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On-Demand Food Delivery: a systematic literature review

Abstract

Purpose – The purpose of this paper is twofold: first, to review the extant academic literature on On-Demand Food Delivery (ODFD) services, i.e., the delivery of freshly prepared meals from restaurants to customers enabled by online platforms; second, to propose directions for future research in this field.

Design/methodology/approach - Our work reviews 59 papers published between 2016 and 2020. They are classified with respect to both their research methodology and the addressed themes, namely the actors involved and the activities creating value for the ODFD ecosystem. The latter are analysed applying a framework derived from the integration of traditional models and literature about platforms/business ecosystems. Results were validated through interviews with practitioners.

Findings – Due to its huge success and the significant complexities behind it, the ODFD business has been gaining the interest of academics. Our review highlights that (i) the perspectives of the various actors involved should be integrated, moving towards an ecosystem-based view; (ii) future research should focus more on restaurant operations and their role in on-demand ODFD systems; and (iii) despite they have been investigated by several academic contributions, human resources management and logistics of ODFD systems still present room

for further extensions, in the areas of intervention/regulation and distribution network/batching respectively.

Originality/value – This review offers insights to both academics and practitioners. On the academic side, it analyses the literature on ODFD systems, outlining directions for future research. On the managerial side, it provides a comprehensive view on the most critical value-creating activities for ODFD businesses.

Keywords – Food Logistics; Urban logistics; Logistics services; Omni-channel.

Paper type – Literature review

Introduction

The so called On-Demand Food Delivery (ODFD), i.e., the purchase and delivery of freshly prepared meals from restaurants to the customers' home enabled by the use of online platforms, has been steadily growing all over the world in the last few years. This novel and disruptive business – based on an ecosystem made by the platform, restaurants, riders and customers – is both very significant (as the related market is growing) and critical (due to very peculiar complexities that characterise it). Accordingly, it has gained the attention of practitioners, policy-makers and academics.

Considering practitioners operating in the food and grocery industry, ODFD is a very attractive market to new and technology-driven players, while being a threat to the incumbents in the more traditional non-delivery food, grocery, and hospitality industry (He et al., 2019). What once was a limited niche sector populated by start-ups, is now a flourishing business ruled by big players, which is changing consumers' habits related to a fundamental part of their daily lives: eating (Wang and Somogyi, 2018). The significance of this business – documented by steady growth rates in the US, Europe and Asia – has become manifest to practitioners all over the world (Furunes and Mkono, 2019). As ODFD companies rapidly gain market share, they are increasingly seen as rivals of two well-established, profitable businesses: grocery – since ready-to-eat meals promptly delivered are a true alternative of buying and prepare food – and offline-only restaurants – since customers may conveniently opt for ordering food from the Internet rather than going out to eat (Ray et al., 2019).

Despite their positive economic outlook, ODFD businesses have been subject to controversy in both the public opinion and the press, especially with reference to two key aspects. First, the working conditions of the riders, who perform the delivery of the meals from the restaurants to

the customers. They typically are not employed, but work according to a crowdsourcing paradigm (Altenried, 2019). Second, the impact that the diffuse presence of delivery agents driving in an urban environment may have on traffic and road safety conditions (Christie and Ward, 2019).

In the academic discourse, the features of ODFD make it a fruitful area of research for many different fields and disciplines. First, the associated pickup and delivery problem is very attractive for scholars in the logistics and operations research domains, due to its inherent complexities: highly dynamic demand characteristics, very stringent time requirements, small order dimensions, and highly perishable products (Allen et al., 2018). Second, it is very interesting from a finance, strategy and micro-economics perspective. Several major mergers and acquisitions completed in recent years all over the world have marked the onset of a significant consolidation of the ODFD industry. This trend is driven by the need to aggregate the demand, as the number and density of served customers is a key driver of cost and thus long-term viability of ODFD business models (Zambetti et al., 2017). Third – aligned to the importance of serving a high number of customers – ODFD has been capturing the interest of authors from the marketing field, who are determined to investigate initiatives aimed to enlarge the customers' base and increase their intention to buy (Yeo et al., 2017). In addition, academics coping with labour policies and legal issues of ODFD services may find a fertile context, with a particular implementation of the disruptive gig-economy phenomenon that deserves an in-depth study (Goods et al., 2019).

In light of these premises, there is growing interest of the academic community and literature in ODFD. However, the research field is very broad and includes diverse domains. Thus, extant knowledge is very dispersed and fragmented, and a clear and organised overview of the current

state of the literature is missing. While some attempts have been made in this direction considering just food logistics (e.g., Cerchione et al., 2018) or crowdsourcing logistics (e.g., Allen et al., 2018), similar works specifically targeting ODFD (and therefore the intersection of food logistics and crowdsourcing) are still unavailable.

Objectives and Methodology

The increasing interest of academics, the significance of the topic for practitioners and policymakers and the lack of a clear and organised view of extant knowledge are adequate reasons to conduct a systematic review of the literature (Huscroft et al., 2012). There is a particular need for such a review in light of novel phenomena such as ODFD services (see for instance the paper by Lim and Winkenbach, 2019). In this context, this work aims to (i) provide a systematic analysis and classification of extant the body of research on ODFD, (ii) outline the major gaps in the extant literature, and (iii) accordingly propose directions for future research, which may be of relevance for both the academic and the managerial communities.

In line with the set objectives, and with the aim of developing the framework to classify the extant body of research, this work addresses the following two questions:

RQ1. What are the main actors in ODFD ecosystems and what is their role? – to identify the main actors involved in ODFD ecosystems and to understand their role and interactions.

RQ2. What are the main value-creating activities and processes performed in ODFD ecosystems? – to identify and discuss the most significant value-creating activities and processes performed by the actors in ODFD ecosystems.

To answer these questions, a systematic review of the literature about ODFD was conducted.

Based on the recommendations in the methodological paper by Seuring and Gold (2012), our

review followed four main phases: phase 1 (material collection) to retrieve and select papers; phase 2 (descriptive analysis) to analyse the contributions based on their main “descriptive” characteristics, i.e., year of publication, region/country, title of the journal/name of the conference; phase 3 (category selection) to identify the dimensions/categories for the content analysis; phase 4 (material evaluation) to review and classify the works based on the defined dimensions.

At the end of the review process, in addition to the defined steps, five interviews with ODFD practitioners were performed to validate the results (phase 5).

Phase 1: Material collection

The first phase – i.e., collecting and selecting the papers – can be seen as composed of three main sub-steps, which coincide with steps 2 to 4 of those proposed in the methodological paper by Durach et al. (2017).

