions site at Cranford Way, north London, sits at the back of an electricity substation, sandwiched between a boxing gym on one side and some overgrown scrub on the other. Despite the rumble of motorcycle engines making their way to and from the entrance, and the beeps of lorries reversing out of the adjacent self-storage and warehouse complex, it feels eerily quiet. You could sit here for hours and almost never hear a human voice.*

### **Figure 5:** Dark kitchen production sites in London

*Insert Figure 5 here*

**Source:** adapted from Walters and Crouch (2020)

Despite the frequent inspections by the relevant government agencies and authorities (i.e. the Food Hygiene Agency), health & safety and food hygiene standards are often neglected at the expense of the kitchen workers and customers (Crawford and Benjamin, 2019). Working in confined spaces with

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2  
3 unsuitable ventilation and lighting under extreme conditions of heat and humidity can harm the  
4 kitchen workers (Guzder, 2019). Meddings (2020) graphically describes the working conditions in a  
5 ghost kitchen located in Battersea, south London:  
6

7 *Inside are eight small kitchens — all but one without a window — squeezed into a 4,452 sq ft*  
8 *space. Each is roughly the size of a garage and employs between five and seven chefs, working*  
9 *in shifts from midday to 10.45pm. They can pump out up to 1,000 orders on a busy evening, as*  
10 *Deliveroo drivers arrive at regular intervals to pick up brown bags of food ordered by hungry*  
11 *nearby residents.*  
12

13  
14 Similarly, Butler (2017) vividly evokes her experience after a visit to a dark kitchen site near Canary  
15 Wharf in London:  
16

17 *The boxes have no windows and many of the chefs work with the doors open ... Working in the*  
18 *metal boxes is either hot or cold, depending on the weather and whether they are cooking or*  
19 *prepping. In one kitchen, there is only a small fan heater for cold days. Another houses a pizza*  
20 *oven that takes up more than a third of the space and makes it extremely hot.*  
21

22 In another description of a ghost kitchen located in Los Angeles provided by Loizos (2019), a  
23 windowless warehouse hosted 27 kitchens in a 300 square-foot area and a lot of low-wage migrant  
24 workers in ‘panic mode.’ These are recorded cases in two of the most developed countries in the  
25 western world; it wouldn’t be an exaggeration to suggest that these working conditions wouldn’t be  
26 any different to a sweatshop located in a developing country. In some cases, dark kitchens production  
27 sites operate without adequate planning permission, causing discontent among residents living in the  
28 proximity (Corporate Watch, 2021; Payne, 2021). Barcelona is a positive example where the City  
29 Council is tightening the rules for operating a dark kitchen after protests in two districts (Iolov, 2022).  
30 The residents complained of constant noise and odour produced from these facilities, with workers  
31 and delivery riders working in 24/7 shifts. In another case, Camden residents in London raised  
32 concerns regarding a Deliveroo dark kitchen site, which over a nine-month period received  
33 complaints for 1,800 alleged breaches of conditions (Walters and Crouch, 2020; Wilkinson and Hui,  
34 2022). These food production sites often lack basic facilities for kitchen workers and delivery riders,  
35 such as changing rooms or parking spaces for the delivery riders’ bicycles and scooters. The  
36 overcrowding and nuisance created in the vicinity of these production sites, are causing disruption in  
37 the neighbourhood and the local community.  
38  
39

40 Food production sites in Great Britain are graded by the Food Hygiene Rating Scheme (FHRS)  
41 (<https://www.food.gov.uk/safety-hygiene/food-hygiene-rating-scheme>). An indicator of hygienic  
42 conditions is given a rating from zero to five, with the highest rating being five. During an inspection,  
43 inspectors may find dirty surfaces, inadequate record keeping, and poor food handling that can result  
44 in a rating of one. Based on a BBC report (Crawford and Benjamin, 2019) more than 400 takeaway  
45 outlets listed on Deliveroo and Just Eat in London, Manchester and Birmingham were awarded a  
46 hygiene rating of one from the Food Standards Agency (FSA). Similar cases have been reported in  
47 New York-based dark kitchens, for example after customers’ complaints, the NYC Health  
48 Department issued the Mikado Poke from Uber Eats, a ‘C’ (low) rating amid “*evidence of mice or live*  
49 *mice present in facility’s food,*” and the presence of “*filth flies,*” (Fickenscher, 2020). The following  
50 story describes a food inspector’s experience in the UK, during a dark-kitchen inspection listed on  
51 Deliveroo (Crawford and Benjamin, 2019):  
52  
53

