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**OM Forum**

# Innovative Online Platforms: Research Opportunities

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**Abstract.** Economic growth in many countries is increasingly driven by successful startups that operate as online platforms. These success stories have motivated us to define and classify various online platforms according to their business models. This study discusses strategic and operational issues arising from five types of online platforms (resource sharing, matching, crowdsourcing, review, and crowdfunding) and presents some research opportunities for operations management scholars to explore.

**Supplemental Material:** The online appendix is available at <https://doi.org/10.1287/msom.2018.0757>.

**Keywords:** online platforms • innovative operations • operations management

## 1. Introduction

To understand the impact of online platforms on today's global economy, one needs to look no further than the *Wall Street Journal's* list of the 10 most valuable venture-backed private companies. As of July 2018, seven of them, including Uber (\$72 billion), Didi-Chuxing (\$56 billion), Airbnb (\$31 billion), Meituan-Dianping (\$30 billion), WeWork (\$20.2 billion), Lufax (\$18.5 billion), and Lyft (\$15.1 billion),<sup>1</sup> are online platforms. Each of these platforms creates value for two or more independent user groups by facilitating transactions or relationships between them. Uber, Didi-Chuxing, and Lyft connect drivers and passengers. Airbnb and WeWork connect property owners and renters for residential homes and commercial offices, respectively. Meituan-Dianping connects merchants (e.g., restaurants) and customers by combining the Groupon model of discounts and the Yelp model of consumer reviews, and Lufax connects capital seekers and capital providers. European Commission (2015) reported that, between 2001 and 2011, online platforms accounted for 55% of gross domestic product (GDP) growth in the United States and 30% of GDP growth in the European Union. PwC projects that platforms will generate \$335 billion in revenue worldwide by 2025 (Federal Trade Commission 2016).

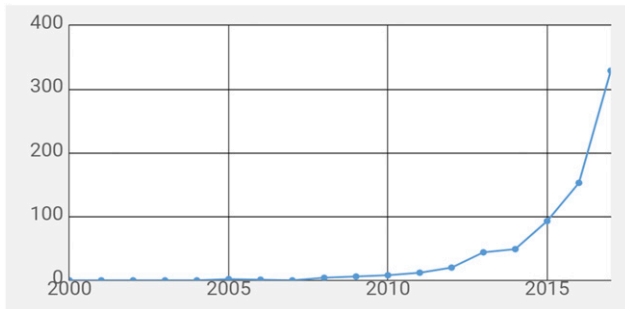
Amid their strong growth prospects, online platforms are controversial, because they disrupt traditional businesses: Uber disrupts taxis, Airbnb disrupts hotels and Alipay (an online payment system) disrupts debit/credit cards. Also, the underlying innovative business models of different platforms are often at odds

with existing policies and regulations. For example, labor lawyers have argued that Uber drivers should be treated as employees instead of contractors, and consumer activist groups have expressed concerns over Uber's safety and privacy issues. Governments around the world are struggling to review their outdated legal frameworks to regulate various online platforms.

Online platforms have generated excitement in the public domain. As of August 2018, a Google search using keywords "online platforms" or "online platform" returned over 21 million webpages. Although some established literature deals with e-commerce platforms and platforms for the distribution of information goods (e.g., Geoffrion and Krishnan 2003), limited published research exists on "many-to-many" online platforms and online platforms that involve exchange of physical goods, labor, or capital. Specifically, using keywords online platforms to search on the Web of Science found 721 research articles that were published between 2000 and 2017, and nearly one-half of them (329 articles) were published in 2017 (Figure 1).<sup>2</sup> Therefore, a great opportunity exists for the operations management (OM) research community to examine strategic and operational issues arising from various online platforms.

Motivated by these observations, this study explored three main questions. (1) What is an online platform, and how should one classify online platforms? (2) How do online platforms create and capture value? (3) What are the OM research opportunities arising from various types of online platforms?

**Figure 1.** (Color online) Number of Academic Publications with Keywords Online Platforms in Titles or Abstracts



The rest of this paper is organized as follows. Section 2 defines and classifies platforms. Section 3 discusses value created and captured by platforms. Section 4 presents potential research opportunities for OM scholars.<sup>3</sup> Section 5 summarizes the study conclusions.

## 2. Online Platforms: Definition and Classification

European Commission (2017) defines online platforms as digital marketplaces that “enable individuals or small entities as buyers and sellers to ‘transact’ (i.e., search and match) effectively and efficiently by employing various Internet-connected digital communication devices.” Online platforms share key characteristics, including (1) the use of information and communication technologies to facilitate transactions between user groups, (2) collection and use of data about these transactions, and (3) network effects that make the use of platforms with most users most valuable to other users. Examples include e-commerce platforms (e.g., Alibaba, Apple App Store), travel websites (e.g., Expedia), crowdsourcing platforms (e.g., InnoCentive), and crowdfunding platforms (e.g., Kickstarter). Figure 2 illustrates this definition of an online platform. In addition, the platform specifies “rules of engagement” (e.g., types of information, pricing formats, ratings, search process, etc.) for users to search, interact, and match with each other.

Because a universally accepted classification scheme for online platforms does not exist, one may take a “buyer-seller perspective” to classify online platforms according to the type of transactions (e.g., service [a ride], capital [a loan], information [a review], etc.)

between buyers and sellers. Alternatively, one may take a “platform perspective” by focusing on what the platform aims to facilitate (e.g., resource sharing, matching, crowdsourcing, reviews, crowdfunding). This study adopts the second approach to classify online platforms, because it enables one to map these facilitations to business models (i.e., activities to create value for buyers and sellers and activities for the platform to capture value) (Chesbrough 2007). Because of page limitations, we focus on *resource sharing*, *matching*, *crowdsourcing*, *review*, and *crowdfunding* platforms as shown in Table 1.<sup>4</sup> (Additional discussions of *e-commerce* and *peer-to-peer* [P2P] lending platforms can be found in Online Appendices A and B, respectively.) In addition, we focus on “virtual” online platforms that “do not own inventory of physical goods or contents.”<sup>5</sup>

Without owning assets, virtual online platforms (Table 1) are essentially “intermediaries” that connect different user groups. What follows are illustrative examples for the five types of platforms. (1) Uber is a resource-sharing platform that coordinates passengers and drivers for rides by leveraging real-time location information of both user groups. (2) e-Harmony is a matching platform that matches its male and female members for dating by using members’ personal information and preferences. (3) InnoCentive is a crowdsourcing platform that enables many solvers to compete for developing the best solution to a problem posted by a seeker. (4) Yelp is a review platform that allows numerous users to post their reviews and share their experiences about various merchants. (5) Kickstarter is a crowdfunding platform that enables a seeker to raise funds from a large number of providers to support a project.