(i) *Determine required characteristics of primary studies* – The requirements for the papers were defined, and they were subsequently expressed as inclusion and inclusion criteria. The focus of the analysis is the delivery (a) of freshly prepared meals (b) from restaurants to customers’ houses (c) enabled by the use of online platforms. Accordingly, as shown in Table 1, we excluded both (a) the delivery of non-fresh – i.e., enogastronomic or grocery – products (such as oil or canned food) and (b) the delivery of fresh prepared meals from supermarkets. In addition, we rejected (c) works investigating the delivery of meals directly managed from single restaurants (e.g., delivery of a pizza ordered from a local “pizzeria” by the phone, accomplished by the deliveryman of the restaurant). As a matter of fact, their case is significantly different with respect to online platforms such as *Glovo* or *Deliveroo* that have the peculiarity of combining the

offer of different restaurants, which accordingly share not only the app, but also logistics resources (and they benefit from a centralised management).

Inclusion criteria	Exclusion criteria
(a) Delivery of fresh prepared meals	Delivery of enogastronomic or grocery products
(b) Delivery of fresh prepared meals from restaurants	Delivery of fresh prepared meals from supermarkets
(c) On-demand delivery of fresh prepared meals from restaurants enabled by online platforms	Delivery of fresh prepared meals managed by single restaurants themselves

Table 1: Inclusion and exclusion criteria

Considering the unit of analysis, it was selected as a single scientific paper, not only from journals, but also from conference proceedings. The choice to include not only black, but also grey literature is due to the novelty of the theme. As a matter of fact, the considerable time needed for a paper to be published on international journals could otherwise result in missing relevant contributions (Mangiaracina et al., 2019).

(ii) *Retrieve sample of potentially relevant literature* – first, a search by keywords was performed in two library databases (i.e., Scopus, ISI Web of knowledge). The selected keywords included both alternative names for ODFD found in literature (which are shown in Table 2, together with the related source) as well as the names of some popular ODFD platforms (“Deliveroo”, “Zomato”, “Uber Eats”, “Glovo”, “Swiggy”, “FoodPanda”, “Doordash”, “Grabhub”).

Keyword	Source
Food Delivery Apps (FDA)	Ray et al., 2019
Food Online Order and Delivery (FOOD)	Preetha and Iswarya, 2019
Online Food Aggregators (OFA)	Kapoor and Vij, 2018
Online Food Delivery (OFD)	Yeo et al., 2017
Online Meal Order and Delivery (OMOD)	Pinto et al., 2019

Table 2: Keywords

As suggested by Durach et al., (2017), we searched the titles, abstracts, and keywords of papers for the above-mentioned terms. In addition, similarly to Nguyen et al. (2016), a further

“snowballing” step was carried out to broaden our search: articles listed in the references of the works we initially retrieved were also included in our search.

(iii) *Select pertinent literature* – the outcome of the previous activities, without considering duplicates, was a set of 183 eligible papers, which were then filtered according to the inclusion and exclusion criteria shown in Table 1. All the inclusion criteria had to be jointly true to select a paper, while one exclusion criterion was sufficient to reject it. The selection process followed three steps. First, works were filtered based on their title (resulting in 122 eligible papers). Second, a further refinement was made reading the abstract (coming to 81 eligible papers). Third, the remaining papers – whose abstract was not sufficient to understand the alignment with the scope of the analysis – were read in their entirety. Finally, 59 papers were selected for in-depth examination.

Phase 2: Descriptive analysis

The 59 publications we reviewed are from a number of different sources: 86% are articles published in scientific journals, while the remaining 14% come from conference proceedings. Two main considerations may be derived from this preliminary analysis. First, despite the novelty of the theme – for which knowledge is still at early stages and not consolidated in literature – the majority of the papers come from journals. This is representative of how the academic community – considering both authors and editors – agrees on the high significance of the topic. Second, both the journals and the conferences are characterised by a high heterogeneity in terms of the core theme they address, including industrial engineering, hospitality management, marketing, logistics and human resources management. This is coherent with the variety of both topics and disciplines linked to ODFD. Considering the journals, the sources are diverse. Except from the *Journal of*

Retailing and Consumer Services, which has 5 publications, there are 10 journals with 2 papers each and the remaining 26 journals count 1 paper only. Among the journals with 2 works, the majority belongs to the technology and engineering field (*Journal of Advanced Research in Dynamical and Control Systems*, *Journal of Theoretical and Applied Information Technology*, *International Journal of Advanced Science and Technology*, *International Journal of Innovative Technology and Exploring Engineering*, *International Journal of Recent Technology and Engineering*), followed by food and hospitality management (*British Food Journal*, *International Journal of Contemporary Hospitality Management*, *Journal of Foodservice Business Research*), logistics (*International Journal of Logistics Research and Applications*) and social sciences (*Work Organisation, Labour and Globalisation*). An aligned by-topic distribution (majority in the technology and engineering field, followed by food and hospitality management, then logistics and social sciences) is maintained also for those journals counting one paper each. ODFD is a broad research theme that, due to the great variety of activities it requires, encompasses numerous disciplines, very different from each other. Accordingly, extant research on the topic is fragmented and dispersed, and results are presented in conferences and journals from fields that barely benefit from mutual contributions

Figure 1 illustrates the uptake of ODFD-related works in the academic discussion based on their year of publication. Two insights clearly emerge. First, the novelty of the theme: there are no works prior to 2015. This is well aligned with the newness of this business, for which the majority of the leading companies were founded after 2013. Second, the rapidly growing interest of the academic community towards ODFD. Specifically, nearly 90% of the works we identified in our review were published since 2018. Despite being quite limited, the emerged time frame (6 years) may be considered a suitable period for a literature review in the SCM field. First, the studied phenomenon

is very recent. Second, the number of analysed contributions is significant and aligned to that of other literature reviews in the SCM field covering wider periods (e.g., Perego et al., 2011). Third, the methodological paper by Seuring and Gold (2012), which analyses the characteristics of 22 SCM literature reviews, shows that only 6 papers (27%) targets a period higher than 7 years.

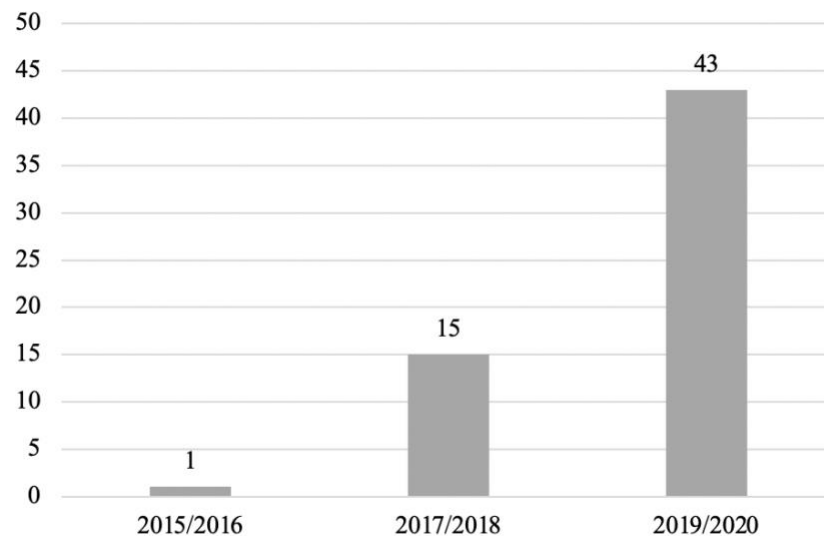


Figure 1: Timeline of the papers

Considering the geographical dimension of the reviewed works, our analysis shows how ODFD is considered an interesting research theme globally and, in addition, many publications are the result of international collaborations. However, particular attention towards the topic has been devoted to use cases in Asia (e.g., China, Thailand, and India). Especially Indian use cases are covered by 31% of the contributions. The high diffusion of ODFD services in India and the associated concentration of academic work is partially driven by a deep-rooted tradition of so-called “Dabbawala” systems in the country, i.e., the delivery of prepared meals to people working away from home (see, e.g., Ganapathy et al., 2016). This well-established habit may be considered as the pre-digital ancestor of the current ODFD, which has accordingly been more easily adopted in this context.