54 *The kitchen was hot, smelly and crowded... One officer opened a cupboard to find pots and*  
55 *pans encrusted with filth, mouse droppings and what looked like the remains of a cockroach.*  
56 *Moving to the main zinc table where the food is prepared we ducked down underneath - I wish*  
57 *I hadn't. The underside was covered in grease and dirt. Below were plastic containers with*  
58 *herbs and spices - the lids were filthy. When asked about the temperature of food left out on*  
59 *the side, one cook produced an electronic probe, which was rusty and cannot have been used*  
60

for months. This place had a hygiene rating of one - in need of major improvement. That sticker was not on the door. Instead, there was one for Deliveroo.

#### *Contractual agreements of an invisible workforce*

Labor in dark kitchens as the concept itself is often opaque and problematic (Doyle, 2021). Delivery platforms demand highly flexible dark kitchen workers, who are more vulnerable to exploitation (Kik *et al.*, 2019). De Groot (2021) argues that dark kitchens “*make fully invisible a workforce that is already so often hidden from view behind the kitchen doors*”. This ‘invisible’ workforce, which is the backbone of the gig economy, is populated mostly with male migrant low-wage workers (Popan, 2021). Mutanda (2021) portrays dark kitchens as ‘*spaces for machines and automation*’ wherein automation is a euphemism for worker exploitation and machines are the low-paid, platform-managed kitchen workers. The multi-billion venture-capitalist food tech industry carefully designed and subsidized the systematic exploitation of dark kitchen workers. The market leader Deliveroo, valued at £7.6 billion, operates in 11 countries, subcontracts 110,000 delivery couriers and partners with over 140,000 restaurants; the company’s shareholders include sound corporate and venture capital firms like Amazon, Fidelity and DST Global (Corporate Watch, 2021). A report compiled by MP Frank Field in 2018 found some delivery couriers were paid as low as £2/hour while Deliveroo upholds that the average earnings are £12/hour (Popan, 2021). More recently, two MPs in the U.K. raised in government the issue of ‘exploitative dark kitchens’ in their constituency and the need to regulate these food production sites (Lynch, 2022). In addition, several court cases against Deliveroo have been reported in the U.K., Spain, Italy and Australia based on unfair termination or dismissal, alongside longer-standing grievances about overpay and employment status (Corporate Watch, 2021).

The employment status of dark kitchen workers is ambiguous due to the fact that their employers (ODPs) are reluctant to disclose any information related to working patterns and contractual agreements (El Hajal and Rowson, 2021). Therefore, it is unclear whether these gig workers are self-employed or employees. In the western world, employee status would automatically secure rights and benefits such as annual leave, sick leave, pension, and health care entitlement. The hyper-flexible employment relationships in dark kitchens, create the conditions for what Popan (2021) calls ‘*flexploitation*’ (from flexible exploitation), which adds an additional layer of precarity for migrant workers and women. In this context, work schedules and income are quite unpredictable: in one week, there can be zero hours of work, the following week, 30 hours in late night shifts (Foti, 2017). The hyper-flexible employment relationship (Rose, 2009) does not guarantee any standardised work patterns or pay for workers, while employers have complete discretion over the hours worked and paid for. This work mode entails few of the employment rights enjoyed by workers on standard contracts (i.e. full-time, permanent or open-ended appointments) (Harvey *et al.*, 2017). The ‘*terms and conditions*’ of employment vary significantly across different countries; even in the same country and company are observed different contracting approaches (Popan, 2021). Vacancies posted online for jobs in such places offer hourly wages of between £8.50 and £10.50, and roles best suited to people who are ‘*reliable*’, ‘*hard working*’, and have ‘*two years*’ experience in [a] fast paced kitchen’ (Harris, 2018).