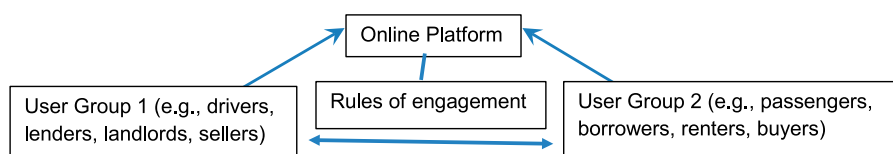
## 3. Value Creation and Value Capture

This section discusses how platforms create and capture value. Section 3.1 analyzes value creation and capture by various platforms, and Section 3.2 highlights the various success and risk factors of these platforms.

### 3.1. Value Created and Captured by Online Platforms

As an intermediary, a platform’s success hinges on the value that it creates for user groups. Wu (2004) summarized informational and transactional values

**Figure 2.** (Color online) Interactions Between an Online Platform and Business or Consumer User Groups



**Table 1.** Classification of Online Platforms According to Business Models and User Groups

Business model/user group	B2B	B2C	C2C
Resource sharing	WeWork <sup>a</sup>	Uber Eats, Deliveroo, <sup>b</sup> Ele.me	Uber, Didi-Chuxing, Airbnb, Yard Club, Udemy <sup>c</sup>
Matching	Upwork (formerly known as Elance)	Monster, CareerBuilder, LinkedIn (a recruitment platform)	e-Harmony, Match, TaskRabbit, Tinder, Instagram <sup>d</sup>
Crowdsourcing	InnoCentive, <sup>e</sup> Kaggle, Topcoder, NineSigma	LiveOps <sup>f</sup>	
Review		Kelly Blue Book, Shopzilla, Shopping.com	Yelp, Rotten Tomatoes, TripAdvisor, Angie's List, Meituan-Dianping
Crowdfunding <sup>g</sup>		Kickstarter, Indiegogo	LendingClub, Prosper

<sup>a</sup>WeWork is a B2B platform, because it offers shared office spaces for small businesses and entrepreneurs to conduct business activities.

<sup>b</sup>Deliveroo, Ele.me, and Uber Eats are online platforms that coordinate self-employed delivery persons to deliver food from restaurants to their customers using bicycles, motorcycles, or cars. These platforms engage three groups of users: restaurants, freelance couriers, and eaters.

<sup>c</sup>Udemy is an online education platform that enables instructors to post their online courses for free, but instructors share a portion of the revenue collected from online students. Udemy has over 15 million students and more than 20,000 instructors offering more than 55,000 online courses.

<sup>d</sup>Safronova (2017) reports that Instagram is now a dating platform. By using its Instagram Stories (a collage of photos, memos, comments, etc.), users can create their own online persona for potential matching.

<sup>e</sup>InnoCentive is a crowdsourcing platform that can be categorized as B2B or B2C, because it contains a large number of solvers who can be considered as consumers; however, these solvers also seek income in the form of awards.

<sup>f</sup>LiveOps is an online service platform that connects freelancer call center agents with consumers. Their business model is categorized as crowdsourcing, because a large number of call center agents are compensated based on their relative rank of service quality. See Stouras et al. (2014) for details.

<sup>g</sup>Reward-based crowdfunding (B2C) platforms, such as Kickstarter, are discussed in Section 4.5; the discussion of P2P lending (C2C) platforms is found in Online Appendix B.

created by intermediaries. The first value reduces information asymmetries between user groups, and the second value reduces the costs of searching and matching. Belavina and Girotra (2012) articulated an additional value: an intermediary can reduce the *matching friction* between buyers and sellers to meet buyers' changing needs and sellers' changing preferences. Table 2 illustrates these different values by platforms and user groups.

In addition to what Table 2 highlights, "network effects" generate a positive feedback loop in which a platform creates more value with more users.<sup>6</sup> For example, as more recruiters post their job openings on Monster, more job seekers will post their resumes. Hence, Monster creates more value when the market

size becomes bigger.<sup>7</sup> Online platforms can also improve social welfare. Arnold and Hildebrandt (2017) stated that ride-sharing platforms, such as Uber, can reduce carbon dioxide emissions. Moreover, online platforms, such as Etsy, create new jobs for low-income women (House of Lords 2016).<sup>8</sup>

In return for value created, an online platform can capture value (i.e., generate revenue from user groups and/or online advertisements) as summarized in Table 3.

### 3.2. Success and Risk Factors of Online Platforms

Because platforms create and capture value, Parker et al. (2016) stated that, by leveraging the capability of digital technologies, platforms have the following competitive advantages over traditional businesses.

**Table 2.** Value Created by Different Online Platforms for Different User Groups

Business model/ value creation	Value created for businesses	Value created for consumers
Resource sharing	Reduce operating costs (e.g., WeWork)	On-demand matching of supply and demand (e.g., Uber); monetize underutilized resources (e.g., Uber and Airbnb)
Matching	Reduce search costs for finding a large number of job applicants (e.g., Monster) or freelancers (e.g., Upwork)	Decrease search, signaling, and communication costs for finding partners (e.g., e-Harmony) or jobs (e.g., Monster)
Crowdsourcing	Reduce search costs for finding a large number of solvers outside the firm; elicit innovative solutions to challenging problems at low cost (e.g., InnoCentive)	More income-generating opportunities with easy access; opportunities to develop and improve skills and reputation (e.g., Topcoder)
Review	Attract more potential customers with better reviews (e.g., Yelp)	Reduce search costs for finding quality products/services (e.g., Yelp)
Crowdfunding	Reduce search cost and demand uncertainty for seekers (e.g., Kickstarter)	Reduce search cost for providers to fund projects that match their interest (e.g., Kickstarter)