Phase 3: Category selection

The content-based review was performed— consistently with the stated research questions — based on a twofold perspective.

- (i) First, we distinguished works based on which of the actors involved in the ODFD ecosystem were considered, i.e., platforms, restaurants, riders and customers (RQ1)
- (ii) Second, we distinguished the works according to the value-creating activities and processes that were investigated (RQ2)

The classification categories – detailed in the following – were selected upfront, thus relying on a (mainly) deductive approach. The choice to define categories “a priori” is supported by different methodological papers about literature reviews for SCM (i.e., Seuring and Gold, 2003; Tranfield, 2003). This deductive mode is beneficial when attempting to classify such dispersed and diverse contributions, in a broad and novel research field where no previous attempts had been made in this direction. An inductive approach has been adopted as a second step to revise the previously identified categories, highlighting the peculiarities of the ODFD. With regard to the two main views identified with the deductive approach - i.e. the actors involved and the value chain activities – we can state that mapping the actors involved in the business is a common practice in SCM literature, as it allows to better comprehend the relationships among them (Kaihara, 2003), whereas the value chain – similarly to previous works addressing business ecosystems – served “as the core mental model in order to explore the value creation process within companies and across their network of relations” (Nucciarelli et al., 2017).

The two views were derived combining and elaborating literature addressing “traditional” business strategy and literature in the platforms/business ecosystems fields.

Considering perspective (i), the ODFD actors were identified taking as a baseline the scheme of business ecosystems proposed in most of the seminal works in the field, which is represented in Figure 2 (Mikkola and Skjøtt-Larsen, 2006).

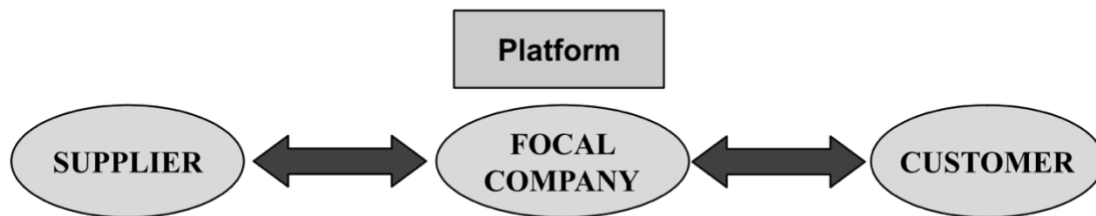


Figure 2: Actors of platform ecosystems. Source: Mikkola and Skjøtt-Larsen (2006)

The main feature of platforms, which differentiates them from traditional business models, is that they create a two-sided market, in which the value does not flow unidirectionally (left to right), but moves on both sides (Iansiti and Levien, 2004). In fact, the value creation entails the participation of multiple users (Eisenmann et al., 2006), and more specifically platforms, suppliers and customers. Applying this model to ODFD systems, two main differences emerge compared to the reference one. First, suppliers were identified as the restaurants. Second, a fourth significant actor was added: the riders (i.e., the people in charge of delivering the meal from the restaurants to the customers).

Considering perspective (ii) – i.e., value creating activities and processes – the classification axes were defined relying on academic works aimed to revise a “traditional” business strategy model - like Porter’s value chain - in the light of platforms literature. According to Porter (1985), the activities that allow firms to create value can be grouped in two main categories: “Primary activities” (Inbound and Outbound Logistics, Operations, Marketing and Sales, Service) and “Support activities” (Firm Infrastructure, Human Resource Management, Technology Development, Procurement). Despite Porter’s value chain was originally developed to fit one

single firm, literature shows later that this model, if conveniently revised, can be applied to wider contexts. Among others, Di Martinelly et al. (2009) switch from a company-centric view to a supply chain one, implementing Porter's model to the whole supply chain. A subsequent work by Walsh (2011) – focused on developing nations – makes a further extension applying the model to society. According to different academics, the value chain is still a reliable tool to investigate also platforms/business ecosystems, but it needs to be appropriately adapted based on the new way value is created in ecosystems: as anticipated, the value does not move unidirectionally from the left side – supplier – to the right one – customers, but it flows on both sides (Eisenmann et al., 2006), as represented by the arrows in Figure 1. As a result, when addressing platforms, Porter's value chain needs to be adapted. More specifically, the main change to be made concerns the list of value-creating activities to be considered, which are: Marketing and Sales, Human Resources Management, Technology Development, Logistics and Operations (Van Alstyne et al., 2016).

Based on these premises it is possible to state that, despite the deductive nature of the category selection process, the first version of the category list was revised and modified following an inductive sub-step (aimed to catch the peculiar features of the ODFD business). Considering actors, the main change relied in the introduction of a fourth player in the ecosystem, namely the riders. Considering activities, the traditional set of activities proposed by Porter (1985) was modified in the light of ODFD ecosystems and only the relevant ones have been selected. This combined process, where the deductive category definition has been followed by an inductive category revision, is supported by the methodological paper by Seuring and Gold (2012), who recommend a first deductive category building step, followed by iterative cycles of inductive category refinement.

Phase 4: Material evaluation

After the descriptive analysis, the articles were classified using a two-pronged approach. On the one hand, they were categorised based on the research method(s) adopted by the author(s). On the other hand, they were classified and analysed based on their content, relying on the categories defined in Phase 3, to highlight significant themes and trends and to identify research gaps.

The analysis was performed according to the following process: first, 10 papers were jointly classified by all the three authors to get to an agreement on both the two dimensions (i.e., actors and activities) and the way in which the classification should be performed. The remaining papers were subsequently independently analysed by the authors, whose percentage agreement was 1 for the methodology, 0.95 for the actors and 0.94 for the activities (the values are good according to Wowak and Boone (2015)). Agreement was considered achieved in case all the three authors had obtained the same result. Those papers for which there was not initial agreement were jointly discussed and classified again by the three authors together, until a consensus was reached.