#### **Figure 6:** Contractual agreements in Dark Kitchens

*Insert Figure 6 here*

**Source:** adapted from Tan *et al.* (2021)

ODPs view gig workers as independent contractors (i.e., not employees) and this is often specified in the agreement that sets forth the terms of the provider-company relationship. Thus, the employment relationship (Figure 6) is ‘on-demand’ and ‘short-term’ and is often described with labels such as ‘freelancer’, ‘self-employed’, ‘independent worker’, ‘contingent worker’ and ‘non-traditional worker’, amongst others (Tan *et al.*, 2021). Based on the above description, gig work can be viewed

as an expansion of traditional freelance work (i.e., self-employed individuals who earn a living through a variety of jobs and projects). Donovan *et al.* (2016) on the other hand argue that gig work differentiates from freelance jobs; for instance, the coordination of jobs through an ODP lowers the entry and operating costs for businesses and permits workers to be part of the gig economy more transiently i.e., with more flexibility regarding work hours. The flexible contractual agreements include many 'grey' areas in favour of the employer, including the ease of termination without compensation. Harvey *et al.* (2017) used the term 'neo-villainy' to characterise the service sector's hyper-flexible and precarious working conditions. In their study of freelance personal trainers, they (ibid.) identified four distinctive features attached to this phenomenon: bondage to the organisation; payment of rent to the organisation; no guarantee of any income; and extensive unpaid and speculative work that is highly beneficial to the organisation. The fast adoption of hyper-flexible employment relationships in the western world signposts the end of an era in labor relations with good working conditions, satisfactory salaries, and protected employee rights. An example of flexploitation in dark kitchens is provided by Morgan (2020) who asked a veteran Pakistani-American cook to keep a diary for three weeks as a Pared app ([www.pared.com](http://www.pared.com)) gig worker:

*In three weeks with Pared, Sheikh worked 18 of 21 days — at a house dinner catered by Jean-Georges one night, at a Guggenheim gala another. He spent 70 hours tediously slicing or washing produce, 100 pounds of onions needed peeling and dicing, 20 cases of mushrooms needed slicing, 760 grapes needed halving. And an additional two hours daily commuting on New York's infamously unreliable subway. He was always late to his therapist.... In total across the three weeks, his weekly averages were \$755.43 for 41.7 hours. Those gigs' hourly rates ranged from \$15 to \$20.25 and averaged \$17.64, 18 cents above MIT's Living Wage Calculator for New York.... When demand is down, Sheikh makes as little as \$150 a week with Pared.*

The above example reflects one of the founding principles of the gig economy: millions of workers globally are forced to work at insubstantial remuneration, which hardly meets the living wage standards; this effectively makes dark kitchen workers 'wage slaves' (El Hajal and Rowson, 2021). The low pay in conjunction with the poor working conditions also have a detrimental effect on the workers' mental health. When Walters and Crouch (2020) investigated dark kitchens in London, received the following response from a cook when asked how it is like to work there:

*We make everything here from sushi to Mexican food to curry to Lebanese cuisine.... There are about 20 to 30 chefs cooped up inside. It's like an open-plan office, but for food prep..... It's quite a depressing place to work, but if you're busy you don't think about it so much.*

Following on the above statement, a former dark kitchen worker in London, describes below the reasons that pushed him to quit his job (Otway, 2020):

*No one seemed to care about us. Out of sight, out of mind. I felt like we'd been dumped there. It was really bleak arriving to work each day. It's not like anywhere else I have worked.*

Whilst the challenging working conditions in commercial kitchens were always an issue in the restaurant industry (Giousmpasoglou *et al.*, 2022), dark kitchens add an extra layer of precarity with high levels of stress and discomfort amongst workers. The almost inhuman working environment and lack of socialisation and collegiality at the workplace pose specific health, safety and welfare challenges for dark kitchen workers. Harris (2018) argues that "in the apparent absence of human contact, daylight and physical space, these new set-ups look like all the grim aspects of catering taken to their logical conclusions." The effects of worker alienation and increased occupational stress can cause severe mental health issues like anxiety, insomnia, depression, and addiction. The most common coping strategy in this case is the use of alcohol, drugs, or any other substances that in the short-term help the workers deal with the mental and physical challenges at work (Giousmpasoglou *et al.*, 2018). In a nutshell, the non-existing wellbeing of workers in dark kitchens is encapsulated on the following statement (Morgan, 2020):

1  
2  
3  
4 *There is no quality of life while we work. And no quality of life promised after we retire. It's*  
5 *all take, no give. It's a broken system that breaks us, too.*  
6  
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## 10 **Conclusion**