**Table 3.** Value Captured by Different Online Platforms from Different User Groups

Business model/ value capture	Value captured from businesses	Value captured from consumers
Resource sharing	Providers pay commission fees (e.g., Uber used to charge its drivers 25% of the price paid by each passenger)	Consumers pay for the service and some other processing fees, but the use of the platform is free of charge
Matching	Business organizations pay some service fees for job postings	Ranges from fully free platforms to ones that charge subscription and add-on service fees (e.g., review of resumes for job seekers); paid memberships for C2C models (e.g., e-Harmony)
Crowdsourcing	Seekers pay service fees or commissions (e.g., InnoCentive charges seekers fees for posting problems or commissions based on the awards given to solvers)	Usually free for solvers
Review	Advertising from businesses (e.g., hotel ads on TripAdvisor)	Free for consumers, but some platforms (e.g., Yelp) reward consumers who post many reviews
Crowdfunding	Seekers pay commissions (e.g., Kickstarter keeps 5% of funds raised in each successful campaign)	Usually free for providers

(1) Low development costs. Because online platforms do not own inventories or contents, the main cost is to develop the platform itself and attract users from both sides to participate.

(2) Low to medium costs of user acquisition and retention. Because online platforms are relatively new, competition among them is less fierce. As such, the costs of user acquisition and retention are relatively moderate. In particular, many online platforms provide free services for consumers, although they charge businesses service fees.

(3) Multisided revenue streams. Because online platforms create value for both user groups, they can potentially generate revenue from each user group and online advertisements.

(4) Ease of scalability. Because online platforms are light in assets, they can easily scale up their operations both locally and globally.

(5) Wide accessibility. As more user groups gain access to the internet and mobile technologies, more user groups can gain access to the services provided by online platforms. This is particularly pertinent to the China market, which has over 600 million smartphone users.

Behind successful online platforms that leverage the previous success factors, there are myriad failures. Van Alstyne et al. (2016) highlighted several key reasons why online platforms fail. First, platforms may fail to optimize “openness.” For example, Apple’s market penetration was in single digits until Apple opened its iOS platforms to app developers. Second, platforms may fail to launch the “right side” of the market. For example, Google launched Google Health for consumers to consolidate their health information; it failed, because it was focusing on consumers without getting support from physicians and insurers. Without the support from providers,

consumers do not find strong reasons to use Google Health. Third, platforms may fail to put critical mass ahead of money. For example, eBay developed Billpoint, a digital payment system that can prevent fraudulent transactions. Whereas Billpoint charged transaction fees, PayPal offered financial incentive to encourage existing users who refer new users to sign up. Within a short period of time, PayPal became the preferred payment system for eBay, and eBay phased out Billpoint and acquired PayPal eventually. Conceptually speaking, many platforms can fail because of the following three major risk factors.

(1) Poor value creation. Van Alstyne et al. (2016) articulated that platforms failed, because they have not created the “right” value for the right user group. For example, Covisint, an online platform that matches major automakers (e.g., Daimler-Chrysler, Ford, GM) with smaller auto parts suppliers failed, because the platform created little value for participating suppliers when many suppliers had to compete for orders from a few automakers. Because only a few suppliers participated, Covisint ended its operations in 2004. Also, Tang (2012) argued that Groupon creates great value to customers but not to merchants: many merchants complain about not being able to “translate” Groupon sales based on deep discount into repeat customers paying the regular retail price. Because Groupon continued to incur extra costs to recruit and retain merchants, it was rarely profitable,<sup>9</sup> and its stock price fell from its initial public offering price of \$28 in 2011 to \$5 in August 2018.

(2) Search and matching frictions. Growing the market size is believed to be critical for online platforms (see Kabra et al. 2017 for a study of ride-hailing platforms). However, this belief may not be true, because the search and matching costs for some



platforms can increase as the size of different user groups increases. To elaborate, consider the empirical study of an online P2P holiday property rental platform conducted by Li and Netessine (2018). They found that, as the number of participants on each side increases, search frictions can cause the number and the quality of resulting matches to reduce.<sup>10</sup> Specifically, they found that doubling the size of travelers and hosts can create extra search costs: the number of inquiries sent by travelers increased by 18.3%, and the number of inquiries received by hosts increased by 19.6%. Also, it can create extra matching frictions: the number of traveler confirmations reduced by 15.4%, and the host occupancy rate reduced by 15.9%. Thus, the platform lost 5.6% of potential matches because of the increased search frictions caused by the increased market size.

(3) Low switching costs. As more platforms enter the market and competition among platforms intensifies, user groups may become disloyal because of low switching costs. Consider the Thingiverse platform that allows users to share or sell product design files to be printed on its MakerBot three-dimensional printers. However, because MakerBot printers are based on open source designs, the product design files are based on industry standard file formats so that users can download design files and print the products on competitor's three-dimensional printers. Consequently, Thingiverse has limited growth, because the company failed to develop proprietary design specs; therefore, similar platforms (e.g., Pinshape, GrabCad, MyMiniFactory, Autodesk123D) can enter the market, and disloyal users can share or sell their product design files on different platforms (Zhu and Furr 2016). In the same vein, user groups can become disloyal, because various ride-hailing platforms (e.g., Uber and Lyft) offer similar services and the switching costs between platforms for drivers and passengers are low (Bai and Tang 2018).

## 4. Research Questions

Some OM research questions, summarized in Table 4, are intended to mitigate the three major risk factors in the last section that can hinder the success of online platforms. These questions can be examined through a variety of methodologies, including analytical modeling, behavioral experiments, empirical analysis, and field experiments. Before discussing each OM research question in more detail, this section contains a brief review of the applicable literature. Except for the *review platform*, these questions are discussed by considering a specific context.

### 4.1. Resource Sharing

The emerging culture of the sharing economy along with the rapidly evolving mobile technology have

given rise to numerous online consumer-to-consumer (C2C) platforms, where consumers can now monetize their underutilized resources by sharing them with other users (*The Economist* 2013). Some existing virtual platforms facilitate the sharing of residences (Airbnb), cars (Uber, Lyft, and Didi-Chuxing),<sup>11</sup> boats (Boatbound), furniture (Furnishare), and equipment (Yard Club). In the context of collaborative product sharing, Benjaafar et al. (2019) showed that product ownership and usage would be higher when the product cost is higher.