Research methods used in the reviewed works

After the descriptive analysis, articles were reviewed based on the research method(s) adopted by the authors. According to Meixell and Norbis (2008), seven main research methods are generally applied in academic research: analytical models, conceptual models or framework, case studies, interviews, surveys, simulations, and others. In the light of this high-level classification, three main clusters of papers can be identified in our review: quantitative models (analytical models

and simulations), empirical analyses (surveys, interviews, and case studies) and conceptual models or frameworks (which also include literature reviews). Table 3 shows the classification of the found papers based on these clusters. In case multiple methods were applied, the work was accounted for in all the related categories. Most of the papers rely on just one method (e.g., Wang and Somogyi, 2018), while some of them are multi-method (e.g., Jacob et al., 2019).

Research method	Number of Contributions
Quantitative model	14
Empirical analysis	35
Conceptual model	10
Other	5

Table 3: Research methods

Considering empirical analyses, the majority is represented by surveys. In general, they take the customers' perspective and aim to identify the main sources of value in the use of ODFD platforms. Vinaik (2019) surveyed 300 people to understand their attitude toward ODFD apps, focusing on their awareness level of the services, their expectations and the dimensions according to which they compare different players. The work by Gilitwala and Nag (2019) presents the results of another survey on 400 clients of a ODFD platform operating in Bangkok, to understand the factors influencing their willingness to repeat the purchases with the same app. Beside surveys, other authors also present case studies (e.g., Furunes and Mkono, (2019) investigate the peculiarities related to the application of the sharing economy model in ODFD). Quantitative models are fewer than empirical ones (26%), and a great part of them propose and solve an optimisation problem to efficiently and effectively manage the delivery of meals from restaurants to customers. One of the main insights from our analysis is the diversity in the considered objective functions. Some authors take the perspective of platforms and aim to minimise their costs and/or to maximise the covered demand (Zambetti et al., 2017). Other

scholars focus instead on the riders, and try to maximise their personal income stemming from the completion of delivery tasks (Li et al., 2018). Some works set instead objectives from the customer' perspective, e.g., prioritising the reduction of delivery delays (Fikar et al., 2018). Finally, there are some authors proposing multi-objective functions, aimed at concurrently considering the perspectives of different actors, due to the need to align their interests, which are frequently conflicting (e.g., He et al., 2019). In general, the objectives of the models may be very different; nonetheless, a recurring element (either as a part of the objective function or as one of the constraints) is the service level, since customer satisfaction is key in determining the success of a ODFD initiative (Furunes and Mkono, 2019).

Concerning the conceptual models, the majority is represented by frameworks aimed at identifying the main factors influencing the ODFD market, and at investigating their mutual relationships (see, e.g., the work by Thamaraiselvan et al. (2019), focussed on India).

Among the multi-method papers considered, there are two main clusters. Works belonging to the first one combine frameworks and surveys. They typically develop frameworks based on the literature, and then test the found hypotheses through questionnaires (see, e.g., Jacob et al., 2019). Among the second – and quantitative – subset of multi-method works, the most frequent association is between analytical models and simulations. Authors develop a model, that is subsequently tested on simulated data (see, e.g., Steever et al. 2019).

Themes arising from the review

After the descriptive and the method-based analyses, the content-based review was performed – as anticipated – based on the twofold actors-activities perspective. One of the outcomes of this

analysis is a framework (Figure 3), which represents value-creating activities next to the links that connect the various actors involved for those activities.

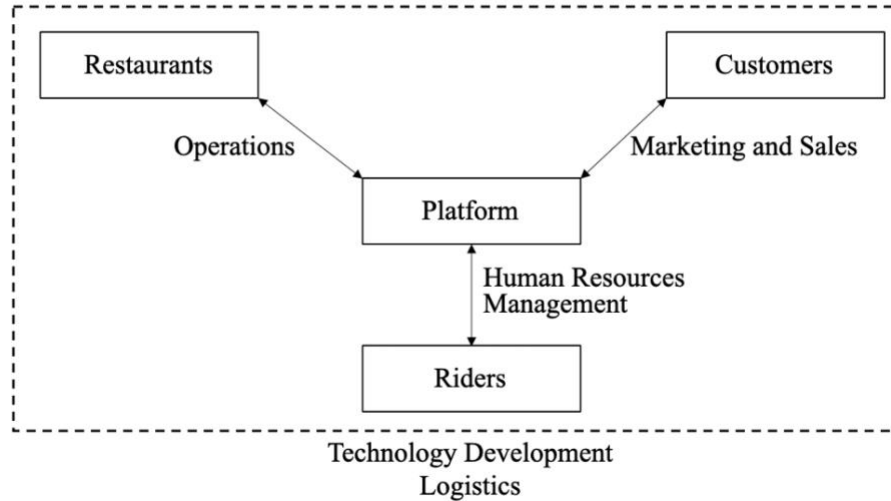


Figure 3: Framework – ODFD actors and activities

The development of the framework as well as the association (and thus the position) of the activities to the links were driven by a quantitative analysis, whose baseline is shown in Table 4. This table reports, at the intersection of the actors and activities, the number of papers addressing a specific activity with reference to a specific actor.

	Customer	Rider	Restaurant	Total (activity)
Marketing and Sales	27	0	1	27
Human Resources Management	1	14	1	15
Technology Development	9	7	4	14
Logistics	9	11	5	12
Operations	0	0	1	1
Total (actor)	36	26	11	

Table 4: Classification based on themes

Considering for instance the first row (i.e., Marketing and Sales), 27 works investigate this activity from the perspective of customers, 1 treat it relating to restaurants, while there are no papers analysing Marketing and Sales for riders. As anticipated, this quantitative breakdown was used to correctly associate the value-creating activities to the links among the actors. Marketing and Sales was placed at the link between Platforms and Customers, Human Resources Management between Platforms and Riders, and Operations between Platforms and Restaurants. Technology Development and Logistics could instead not be uniquely associated to a specific dyad of actors, but they lie at the intersection among all of them. Details concerning both the actors and activities perspectives are presented in the following sections.

Two clarifications should be made about Table 4.

First, it must be noted that only three actors (i.e., Customer, Restaurant and Rider) are listed, while the presence of Platforms is not explicitly stated: the reason behind this choice is that Platforms were addressed in all the papers (as it could be expected being this a literature review about ODFD).

Second, the total number of contributions addressing one activity, which can be read in the last column (e.g., 27 papers for Marketing and Sales), may be lower than the sum of the numbers in the row (e.g., 28 papers for Marketing and Sales, found as 27 for Customer/Marketing and Sales + 1 for Restaurant/Marketing and Sales). As a matter of fact, in the part of the table combining the actors and activities dimensions, the same paper could be accounted for twice (or three times) in case it includes the perspective of two (or three) actors concurrently (e.g., one paper tackling Marketing and Sales was accounted for considering both the Customer and the Restaurant perspectives). The same reasoning is valid for the number of works addressing the single actors: the total number reported in the last row is lower than the sum of the different numbers in the

column, as the same paper could concurrently treat different activities from the perspective of the same actor.