11 The Gig Economy has, without a doubt enabled new business models to emerge, with subsequent  
12 changes in working practices affecting a number of sectors, of which the online food delivery service  
13 is one. The emergence of ghost kitchens is a contemporary phenomenon that was accelerated due to  
14 the unprecedented impact of COVID19 on the global economy (Kahveci, 2022). Historically, grand  
15 societal and economic changes have always created winners and losers. On the positive side,  
16 consumers were, to some extent, able to purchase food and drink with minimal human contact in  
17 times of stay-at-home directives, and for some employers and employees, limited work continued  
18 allowing for some income generation. Perhaps the greatest winners in the longer term are the global  
19 investors “*who are gambling millions on an app-driven, dark-kitchen dominated future*” (Shenker,  
20 2021). On the other side, however, an invisible workforce exists, that struggles every day to make  
21 ends meet under almost inhuman working conditions. The well-known conditions, such as low labour  
22 costs, poor working practise and low unionisation and protection that have existed in traditional food  
23 production and service environments have been further compounded in the case of dark kitchens.  
24 There exists a divide between the worker as a resource (‘utility’) and the worker as a human  
25 (‘dignity’). When workers are viewed as an expense we are unlikely to see much change (Latemore *et*  
26 *al.*, 2020). There needs to be more to compel the investors to implement change whilst a workforce  
27 exists willing to work under such conditions and contracts. To a large extent, the gig economy has  
28 lowered the barriers to entry for more workers, with low-entry jobs without capital requirements  
29 appealing to migrant workers who are often looking for any job that is available to gain entry into the  
30 labour market. The ethical dilemmas and the social segregation caused by the poor working  
31 conditions call for a detailed inquiry on this phenomenon. However, with the lack of transparency  
32 around platform-based business models, data about platform workers is hardly available (Oskam,  
33 2019). The invisibility of this workforce is a significant barrier to tackling worker exploitation. We  
34 hope in that our exploration of working conditions is the first stage of the journey to identify and  
35 address a multitude of concerns.  
36  
37  
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## 39 *Theoretical Implications*

40 This paper responds to a call for further research into the impacts on employees of a ghost production  
41 food service system (Ashton *et al.*, 2022; Belanche *et al.*, 2021). In doing so, we found a paucity of  
42 research, with the limited information available found in sources outside of academia. As such, the  
43 contribution of our paper lies in the identification of dark kitchens compounding worker precarity and  
44 exploitation due to the working contracts and working conditions. A number of wider implications  
45 arising from this initial exploration into working conditions and workers’ contracts in dark kitchens.  
46 The authors argue that the working arrangements for dark kitchens have a theoretical contribution to  
47 make around workforce precarity. Precarious work essentially describes a situation whereby access to  
48 work is uncertain and income is unpredictable. It is most common in low-wage sectors of the  
49 economy and has an association with limited access to workers’ rights and protection. There is also a  
50 lack of opportunity for workers to be heard due to a low level or nonexistence of union representation.  
51  
52

53 The gig economy typifies many of these precarious working arrangements, and as more people make  
54 a living from such type of work, there is a risk of increased poverty, with little or no financial stability  
55 required for a planned and stable existence. Some researchers have critically examined worker  
56 precarity in hospitality (for example Baum *et al.*, 2020; Lin *et al.*, 2022; Robinson, 2013) with  
57 mounting evidence of precarity being on the increase rather than the decline. This is particularly the  
58 case for vulnerable groups, including migrant workers who are often employed in low-paid service  
59 work, and who enter the food and accommodation sector due to low barriers to entry as described  
60 earlier. Workforce precarity is clearly a complex phenomenon, calling for an intersectional approach,

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2  
3 advocated by Mooney (2018) to examine connections between multi-level studies. Age, race, gender,  
4 and other categories of demographic identity combine to alter employment chances and outcomes for  
5 both individuals and groups of workers. An intersectional approach to worker precarity can assist in  
6 our exploration of worker exploitation in this context.  
7