With the advent of real-time geographic location information about providers and users, the search cost to locate providers and users is low. However, the matching frictions can be high, especially when each on-demand transaction involves two entities who are unfamiliar with each other. To reduce this friction, many sharing platforms develop mechanisms to (1) foster trust by using a bilateral rating system that serves as “proxies” about the quality of both parties and (2) enhance payment security by charging a user's preregistered credit card and allowing users to challenge the payment because of unsatisfactory services. Although these measures can reduce search and matching frictions, the following questions are intended to provide right value to the right user groups, reduce search and matching frictions further, and cultivate loyalty from both user groups.

(1) Can a sharing platform create more value by giving price-setting power to users? In recent years, researchers and practitioners have recognized the importance of having online platforms to attract the right type of users (Veiga et al. 2017). One way to influence user entry is through the design of pricing mechanisms, which include the decision regarding the price-setting entity. When Airbnb charges a commission, it is the provider (property owner) who sets the price (i.e., rent). The provider has superior information about the quality of the product (room or apartment) and can assess the value better than a central planner. Li et al. (2015) also showed empirically that “professional” owners earn more, because they may get better in assessing the value of their property to others in addition to their own knowledge about quality. However, it is the platform (Uber) that sets the price and the commission fee. By comparison, HKTaxi, a taxi-hailing app, enables passengers in Hong Kong to bid for taxi rides. In view of the on-demand nature and the heterogeneity of both user groups, it is unclear which price-setting mechanism is most effective.

(2) How can a sharing platform reduce supply-demand imbalance and regulatory uncertainty? In addition to the ways to reduce search friction, when demand exceeds supply during peak hours, ride-hailing platforms (such as Uber and Lyft) adopt surge pricing to reduce matching friction by serving

**Table 4.** OM Research Questions Motivated by Five Types of Online Platforms

Platform type (context)	OM research questions
Resource sharing (ride sharing)	<ol style="list-style-type: none"> <li>1. Adequate value creation: Can a sharing platform create more value by giving price-setting power to users?</li> <li>2. Reducing frictions and uncertainty: How can a sharing platform reduce supply-demand imbalance and regulatory uncertainty?</li> <li>3. Sustaining user groups: How can a sharing platform mitigate the effect of multihoming by boosting user loyalty?</li> </ol>
Matching (online dating)	<ol style="list-style-type: none"> <li>1. Adequate value creation: How should a matching platform design its communication mechanisms between users?</li> <li>2. Reducing frictions and uncertainty: How should a matching platform design its recommendation mechanism to reduce search friction?</li> <li>3. Sustaining user groups: How should a matching platform design its pricing strategy to maintain a diverse user base?</li> </ol>
Crowdsourcing (innovation contests)	<ol style="list-style-type: none"> <li>1. Adequate value creation: How can value be created to both solvers and seekers by balancing audacity and achievability?</li> <li>2. Reducing frictions and uncertainty: How can rules of engagement be designed to reduce search friction?</li> <li>3. Sustaining user groups: What is the impact of information design on user satisfaction?</li> </ol>
Reviews	<ol style="list-style-type: none"> <li>1. Adequate value creation: How does the design of a review platform facilitate continuous feedback about business operations and consumer preferences?</li> <li>2. Reducing frictions and uncertainty: What are the tradeoffs behind a review platform's choice of the accessibility of its reviews?</li> <li>3. Sustaining user groups: How can fake reviews be fought in an effective and sustainable manner to cultivate user loyalty?</li> </ol>
Crowdfunding (reward based)	<ol style="list-style-type: none"> <li>1. Adequate value creation: How does platform design (e.g., information disclosure policy) affect user interactions and hence, value creation?</li> <li>2. Reducing frictions and uncertainty: How can artificial intelligence (e.g., blockchains) be leveraged to reduce outcome uncertainty and increase allocation efficiency?</li> <li>3. Sustaining user groups: How can user loyalty be boosted by softening interseeker competition?</li> </ol>

passengers with higher willingness to pay and encourage more drivers to participate during rush hours. In a monopoly setting, Cachon et al. (2017) found that surge pricing can outperform static pricing. Riquelme et al. (2015) characterized a small performance gap between static and surge pricing in an asymptotic regime. Chen and Hu (2018) found that, in the presence of forward-looking drivers and riders, static pricing can deter strategic behavior and achieve asymptotic optimality. In a competitive environment, Wang and Hu (2014) found that static pricing can sustain in equilibrium, because relative to contingent pricing, it helps soften competition. Tang and Yoo (2018) showed that a platform should not surge unless it has a competitive advantage over its competitor. However, when both user groups are heterogeneous and time sensitive, it is not immediately clear if surge pricing is a dominant competitive strategy. For example, to compete with Uber in London, Kabbee does not adopt surge pricing (Field 2017). In the OM literature, the conditions under which a sharing platform should adopt surge pricing and how surge pricing affects supply-demand imbalance deserve additional examination.

A notable source of uncertainty surrounding resource-sharing platforms arises when they interact with regulators. Because a resource-sharing platform often serves a sector of public interest (e.g., transportation and housing), it must be keenly aware of the externality of its service offerings (e.g., increased congestion in major

cities because of ride-hailing services). It is of interest for OM scholars to examine the interactions between platforms and regulators and examine, from a regulator's perspective, the optimal quantity of resources allowed for sharing on such platforms. Yu et al. (2017) presented a multistakeholder model to examine the implications of the 2017 policy for regulating on-demand ride services in China. They showed that the Chinese government policy can result in the reduction of the number of ride-hailing service cars on the road. In 2018, the New York City (NYC) council voted to temporarily cap the total number of Uber or Lyft car licenses operating within the city. Clearly, the optimal cap depends on the competing objectives associated with different stakeholders (Yu et al. 2017, Badger 2018). Hence, this new policy in NYC raises some new research questions. Should the total number of taxi licenses (including those for Uber and Lyft cars)<sup>12</sup> be capped? Should the number of "actively participating" Uber drivers be capped at all times or only during rush hours?