The next sections take the twofold actors-activities perspective and discuss the main findings of the review, based on the results of the quantitative analysis reported in Table 4.

(i) Main findings: actors perspective

The last row of table 4, displaying the distribution of the papers based on the addressed actors, shows how the highest number of papers (49%) is associated to the customers, followed by riders (36%), while less than 20% consider the perspective of restaurants.

Platforms

ODFD platforms act as intermediaries between restaurants and customers. In the context of ODFD services, it is possible to identify two main types of platforms, depending on the type of services provided. First, the so-called aggregators, that arose at the beginning of the 21st century. They provide customers with a technological solution by which a wide variety of restaurants can be accessed, compared, and selected, and orders can be issued directly to the restaurants. They do not provide logistics services, since the restaurants are directly in charge of arranging and providing the delivery on their own (Zambetti et al., 2017). An example of these companies is represented by *JustEat*. Beside aggregators, the second – and currently most diffused – type of platform also offers the required logistics services, relying on their own logistics network (typically based on freelance couriers) and provide the delivery in addition to the order arrangement, issuing, and management (Fikar et al., 2018). Some examples are *Deliveroo*, *UberEats* and *Swiggy*. Due to the wider range of activities they manage and the higher

complexities they have to tackle with respect to those faced by the first type of ODFD platforms, this second type has gained the interest of academics.

Customers

They order the meal using the app and receive it at home. Despite being the final recipient of the service, customers are typically treated as a part of the food delivery ecosystem in literature (see for instance the work by Furunes and Mkono, 2019). As a matter of fact, their judgement about the performances of the other actors in the ecosystem determines the success of an ODFD initiative, thus reflecting on both the strategic choices and the management of daily operations for platforms. This is manifest in most of the reviewed works that propose analytical models, in which customers' perspective is typically included either in the objective function – e.g., minimisation of their waiting time (He et al., 2019) – or as constraints to be met – e.g., target service quality (Yildiz and Saverlsberg, 2019). Customers' utility typically depends on three dimensions that are by some means in a trade-off among each other: delivery effectiveness – in terms of speed, timeliness and punctuality – (Zambetti et al., 2017), food quality (Suhartanto et al., 2019) and price (Chandrasekha et al., 2019).

Riders

Riders are in charge of the delivery process, i.e., they collect the meals at the restaurant and deliver them to the customers. They are typically freelance workers, operating in a crowdsourced context: the app of the ODFD platform proposes a delivery task, and they may decide whether to accept it or not (Goods et al., 2019). As in every crowdsourcing environment, it is fundamental to consider the workers' perspective in order to build a successful business. As a matter of fact, on the one side, their unavailability – or the missing acceptance – to perform a task may

undermine the accomplishment of an on-time delivery to a customer (Dahle et al., 2017). On the other side, a rider is “an individual who only cares about his own profit, instead of the overall performance of the system” (Li et al., 2018, p. 2). Ignoring the way in which they operate could thus result in a myopic view, potentially causing significant losses for the other actors in the ecosystem.

Restaurants

Restaurants prepare the food to be delivered. Their role is key in different ways. First, they are in charge of preparing the meal and therefore, the quality of the food – which is one of the main factors affecting customers’ satisfaction and thus the intention to buy their meal online – depends on them (He et al., 2019). Second, restaurants are responsible for the production planning. As a result, they determine different constraints to the food delivery problem; among them there are the production capacity, i.e., the number of orders that may be processed (and thus proposed to customers), and the preparation time (Yildiz and Savelsbergh, 2019). Third, their position limits the available options in defining the structure of the distribution network, as their location – i.e., the location of the points of origin for the last-mile delivery – has to be considered as fixed when designing the network (Zambetti et al., 2017).

(ii) Main findings: activities and processes perspective

The last column of table 4 shows the distribution of the papers based on the addressed activities. The activity associated to the highest number of papers is Marketing and Sales (27), followed by Human Resources Management (15), Technology Development (14) and Logistics (12). Only one paper was instead found addressing Operations.

An in-depth activity-based analysis allowed to classify the papers based on the main addressed topics. Results (in terms of topics, number of papers and main references) are shown in Table 5.

Activity	Topic	Number of papers	Main references
Marketing and Sales	Promotion of ODFD vs. Traditional food businesses	14	Gunden et al. (2020); Jacob et al. (2019); Lee et al. (2017)
	Promotion among different ODFD players	13	Yeo et al. (2017); Suhartanto et al. (2019); Ray et al. (2019)
Human Resources Management	Positive/negative aspects	12	Altenried (2019); Christie and Ward (2019); Leonardi et al. (2019)
	Intervention/regulation	3	Goods et al. (2019); Viossat (2019); Richardson (2020)
Technology Development	App	8	Ilham et al. (2018); Kapoor and Vij (2018); Fauzi (2019)
	Algorithm	6	Correa et al. (2019); Cosmi et al. (2019); Hu et al. (2019)
Logistics	Last-mile delivery	6	Yildiz and Savelsbergh (2019); O'Neil and Hoffman (2019); Li et al. (2019)
	Distribution Network Design	4	Pinto et al. (2019); Yildiz and Savelsbergh (2019); He et al. (2019)
	Batching	2	Steever et al. (2019); Fikar et al. (2018)
Operations	Food preparation	1	Das and Ghose (2019)

Table 5: Value-creating activities

Marketing and Sales

Marketing and sales refer to all the actions taken to inform buyers about products and services, and induce them to make the purchase (Porter, 1985). When considering ODFD, it includes all the activities and initiatives aimed to push consumers to order their meals online, through the app. This theme has been capturing the attention of academics, as shown by the significant number of works aimed to identify the main factors affecting the customers' intention to order

their meals online. These factors may be classified in two groups, depending on the perspective taken by the respective authors in their research.

Promotion of ODFD vs. Traditional food businesses. The first perspective is broader and investigates the drivers of convenience persuading consumers to choose ODFD over other – more traditional – businesses, i.e., restaurants or grocery shopping. When the alternative is represented by eating at the restaurant, the main benefits stemming from the use of on-demand ODFD services are the access to a wider choice of restaurants and types of food without having to move from home (Kapoor and Vij, 2018) and the possibility to avoid waiting time at the restaurants before being seated and ordering food (Jacob et al., 2019). If the benchmark is instead grocery shopping and subsequently cooking a home-made meal, the main benefit is ascribable to the lack of time and effort needed to prepare the food (Bagla and Khan, 2017).