### 8 *Practical Implications*

9 During this time of unprecedented labor shortage in hospitality, regardless of whether the stories  
10 found in the news are biased or fake, negative publicity will not help the hospitality labor shortage  
11 crisis. There is a clear need for hospitality employers, as well as other stakeholders, to work together  
12 to reverse the trend of workers leaving the industry, and dark kitchens as well as other restaurant  
13 sectors have a responsibility to offer fair and decent working conditions. From a management  
14 perspective, businesses that consider people as the most important resource and consideration of an  
15 organisation are at the leading edge of positive change. In this vein, humanistic management (Pirson,  
16 2019) and empathetic leadership (Shukla *et al.*, 2022) can play an important role in promoting well-  
17 being and protecting dignity; this management approach currently is far removed from the working  
18 conditions found in dark kitchens. Fair and decent treatment under traditional business models of food  
19 service operations and delivery would fall under the remit of human resource departments, beginning  
20 with legal requirements for policies and procedures, clearly defined human resources policy on  
21 employment contracts and working arrangements, and the overarching organisational culture. In the  
22 absence of this, as a minimum within each kitchen, responsibility for health, safety and wellbeing  
23 must be identified along with clear guidance for how concerns can be raised. From the restaurant  
24 businesses' perspective (virtual or otherwise), safeguarding their reputation is crucial to keep existing  
25 customers and expand into new markets. A loss of control of the business' human resources and  
26 human welfare aspects is a risk, and as such warrants an element of monitoring and resourcing.  
27 Understanding the impacts on the workforce requires social reciprocity (Lin *et al.*, 2022),  
28 collaboration between the production unit and the platform provider, and ultimately the will to listen  
29 to the employee voice. As a final note, due to the lack of transparency around the way food is  
30 produced in commercial kitchens for on-demand food delivery, it is a challenge for consumers to  
31 make ethically informed decisions (Tan *et al.*, 2021). Raising awareness of the business models and  
32 operations surrounding the food delivery sector would empower consumers to make an informed  
33 choice. Linked to this, there is a responsibility for both educators and employers; the former should  
34 create the conditions to engage in debate and discussion for a positive way forward, and the latter are  
35 obliged to implement safe and secure working practices.  
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### 39 *Limitations and future research*

40 The study is not without limitations. It is noted that there may be an element of bias in the reports  
41 derived from the popular press. Furthermore, the analysis has been based on a limited number of  
42 academic sources. Drawing findings from secondary sources only without empirical data can also be  
43 criticised. However, due to sensitive nature of the topic, the collection of primary data is a significant  
44 challenge for researchers. The findings of this study suggest that our knowledge about the working  
45 conditions in dark kitchens is limited to a few anecdotal stories in newspapers, websites, and blogs.  
46 This paper will trigger the research community's interest for a series of in-depth studies that will  
47 identify and surface the issues related to worker exploitation in dark kitchens and worker precarity.  
48 This is a challenging task given the particularities of this topic i.e. the unwillingness of dark kitchen  
49 workers to talk and most important the difficulty to access to these workers and their workplaces. In  
50 addition, a multidisciplinary approach is needed to explore this topic in-depth, mainly from social  
51 sciences' and management studies' perspectives. Finally, we already know that this is a global  
52 phenomenon therefore, a cross-cultural approach is required to investigate this issue holistically.  
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<b>Delivery Kitchen</b>	A delivery kitchen is a restaurant that has no physical space and no dine-in or takeaway facility as it does not exist as a restaurant of any sort. It relies completely on third-party integrations or home delivery orders placed on call or through a website. A Delivery Kitchen operates independently for a single brand name.
<b>Cloud Kitchen</b>	A cloud Kitchen, like a delivery kitchen, is a restaurant where there is no physical outlet and the food is prepared for all sorts of deliveries. What differentiates a cloud kitchen from a delivery kitchen, is the number of brands or restaurants operating in the same outlet. In a cloud kitchen, the number of restaurants operating is more than one. The owner could be the same person or different people.
<b>Ghost Kitchen</b>	A ghost kitchen is a cloud kitchen which is virtually located in different destinations but operate on a <i>'hub and spokes'</i> model. This means that there is one central kitchen where the food is prepared and delivered to the subsidiary kitchen. These subsidiary kitchens are located in different areas. When a customer orders, is rerouted to the nearest virtual kitchen from where the food prepared in the central kitchen is delivered.
<b>Dark Kitchen</b>	A dark kitchen is a ghost kitchen owned by an Online Delivery Platform (ODP).