(3) How can a sharing platform mitigate the effect of multihoming by boosting user loyalty? Because a sharing platform does not own or have direct control over resources (e.g., cars as assets or drivers as employees), independent providers may "multihome." Also, because of low switching costs across platforms, customers are not loyal either. Because customers are sensitive to delay, they would choose whichever service satisfies their needs sooner. To stabilize supply

and demand and soften competition among different platforms, it is of interest to examine ways for a platform to cultivate loyal providers and customers. In this context, Chen and Sheldon (2015) showed empirically that surge pricing can induce independent drivers to work for longer hours. Scheiber (2017) reported that, by alerting drivers that they are close to hitting certain earning targets, platforms can “nudge” some drivers to work for longer periods. The literature motivates additional research issues for further examination. For instance, it is interesting to note that Uber and Lyft now offer extra bonuses to drivers if the number of rides that they provide over a week exceeds a certain threshold. This strategy increases switching cost for drivers so that they become more loyal to one of the platforms. To make customers more loyal, Kabbee, a United Kingdom-based ride-sharing service company that competes with Uber has launched a customer loyalty program called Kabbee Treats. In the same vein, Uber offers city passes that allow a user to take unlimited rides in a given period of time in certain markets. It is of interest to examine the implications of these loyalty programs in the context of online platforms.

In addition to these three questions, it is also important to examine resource-sharing platforms from a provider’s perspective and understand their impacts on social welfare (that includes consumer welfare), particularly when customers are delay sensitive. Benjaafar et al. (2018) found that, as platforms increase the labor supply (e.g., the number of Uber drivers), labor welfare can increase or decrease depending on customers’ sensitivity to delay and other factors. Taylor (2018) discussed how customers’ sensitivity to delay may impact the pricing and wage decisions for a service platform. Taylor (2018) found that delay sensitivity may increase price and decrease the optimal wage under certain conditions of customer valuation uncertainty and agent opportunity cost uncertainty. In terms of traffic congestion, Benjaafar et al. (2017) examined how different ride-sharing models (business-to-consumer (B2C) and C2C) affect traffic congestion. They found that revenue-maximizing platforms that prefer fewer seats being occupied would create high traffic congestion. By examining an ecosystem comprising consumers, taxi drivers, platform drivers, etc., Yu et al. (2017) found that a carefully designed regulatory policy can strike a balance among competing objectives associated with different stakeholders.

## 4.2. Matching

An online matching platform is a marketplace that brings together users who search for, interact with, and establish personal (e.g., dating platforms, such as e-Harmony and Match) or business (e.g., recruitment platforms, such as Monster and CareerBuilder) relationships with each other. Compared with other

types of platforms, online matching platforms are more involved, because the user groups need to establish some form of relationships (e.g., communication, discussions, interviews, tests) before any matching can take place. In addition, each user not only has to choose another user but also, has to be chosen. For this reason, the design of matching platforms often follows reasoning drastically different from the design of other types of platforms (Wright 2004).

Relative to a traditional format, an online interface helps remove physical limitations, such as geography, presence, time, and scale. As noted in Section 3.2, accessibility and scalability have enabled matching platforms to thrive in the online marketplace. For example, Pew Research Center (2016) reports that 15% of adults in the United States used online dating sites in 2016. Also, the online dating industry is worth U.S. \$2 billion in the United States and U.S. \$1.6 billion in China. To capture the economic value, most online matching platforms adopt a *subscription-based model* that charges users fees for access or an *advertising-based model* that offers the service for free.<sup>13</sup> However, job search platforms (Monster and CareerBuilder) charge recruiters on a “pay as you go” basis but offer services for free to job seekers.

The limited and yet fast-expanding literature on online matching platforms has touched on several aspects. For example, Allon et al. (2017) examined whether an online matching platform (e.g., Upwork) can capture value by using different tests to certify that service providers’ skills (e.g., app or web programming) are above certain thresholds. Also, there is a need to understand the risks and costs that are unique to online matching platforms, such as overcommunication (Kanoria and Saban 2017), and choice overload (Schwartz 2004, D’Angelo and Toma 2016). In addition, the economics literature on marriage focuses on *vertical* quality differentiation across users such that each user can be of either “high type” or “low type,” and their types are observable and static (see, e.g., Becker 1973, Burdett and Coles 1997, Damiano and Li 2007). It is important to incorporate *subjective*, *idiosyncratic*, and *personalized* user preferences to develop recommendations systems to improve match quality and investigate the interaction of pricing mechanisms on user behavior, revenues, and welfare in dating and matching markets. Surrounding these issues, there are several research opportunities for OM scholars.

(1) How should a matching platform design its communication mechanisms between users to improve value creation? Users of online matching platforms may incur high search costs because of too many options and high matching costs because of choice overload and overcommunication. Allon et al. (2012) examined whether an online matching



platform (e.g., Upwork) should provide additional job posting and job search mechanisms to improve the matching efficiency. They found that these mechanisms can be detrimental to the matching platform unless the platform allows providers to communicate among themselves and exchange information on prices and job requirements. This finding is relevant to online dating platforms as well, because owing to low communication barriers and a large user base, male users tend to “overcommunicate” by sending an excessive number of low-quality messages to female users, who end up paying little attention to each message. To overcome this challenge, Bumble (an online dating platform) only allows female users to initiate communication (Kanoria and Saban 2017). Future research may explore other communication mechanisms and broaden the scope to other types of matching platforms (e.g., Monster, Upwork). Should the platform impose fees to earn the right to initiate communications? Would such a fee improve the quality and the quantity of matches? Can a platform change user behavior by disclosing information about user communication frequencies (i.e., a matching platform may display each user’s total number of sent and received messages)? By requiring a fee for initiating communication or disclosing users’ communication styles, a platform may be able to create a “self-enforcing” effect, which may improve the quality of matching.

(2) How should a matching platform design its recommendation mechanism to reduce search friction? Online matching platforms rely on algorithms to recommend potential matchings. Halaburda et al. (2018) showed that making fewer recommendations to each user can increase both the quantity and the quality of matches in online dating platforms. The intuition is because when users are faced with many recommendations, they are less likely to accept a recommendation, reducing the chance of finding a successful match. Although the literature assumes static and myopic user preferences and behavior, future research can incorporate richer searching and matching dynamics as well as user learning. Research along this line can help online matching platforms design a recommendation system that considers intertemporal preferences of users, choice overload, and leaning.