Promotion among different ODFD players. The second perspective is more narrowly defined and focusses on the ODFD sector only: provided that customers have already decided to order their meals online, authors investigate the factors driving the choice of which ODFD service they will be using. When comparing different vendors, customers consider the variety of restaurants among which they may choose (Bagla and Khan, 2017), the price (Chandrasekha et al., 2019), the ease of payment methods (Vinaik et al. 2019), the speed of the service (Yeo et al., 2017), the firm's reputation (Gilitwala and Nag, 2019), and the absence of a minimum order value (Thamaraiselvan et al., 2019). In addition, recent studies are showing that a successful initiative in increasing customers' loyalty to ODFD services (i.e., the intention to purchase again from the same service) is the introduction of cashback and other reward programs (Vinaik et al., 2019).

Human Resource Management.

When referring to workers, ODFD platforms – as well as many other phenomena belonging to the gig-economy – have been massively capturing the interest of academics, practitioners and policy-makers. In the ODFD business, the management of workers – often referred to as ‘riders’ – follows the logic of ‘crowdsourcing logistics’: riders receive delivery proposals they may decide whether to accept or not (Fikar et al., 2018). They “are non-salaried but nevertheless highly dependent on digital platforms that pay them by the job” (Viossat, 2019, p. 63), and “as independent contractors (they) engage in digitally-enabled and controlled work that is remunerated on a piece rate basis” (Goods et al., 2019, p.502). This emerging working paradigm has been raising numerous questions and driving the development of very different – and sometimes conflicting – theories and views. Two main streams of works may be identified.

Positive/negative aspects. The first cluster of works discusses the positive/negative aspects of crowdsourcing logistics, often comparing it to more traditional working paradigms. On the one hand, considering the drawbacks of employment with ODFD services, it generates various health and safety risks both for the workers and the other road users, due to the pressure on riders to avoid delays and to the use of the phone while riding (Christie and Ward, 2019). On the other side, this type of flexible work allows riders to benefit from autonomous organisation (Briziarelli, 2019) and short-term sources of extra-incomes (Goods et al., 2019). Therefore, an agreement about the theme has not been reached. Accordingly, some authors propose a dual view, and look at logistics connectivity through an ambivalent lens: the digital connectivity embedded in ODFD may be seen as a tool to supervise labour exploitation, as well as an opportunity to establish new types of relations and to organise working activities (Leonardi et al., 2019). Similarly, what may be asserted as labour precariousness can actually also be seen as flexibilization of the jobs (Altenried, 2019).

Intervention/regulation. The second cluster of works proposes instead potential interventions that should be pursued to correctly regulate and manage crowdsourcing logistics. Whatever their opinion about the positive and negative effects of ODFD, academics agree in recognising that it is now reconfiguring both urban spaces and labour conditions. Accordingly, there is a need for new measures and legal frameworks, which adapt to current and future developments of this emerging paradigm (Viossat, 2019), “the consequences of which need to be taken seriously by regulators, scholars, workers and other relevant stakeholders” (Goods et al., 2019, p.502). The main topics in this direction are labour regulations, urban freight policies and urban planning choices.

Technology Development

Technology is a key theme when dealing with ODFD, due to the significance of the digital component in this business: the technological element, and more in detail the rise of the Internet, has been the enabler for the birth of ODFD. The literature exhibits two main angles from which technology may be seen with reference to ODFD platforms.

App. The first is the app (i.e., mobile or web application) of the respective ODFD service. It is the tool linking all the different actors of the ecosystem, and the mean of communication for customers, restaurants and riders with the platforms. The literature shows both that it constitutes the interface experienced by consumers when they decide to order their meal online, and how its functionalities/features have a great impact on customer satisfaction. More specifically, the two most impacting elements for the customers, which are addressed by the majority of the papers, are the ease of use (Gilitwala and Nag, 2019; Ray et al., 2019) and the processing speed (Pattnaik, 2019; Vinaik et al., 2019). In addition to them, two other characteristics influencing customers' intentions to use ODFD apps are the aesthetic design (Kapoor and Vij, 2018) and the

different payment options supported (Vinaik et al., 2019). Fewer papers focus instead on the app features that are important to restaurants, and also in this case the ease of use and the processing speed are the two key elements (Fauzi, 2019).

Algorithm. The second crucial technological element of platforms relies in the algorithm that allows to manage the ODFD activities. It has three main purposes, which are strictly interrelated. First, it is in charge of receiving customer orders: based on the delivery location, it allows customers to issue orders only to those restaurants close enough to grant an acceptable delivery time (considering both the preparation and the delivery time) (Yildiz and Savelsbergh, 2019). Second, it assigns orders to the riders, who are then in charge of reaching the restaurant, collecting the parcel and delivering it to the final customer. This is a very critical task, which has to take into consideration the departing point of the rider, the position of the restaurant and that of the customer (Huq et al., 2019). Third, it defines the routing, i.e., the route the rider has to follow to reach the restaurant(s) and the customer(s) – one or more depending on the number of orders that can be consolidated in one tour (Fikar et al., 2018). Most of the papers propose new and improved versions of the traditional assignment-and-routing logic, and they recommend enhancing the objective function to combine the perspective of platforms with that of the other actors, i.e., restaurants (Yildiz and Savelsbergh, 2019), customers (Li et al., 2018) and riders (He et al., 2019).

Logistics

As manifest in the scheme in Figure 3, logistics plays a fundamental role in the ODFD business, as it constitutes the link among all the involved actors, including the platform itself. Papers addressing logistics treat it from different angles, but three key domains may be identified: last-mile delivery, distribution network design and batching policies.

Last-mile delivery. The majority of papers in the logistics field address the management of the last-mile delivery, i.e., the delivery process through which riders collect meals at the restaurants and deliver them to the customers' doorstep. There is agreement among academics in recognising how the last-mile delivery for ODFD has much higher complexities if compared to more traditional vehicle routing problems with pick-ups/deliveries and time windows (VRPPDTW by He et al. (2009)). Among the main pitfalls of the ODFD last-mile distribution with respect to generic e-commerce parcels, there is the presence of strict requirements pertaining to the time dimension. First, delivery lead times are very short, as the meal must typically be delivered very quickly from the moment it is ready – often within 15 minutes (Allen et al., 2018). Second, punctuality is key, since customers expect their order to arrive in the selected time-window (Vinaik et al., 2019). In addition, the type of (produced, managed and delivered) products is characterised by criticalities, as freshly prepared meals have a very short shelf-life (just a few minutes, in many cases), and are often characterised by temperature maintenance requirements (He et al., 2019). The delivery operations of ODFD services are thus much more complex than those for non-food e-commerce parcels, where a rather conventional Vehicle Routing Problem (VRP) has to be solved (Allen et al., 2018). In the ODFD case, the underlying planning and optimisation problem is a variant of the dynamic Pickup and Delivery Problem (PDP), in which (i) orders can often not be consolidated before starting the delivery tour (Zambetti et al., 2017), and (ii) where there are rigid precedence constraints to be respected for pickups and deliveries (i.e., the order pickup at the restaurant must happen before the delivery to the customer, so that the restaurant needs to be reached before getting to the associated customer) (Yildiz and Saverlsberg, 2019).