Table I

161x91mm (300 x 300 DPI)

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<b>Efficiency</b>	Efficiency is the choosing of “the optimum method for getting from one point to another” (Ritzer, 2013, p. 13). Bureaucracies attempt to increase efficiency by requiring employees (and sometimes customers) to follow steps in a predesigned process governed by organisational rules and regulations and by having managers supervise employees (and customers) to make sure they follow the rules, regulations, and process. Increasing efficiency usually entails streamlining various processes, simplifying products, and having customers do work formerly done by paid employees.
<b>Calculability</b>	Calculability refers to the quantitative aspects of McDonaldization (e.g., costs and the amount of time it takes to get the product). Calculability allows McDonaldized institutions to produce and obtain large amounts of things rapidly and to determine efficiency. Calculability also makes McDonaldized institutions more predictable and enhances control.
<b>Predictability</b>	Predictability means that products and services will be uniform everywhere and at all times; there are no surprises. For consumers, predictability provides peace of mind. Employees of the process are also predictable in their actions because of rules and supervision. For workers, predictability makes their jobs easier. To achieve predictability McDonaldized organisations stress discipline, order, systemization, formalization, routine, consistency, and methodical operation.
<b>Control</b>	Control involves the ability of the organisation to get employees and customers to follow the rules and regulations governing the process. In the case of employees, this is accomplished by training them to do a few things in a precise manner with managers and inspectors providing close supervision.

Table II

161x87mm (300 x 300 DPI)



Fig1

175x111mm (300 x 300 DPI)

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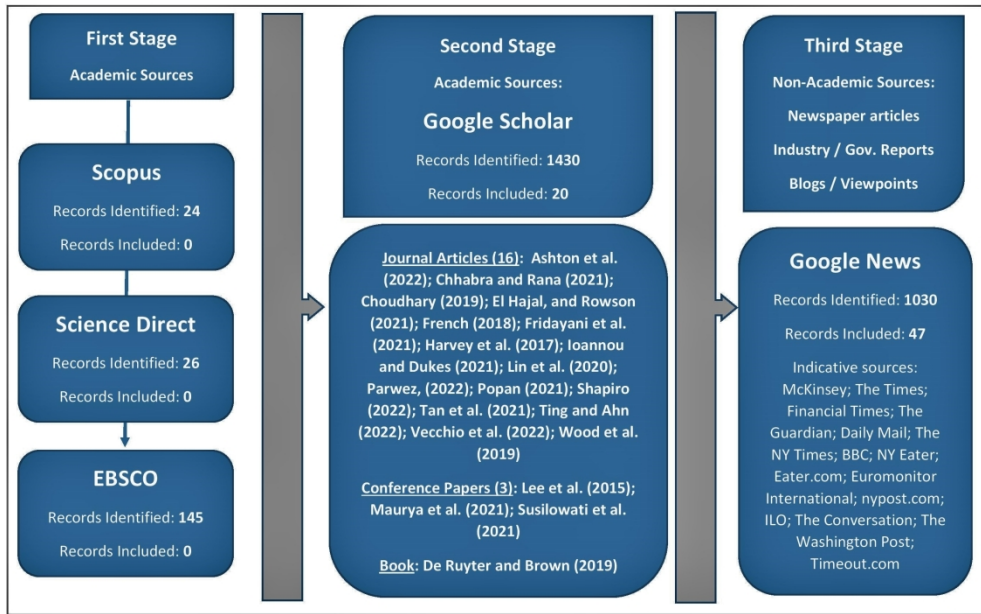


Fig2

234x147mm (300 x 300 DPI)



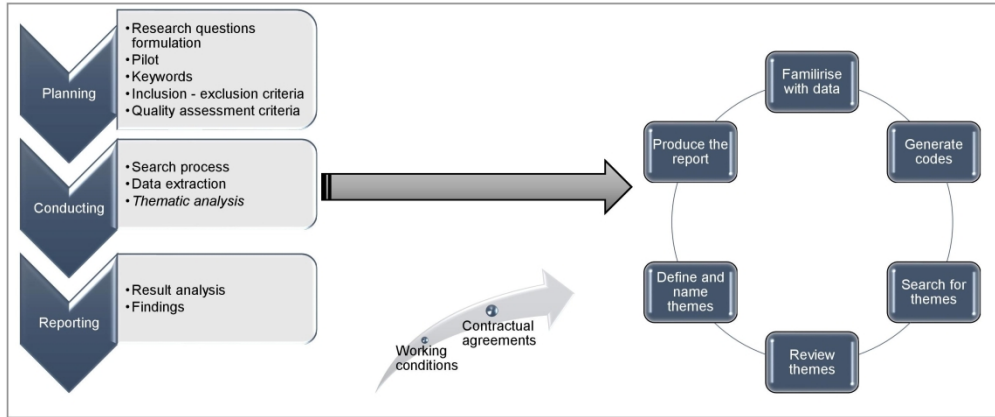


Fig3

250x107mm (300 x 300 DPI)