(3) How should an online matching platform design its pricing strategy to maintain a diverse user base? Online matching platforms use different business models and pricing strategies to engage their users (Rudder 2010, Slater 2013). Because “a large, active, and demographically interesting user base is usually a (matching) platform’s most precious asset” (Van Dijck 2013, p. 36), managing *user composition* through pricing is an interesting issue. For instance,

online matching platforms can use pricing strategies that “allow for self-selection of types” of users participating on the platforms (Belleflamme and Peitz 2015, p. 649). In a matching environment where user quality is highly subjective and the value of a match is uncertain, Dai et al. (2018) showed that a matching platform can use a “refund” mechanism to attract a diversified user base that can improve the revenues and social welfare in the presence of “heterophily-seeking” users.

### 4.3. Crowdsourcing

An online crowdsourcing platform enables a “seeker” to organize “crowdsourcing contests” so that the seeker can elicit the best solution(s) to a problem from a large group of “solvers.” Such a platform (e.g., InnoCentive, Topcoder) administers contests on behalf of seekers and helps seekers to elicit solutions from a group of highly qualified solvers. For example, InnoCentive organizes ideation, theoretical, and reduction-to-practice contests in which a seeker can elicit innovative ideas, theoretical solutions, and validated prototypes, respectively. Also, some crowdsourcing platforms help seekers in determining contest rules, such as an award scheme to maximize satisfaction of both user groups. Indeed, many companies with their own in-house R&D units, such as IBM, HP, P&G, and Pfizer, are increasingly turning to crowdsourcing platforms for solutions to various problems. According to Deloitte (2016), “85% of the top global brands have used crowdsourcing in the last ten years; and by 2018, 75% of the world’s high performing enterprises will be using crowdsourcing.”

The OM literature on crowdsourcing contests can be divided into two streams. The first stream deals with the rules of engagement in any (online or offline) crowdsourcing contest, such as the format of the contest (i.e., open to all solvers or restricts entry) and the award scheme (Ales et al. 2017). Terwiesch and Xu (2008) showed that it is always optimal to allow free entry open innovation contests, because the seeker can access a diverse set of solutions. Interestingly, Boudreau et al. (2011) showed empirically and Ales et al. (2018) showed theoretically that free entry is optimal only when the output of solvers is highly uncertain. This is because in the presence of a large number of solvers in a contest, generally, solvers put in less effort, which dominates the diversity effect. Boudreau et al. (2016) examined empirically and Körpeoğlu and Cho (2017) examined theoretically the impact of solver heterogeneity and showed that solvers can react differently to more intense competition.

The second stream of literature examines the rules of engagement in the context of an online platform. For example, Jiang et al. (2016), Bimpikis et al. (2019), Mihm and Schlapp (2018), and Wooten and Ulrich (2017)

studied whether, when, and how a seeker should provide feedback to solvers. Similarly, Bockstedt et al. (2016) characterized solvers' entry behavior when their submissions are publicly shared with all solvers. Körpeoğlu et al. (2018) analyzed whether the seeker should organize multiple contests and whether the seeker should discourage solvers from working on multiple contests in parallel. Hu and Wang (2017) examined whether the seeker should run componentwise (i.e., sequential) contests or a single comprehensive (i.e., simultaneous) contest. Korpeoglu et al. (2018) analyzed the optimal contest duration from a seeker's perspective. Building on these two streams of literature, the following research questions are proposed.

(1) How do we create value to both solvers and seekers by balancing "audacity and achievability?" Compared with a traditional research and development processes, innovation contests create value through attracting a heterogeneous pool of participants from diverse disciplines. Thus, keeping the goal of a contest as general as possible helps attract solvers with diverse backgrounds. However, overly general goals may result in either preexisting or infeasible solutions for seekers. Therefore, a crucial tradeoff in designing innovation contests is between audacity and achievability (Zachary 2008). Where some platforms, such as InnoCentive, allow seekers to post broadly defined problems with subjective evaluation criteria, other platforms, such as Kaggle and Topcoder, usually run contests with well-defined problems and evaluation criteria. Broadly defined problems may lead to a more diverse set of solutions, but well-defined problems may lead to larger, more focused efforts from solvers. Similarly, evaluating solutions based on objective criteria may reduce the uncertainty of solvers, but subjective evaluation criteria give seekers more flexibility when defining problems. Thus, it is of interest to theoretically and empirically analyze the impact of problem specifications and the objectivity of evaluation criteria on the outcome of a crowdsourcing contest.

(2) How do we design rules of engagement to reduce search frictions? As of 2018, InnoCentive has attracted over 380,000 registered solvers, hosted more than 2,000 "external challenges," and received more than 62,000 solutions. With such a large scale, search friction naturally arises as a key consideration in designing innovation contests, but the issue of search friction is little explored in the literature, which largely treats a seeker as a monopolist principal to a group of solvers without considering the impact of competition among seekers. Yet, on an online platform, seekers compete for solvers' attention and time. Such competition effect drives the value proposition and growth of a platform. Thus, it is important to analyze contest design rules, such as whether to run

an open contest and whether and how to give feedback when seekers compete for the attention of solvers. Interviews with practitioners at InnoCentive and Topcoder revealed that these platforms either make important design decisions (e.g., award scheme) on behalf of seekers or guide seekers about such decisions. Therefore, it is of interest to analyze both theoretically and empirically how a platform should guide seekers who compete for the attention of solvers. Another related question is how an increased number of contests and members affects the welfare of solvers.

(3) What is the impact of information design on user satisfaction? The importance of cultivating a loyal user base is self-evident, because the success of a crowdsourcing platform hinges on the growth of its registered solvers and seekers, which in turn, depends on the solvers' and seekers' expected returns. An exciting research opportunity in this space is in the application of the theory of information design (see, e.g., Bergemann et al. 2018). For instance, to improve the solvers' potential earnings, the platform needs to decide whether to promote its registered solvers by providing data analytics tools. These tools can help solvers understand their likelihood of winning a particular contest and recommend contests based on their inclination and past performance accompanied by information as simple as the number of solvers participating in the contest, ratings and expertise. The information made available to users has implications on the type and number of solvers attracted to the contest. These issues can be investigated empirically, experimentally, and theoretically. It is also useful to model the credibility of such tools and how a specific information environment interacts with agents' strategic behavior. Therefore, it is of interest to examine the type of information environment that those platforms should offer to help its users succeed and in return, win loyalty from them.