Distribution network design. The second – and more strategic – logistics domain addressed in literature refers to the design of the distribution network, i.e., the choice of the number and location of facilities supporting the distribution of goods. Also in this case, ODFD introduces novel challenges compared to traditional e-commerce distribution. The points of origin of individual deliveries are a large number of restaurants that – unlike traditional e-commerce hubs – are dispersed in space and highly specialised (i.e., only one specific restaurant can be the point of origin for a customer, due to its unique offer of freshly prepared meals and/or to the time constraint for the delivery to be performed) (Bagla and Khan, 2017). On the demand side, one of the peculiar characteristics of ODFD orders is the high intra-day seasonality of order volumes, namely lunch and dinner peak times (Kapoor and Vij, 2018). This demand pattern requires a tremendous flexibility that can be guaranteed only by crowdsourced work, as it allows engaging riders for shorter time slots (Dahle et al., 2017). Given the position of restaurants (i.e., the pick-up points), the most important choice to be made about the network is defining the demand area to be served, and the subsequent planning of both the production and the delivery capacity (Yildiz and Savelsbergh, 2019). Based on this first decision, two following choices are: first, the location and the number of riders' departing points (Zambetti et al., 2017). Second, the possibility to adopt – and locate – transshipment points to transfer orders from one vehicle to another, and to consolidate multiple shipments (Fikar et al., 2018).

Batching. The third, and least discussed, logistics topic concerns the batching policy, i.e., the possibility to combine food coming from different restaurants in the same customer order (Steever et al., 2019). Grouping different orders and assigning them to the same rider allows to increase the number of deliveries in the same tour (as two or more customers belong to the same delivery tour), thus having a positive effect on efficiency performances. Despite the potential

significant benefits that batching may entail, it is still not widely considered in literature, as it is not suitable for all the contexts (Seghezzi et al., 2020). As a matter of fact, in order to have the possibility to aggregate different orders, the number of orders need to be particularly significant (i.e., the demand has to be high). It is otherwise very difficult to find two orders fulfilled by restaurants near to each other and addressed to close customers in the same delivery time window. This “reduces consolidation opportunities and imposes the need for more vehicles operating simultaneously and executing shorter routes” (Reyes et al., 2018). Therefore, the batching policy well fits contexts in which ODFD is already widespread, while there are several countries – such as France or Italy (Pinto et al., 2019) – that are not mature and for which the conditions for its introduction are still not met yet.

Operations

Operations refer to the activities transforming inputs into outputs (Porter, 1985). In the ODFD context, this involves the preparation of the meal, of which the restaurants are in charge.

Differently from the other activities, literature counts few works addressing operations.

Accordingly, no clusters of papers were identified. Affecting both time performances and quality of the delivered product, operations have a twofold role. First, the timeline presented by Yildiz and Savelsberg (2019) and depicted in Figure 4 shows how operations are carried out between the moment an order is placed by a customer and the moment the order is ready to be picked up by the rider.

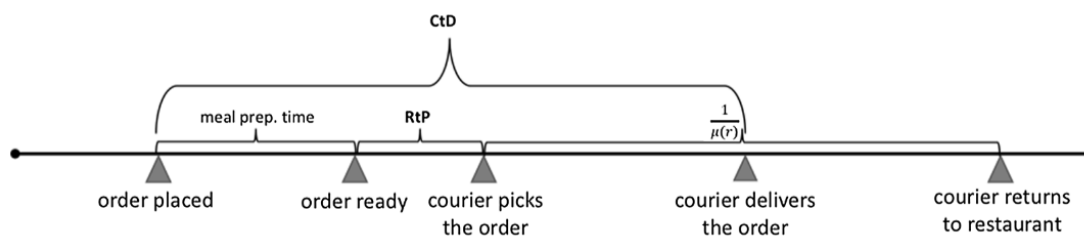


Figure 4: Timeline of events. Source: Yildiz and Savelsberg, 2019

Preparation time has a huge impact on the overall delivery time seen by the customers, even if it may not be immediately evident from this representation. As a matter of fact, this timeline displays a situation in which the rider is not yet at the restaurant when the meal is ready. In this case, there is a ready-to-pickup (RtP) interval that acts as a buffer: a longer preparation time does not directly affect the overall delivery time, since the meal would not be able to leave the restaurant anyway until the rider arrives. Nonetheless in reality, the RtP time is typically very tight – usually no more than 5% of the overall click-to-door (CtD) time (Yildiz and Savelsberg, 2018). Often RtP time is null, as the riders may get to the restaurant before the meal is ready. In this case, the preparation time is determinant in defining the delivery time seen by the customers. Second, besides determining delivery times, restaurants are also responsible for the quality of food, i.e., the output of the operations. Here, again, the impact of operations is huge, since customers directly perceive and experience this performance dimension. Besides the quality of the delivery service – which is crucial (Pattnaik, 2019) – food quality is one of the key factors driving customers' choice to rely on ODFD services (Suhartanto et al., 2019).

Phase 5: Interviews with practitioners

To complement our review of the literature, interviews were performed with 4 practitioners working for 4 different multinational ODFD companies. Interviewees were selected based on a twofold criterion. Similarly to Huscroft et al. (2012), first, potential participants were identified among volunteers from previous research efforts and references from senior logistics professionals. Second, practitioners had to belong to the senior management, and not to a specific function (they are: 1 logistics manager, 1 marketing manager, 2 general managers); this

allowed to gain a wider perspective on the ODFD business, avoiding potentially misrepresented or partial views.

The involvement of the managerial community in academic works is increasingly diffused in the supply chain management field, especially in the logistics one, as it helps granting practical significance of research for managers. The role of practitioners in literature review papers may be very different: they may contribute in the definition of the keywords to be used for the search (e.g., Huscroft et al., 2012); they may help identify elements for the emerging framework (e.g., Elbarkouky and Abdelazeem, 2013); according to an emerging trend for literature reviews – which we adopted in this work – practitioners can also give a significant contribution in validating the outcomes of the review (Mangiaracina et al., 2019) and interpreting them from a managerial perspective (Bardauskaite, 2014).

Participants were first individually interviewed, deep diving both the framework and the sub-topics related to each activity: the results of the literature review were shown and discussed.

These semi-structured interviews allowed to both validate the outcomes (i.e., showing that the most significant actor and activity-related topics are those emerging from the literature) and better read and interpret them (Harland et al., 2019). A group interview was subsequently performed, in which all the practitioners discussed together under the guide of a moderator.

Group interviews benefitted from the participants' simultaneous interviewing, which allowed to combine and stimulate their mutual contribution (Urciuoli and Hintsä, 2017). This was mainly aimed to discuss the gaps from a managerial perspective, and to introduce potential sparks for further research (e.g., analysing the introduction of dark kitchens).