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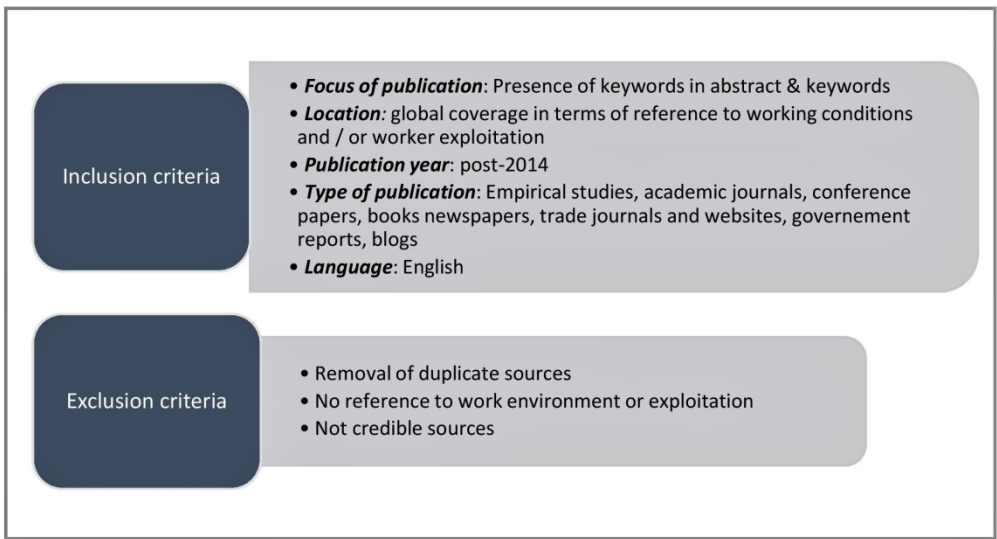


Fig4

180x98mm (300 x 300 DPI)



Fig5

342x98mm (300 x 300 DPI)

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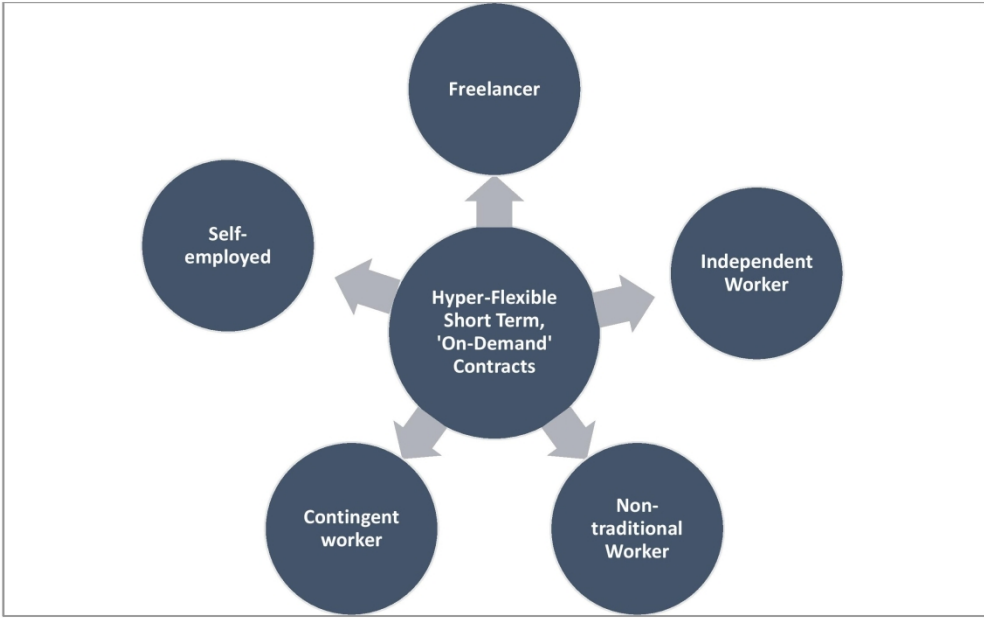


Fig6

236x147mm (300 x 300 DPI)