#### 4.4. Review

Online review platforms serve as online channels for different affinity groups of consumers to post reviews about certain products or services and for potential consumers to make informed purchasing decisions. Online review platforms are often specialized; for example, Yelp focuses on local business reviews, and TripAdvisor focuses on hotel, restaurant, and airline reviews. Review platforms "pull" a large number of buyers to submit their reviews (e.g., restaurant reviews on Yelp) without offering any monetary compensation. By posting their reviews online, buyers create "altruistic" values, such as promoting a firm for providing good service, helping other consumers, feeling good when other consumers appreciate their reviews, and punishing a firm for providing bad

service (Hennig-Thurau et al. 2004, Yoo and Gretzel 2008). Although the reviews posted on review platforms are subjective and difficult to verify, online reviews serve as a form of word-of-mouth that can influence consumer perception and purchasing decisions. Goldsmith and Horowitz (2006) showed that consumers seek information from other consumers' online reviews to reduce their purchasing risks (high price, low quality, etc.). According to eMarketer (2016), 80.7% of 1,132 internet users said that online reviews are important to their online purchasing decisions. Also, Pew Research Center (2016) reported that more than one-half of internet users read online reviews before making their purchasing decisions.

There are two main streams of literature on online review platforms. The first stream examines the impact of online reviews on sales. Luca (2011) showed that a one-star increase in Yelp rating leads to a 5.9% increase in the revenue of an independent restaurant but does not lead to an increase in the revenue of a chain restaurant. Yet, researchers focusing on different industries find mixed results, and the reader is referred to Zhu and Zhang (2010) for a comprehensive review about the impact of customer ratings on movie and book sales. The second stream examines the issue of fake reviews. By noting that competition may induce some firms to create fake reviews for themselves and their competitors, Luca and Zervas (2016) used fake reviews rejected by Yelp's filtering algorithm to identify the reasons (e.g., poor online reputation, fierce competition) for restaurants to commit review fraud. Recognizing the presence of fake reviews, Ayeh et al. (2013), Filieri et al. (2015), and Filieri (2016) used data collected from TripAdvisor to examine the factors that can improve the trustworthiness of online reviews. These factors include the reputation of the platform, user experience with the platform, the content, and the style of the reviews. Below are three sets of proposed research questions for OM scholars.

(1) How does the design of a review platform facilitate continuous feedback about business operations and consumer preferences? A static view of a review platform is that it creates value to businesses and consumers by providing a sufficiently large number of views reflective of the quality of the goods and products. Such a view does not account for *dynamic* interactions between businesses and customers. Thus, an area of interest to OM scholars involves feedback mechanisms between businesses and consumers. Businesses use customer feedback to improve their operations on an ongoing basis, whereas customers gain an updated view of how product/service quality evolves because of their reviews. Indeed, it is plausible to believe that customers' willingness to contribute reviews grows in the presence of a rational expectation that their effort

will make a difference to not only peers but also, business operations. With the rise of companies like HappyOrNot that provides real-time, data-driven consulting services in addition to helping to collect reviews (Owen 2018), one can expect empirical studies and field experiments as well as analytical modeling to be valuable tools for conducting future research in this area.

Ways to boost the number of reviews can also be a potential research topic. Conflict of interest arises when a firm (e.g., a restaurant) provides financial incentives to its own customers for posting (presumably positive) reviews. Without any incentive, Dellarocas (2003) commented that voluntary customer reviews will be underreported, because reviews are "public goods," and no incentive exists for posting reviews or for a consumer to take the risk to try new products or services. Hennig-Thurau et al. (2004) showed that providing economic incentives is critical for an online review platform. Indeed, Yelp offers its loyal members (e.g., "Yelp Elite" members who provide well-written reviews and high-quality tips for consumers) free tickets for special events and invitations to try out new businesses. In this way, new businesses can get some ratings on Yelp, and Yelp can help them improve their service, thereby creating a virtuous cycle. However, when an online review platform provides economic incentives for customers to post reviews, it remains unclear how these incentives impact the trustworthiness of these reviews. It calls for both empirical and experimental studies. Additionally, it is important to analyze whether and how the platform should pay customers for writing reviews. In light of competition among online review platforms, it is of interest to examine how platforms should compete for more high-quality reviews by offering appropriate incentives.

(2) What are the tradeoffs behind a review platform's choice of the accessibility of its reviews? To create value for heterogeneous customers, some review platforms offer different ways for customers to search for relevant reviews. For example, TripAdvisor allows customers to search reviews by traveler type. With simple search mechanisms, customers gain easy access to relevant information. However, it remains unclear whether this improves customer welfare and how it influences the platform's profit. Moreover, some platforms, such as Tmall and Expedia, choose not to provide simple search mechanisms for customer search. Hence, it is of interest to examine the impact of the provision of different search mechanisms on the value created for different user groups: under what conditions should a platform provide which type of search mechanisms?

(3) How do we fight fake reviews in an effective and sustainable manner to cultivate user loyalty? The



reputation of a review platform is likely its single most important asset. When a platform is flooded with fake reviews, users will lose their confidence in the platform and flee to its competitors.<sup>14</sup> Indeed, a sizable worldwide ecosystem specializes in creating fake positive reviews (Stevens and Emont 2018). However, some sellers, in addition to posting fake reviews of their own products and services, “viciously bad-mouth the competition” (Bhide 2018). Such shady practices, despite affecting consumer welfare and day-to-day operations of numerous businesses (and their competitors), deserve some consideration.