Summary, gaps and future directions

ODFD is a broad research theme that, due to the great variety of activities it requires, encompasses numerous disciplines, very different from each other. Accordingly, extant research on the topic is fragmented and dispersed, and results are presented in conferences and journals from fields that barely benefit from mutual contributions. In addition to identifying the key themes, our review of the extant literature reveals the main shortcomings of extant academic literature, and leads us to propose fruitful avenues for future research. Aligned to the literature review by Mangiaracina et al. (2019), gaps can be identified on three different levels: (i) lack of a comprehensive view integrating the different topics, (ii) presence of topics that – despite their significance for both academics and practitioners – are under-investigated, and (iii) presence of topics that – even if discussed by a higher number of papers – need to be studied in further depth. Gaps (i) and (ii) may be derived from the analysis summarised in Table 4, gaps (iii) are instead referred to that displayed in Table 5. We will comment on each of these in the following.

Lack of an integrative view. Even if some efforts are starting to be made to combine and include the perspectives of the different actors involved, there is still great room for works aimed at integrating them, trying to move towards an ecosystem-based view. This is manifest if considering that only 3 papers out of 59 include all the three actors, and just 6 out of 59 combine the perspective of two players. In this direction, literature could benefit from both qualitative works (e.g., frameworks providing a complete picture of the ecosystem trying to explain the relationships and the dependencies between the actors involved) and quantitative ones (e.g., analytical model with multi-objective functions that take into account the needs of all the players involved and impacted by the decisions).

Under-investigated topics. Some themes are under-investigated, and this is true concerning the actors and the value-creating activities. Focussing on Table 4, it is possible to decline this gap

from the perspective of both actors and activities. Considering actors (i.e., looking at the last row of the table), the perspective of restaurants (treated by 19% of the works) results to be significantly less studied if compared to both customers (61%) and riders (44%). Considering activities (last column of the table), the analysis clearly shows how Operations have been barely taken into consideration by academics (only one paper was found addressing them). Despite its importance with respect to the core topic of the work, this activity – i.e., the preparation of fresh meals – is typically just cited and treated as an ancillary. Evidences coming from our interviews with practitioners confirm an urgent need for a deeper analysis of the perspective of restaurants, and more specifically in the field of operations (food preparation above all), due to their crucial impact on ODFD performance.

Topics requiring more in-depth investigation. Considering Table 5, three main fields were identified as requiring higher attention: one concerning Human Resources Management (Intervention/regulation) and two concerning Logistics (Distribution Network Design and Batching). The reason behind the identification of these topics is twofold. On the one hand, the high significance of the related value-creating activities; on the other hand, the low coverage of the mentioned sub-topics.

Starting from Human Resources Management, the review of the literature showed how the majority of the authors devoted their efforts to critically analyse the working conditions of the riders, and to identify the positive and negative aspects of such a novel employment paradigm. Nonetheless, only few of them made a step forward in proactively proposing and evaluating potential solutions that could improve them, mitigating the criticalities of the gig-economy consequences for riders. In this sense, the literature review suggests two potential directions towards which new research could be aimed. On the one hand, legal matters about job and

employment regulations, which are also gaining the interest of both the public opinion and the press. On the other hand, measures concerning urban planning choices, aimed to address and manage the presence of riders in the cities, considering both the traffic and the safety conditions. Switching to Logistics, the first domain relates to the strategic choices linked to the design of the distribution network. As illustrated, most of the works in this field focus on the definition of the points where the riders should wait before moving towards restaurants. Further research efforts should instead study the location-allocation problem concerning restaurants, i.e., define the optimal set of restaurants to target, and define the demand area to be covered by each of them (i.e., combination of Logistics with Restaurants). In addition, new works should be steadily developed to keep up with rapid industry innovation that characterises the dynamic ODFD sector, which may also affect the design of the network. Among them, there are the so-called dark kitchens, i.e., cooking areas shared by different restaurants and dedicated to the ODFD business (Karamshetty et al., 2020). The introduction of dark kitchens changes the delivery problem, since they concentrate different points of origins (i.e., restaurants) in the same location with a dedicated and a bigger production capacity. As a result, both academics and practitioners would benefit from works aimed to identify the optimal location-allocation of orders to dark kitchens.

The second logistics topic to be addressed is instead related to the batching policy. As already mentioned, the number of contributions in this field are few. As a matter of fact, being able to consolidate different customer orders in the same delivery tour requires a significant demand level (so that it is possible to combine orders for which the points of origin, the points of destination and the delivery time window are compatible). While this is not the case of less mature ODFD markets (in which the delivery density does not allow to consolidate orders), this

configuration gets increasingly interesting as the market is more diffused. Accordingly, these contexts would deserve closer consideration from a go-to-market perspective, and the drivers of profitability of ODFD services should be investigated in greater depth. In addition, further works should investigate the effect that variations in key variables and parameters would have on the found outcomes in a generic environment (e.g., analysing the impact of changes in the density of customers and restaurants, the availability of riders) to derive principles of general validity.

Conclusions

In this work we reviewed 59 papers, including both works published in scientific journals and presented at international conferences. After considering their general characteristics – i.e., year, source, and country – the contributions were systematically analysed following a two-pronged approach. On the one hand, the research method(s) adopted by the author(s) were identified. On the other hand, the papers were analysed based on their content. Specifically, a classification was built based on the integration of two dimensions. First, the involved actors, i.e., platforms, restaurants, riders, and customers (thus answering RQ1). Second, the main activities and processes, which allow to create value in the ODFD ecosystem: Marketing and Sales, Human Resources Management, Technology Development, Logistics and Operations (thus answering RQ2). Based on this classification, the extant literature was presented, some key themes were derived, and the main shortcomings of the extant body of literature were outlined.

This work offers insights to both academics and practitioners. On the academic side, it analyses and classifies the relevant literature on on-demand ODFD services, proposing directions for future research activities based on the identified gaps. On the managerial side, it presents a

framework associating the main activities to be performed in a ODFD context to the corresponding link between the relevant actors.

This work has two main limitations. First, it may not be considered as all-inclusive in terms of analysed contributions, since some works could have inadvertently been missed. Nonetheless – also thanks to comprehensive interviews with practitioners we conducted – we are confident that the general insights and conclusions from our review are reliable, and that the presented results are representative of the current state of research on the topic.

Second, activities and processes in the framework are reported just once, in correspondence to the link between the two actors that each activity most significantly relates to. However, this association is not always univocal. It could happen that an activity impacts the link between more than just one pair of actors (e.g., marketing activities could be performed by platforms towards new restaurants as well as towards new customers). The choice of proposing a slightly simplified view on value-adding activities was motivated by two main considerations. First, this simplified view makes the framework structuring our review clearer and more concise in representing both the main logic behind ODFD businesses and the recent academic research. On the other hand, it still provides an integral view of the main activities and links, without neglecting any significant issue. Future works could be aimed at extending this generic framework and tailoring it towards specific variants of ODFD ecosystems, highlighting the additional roles activities may have for some specific actor pairs in these ecosystems.

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