Another issue of note is that reviews on some platforms are one sided in the sense that only customers can post reviews about firms, but firms cannot post reviews about their customers or respond to a review posted by a customer. However, a one-sided review system may give rise to unpleasant outcomes, such as customers being overly positive or negative, because customers can be biased and a one-sided review system gives more power to customers. To balance the power between firms and customers and enable other customers to calibrate the credibility of reviews, it is of interest to examine the reviewers’ behavior when the platform operates under a unilateral rating system (e.g., Yelp) versus under a bilateral ratings system (e.g., TripAdvisor). Recent OM literature (e.g., Jin et al. 2018) examined the effect of bilateral ratings on a *resource-sharing platform* (e.g., Uber). Additional research can study how user behavior under various rating systems affects the credibility of reviews on a review platform and thus, interacts with the operations of various businesses.

#### 4.5. Crowdfunding

A crowdfunding platform enables a capital seeker to collect small contributions from a large number of capital “providers” to fund a project that can range from an art project, such as a music album (e.g., ArtistShare), to a business project, such as a smart-watch startup (e.g., Kickstarter). Crowdfunding can take the form of B2C, such as charity-based (making donations), debt-based (in exchange for interest payments), equity-based (in exchange for company shares), and reward-based (in exchange for future products) crowdfunding, or it can take the form of C2C, such as P2P lending (in exchange for interest payments). A seeker who runs a crowdfunding campaign decides on the funding target, the pledge price, and the type of funding. The funding target is the level of funds necessary for the campaign to succeed, and the pledge price<sup>15</sup> is the level of contribution that entitles a provider to receive the product as a reward from the seeker if the campaign becomes successful. In terms of type of funding, a seeker may run a *fixed-funding* or a *flexible-funding*

campaign. Under fixed funding, if the campaign becomes successful, the seeker gains access to contributions, and each provider receives the finished product (reward) from the seeker when it becomes available. If the campaign fails, contributions are refunded to providers. Under flexible funding, the seeker can keep contributions regardless of the campaign’s success,<sup>16</sup> and therefore, contributions may not be refunded back to providers if the campaign fails.

A crowdfunding platform runs campaigns on behalf of seekers (also called entrepreneurs or project creators) to raise funds from providers (also called contributors or backers) by introducing seekers to a large number of registered providers who are already interested in contributing to crowdfunding campaigns. In return, it charges seekers certain commissions; for example, Kickstarter helped seekers raise more than U.S. \$3.7 billion through 145,000 successful campaigns, and it monetized its service by charging 5% of the funds raised for each successful campaign (Kickstarter 2018). At the same time, a crowdfunding platform (e.g., Kickstarter) reduces search costs for providers by categorizing campaigns based on subjects (e.g., film, games, and music) and success so far (e.g., percentage of funding target reached). Furthermore, a crowdfunding platform (e.g., Kickstarter) reduces providers’ uncertainty by (1) keeping contributions and not releasing them to the seeker until the campaign becomes successful, because otherwise, if the campaign fails, the seeker may not be willing to refund contributions back to providers, and (2) by requiring seekers to share a prototype of the finished product along with other relevant information and include an estimated delivery date.

The OM literature on crowdfunding can be categorized into two streams. The first stream examines when a seeker should run a crowdfunding campaign (instead of asking venture capitalists for funds) and how a seeker should design its campaign to maximize the success probability and profit. For instance, Roma et al. (2018) showed that a crowdfunding campaign is desirable only for a small funding target. Babich et al. (2017) showed that, when a crowdfunding campaign raises large funds, venture capitalists are discouraged to invest in this project. Along these lines, Hu et al. (2015) showed that, when providers are sufficiently heterogeneous, a seeker should offer a menu of products instead of offering a single product. Chakraborty and Swinney (2017) found that a seeker should signal the quality of its product by using the funding target instead of the pledge price; Chang (2017) showed that a seeker’s profit under fixed funding is larger than that under flexible funding.

On a more technical front, Alaei et al. (2018) provided guidelines for seekers on the design of



crowdfunding campaigns by introducing a stochastic process for the sequential arrival of providers. In addition to these theoretical papers, empirical research has also explored issues, such as product quality (Mollick 2014), intracampaign updates (Du et al. 2017), and availability of contributors' identity (Burtch et al. 2015). The second stream focuses on the mechanism design of a crowdfunding platform. Strausz (2017) examined the implications of the deferred payment mechanisms. Belavina et al. (2018) compared two specific mechanisms that implement deferred payments as a way to alleviate the two biggest risks that providers face: the risk that seekers keep providers' contributions despite not delivering products and the risk that seekers misrepresent their product features. In one mechanism, the campaign stops as soon as the funding target is reached, and providers who could not contribute to the campaign are given a chance to buy the product only after it has been developed. In the other mechanism, the platform keeps any funds raised beyond the funding target and releases only if the seeker successfully develops the product. In light of the literature and industry practice, the following research questions are proposed.

(1) How does platform design (e.g., information disclosure policy) impact user interactions and value creation? To generate insights into how a crowdfunding platform improves its value creation, it is of interest to examine how platform design impacts the interactions between its users. For example, a platform often allows seekers to provide updates after their campaigns start. Then, an important design-related question entails whether a seeker should strategically disclose desirable features of its product dynamically over time, especially when providers use the disclosed features to form certain "benchmarks." If the seeker discloses all desirable features of its product at the beginning of the campaign, it attracts more providers early on but few later on (because of no new features relative to the benchmark). If the seeker discloses partial information initially and then discloses the remaining desirable features later on, it can elevate providers' interest at different stages of the campaign, but it cannot attract too many providers initially. Therefore, it is of interest to analyze a seeker's optimal dynamic information disclosure policy.

(2) How do we leverage smart contracts (e.g., blockchains) to reduce outcome uncertainty and increase allocation efficiency? From the provider's perspective, the biggest risk factor of crowdfunding is uncertainty regarding the outcome of campaigns because of the issue of moral hazard. One way to reduce (and possibly eliminate) such uncertainty is to implement, for example, a *dominant assurance contract* (Bagnoli and Lipman 1989). Thanks to technological advances, such contracts can be implemented by blockchain

technology, which can help create a "smart contract" using "Ether-on-a-stick" (Blockchain at Berkeley 2018); this partially pays out to a specified seeker if and only if the providers (or an independent third party) vote that a promise has been delivered. This topic is an exciting area where OM scholars can contribute to the interface between OM and information technology.

(3) How do we boost user loyalty by softening interseeker competition? Where the crowdfunding literature restricts attention to a single seeker, in practice, multiple seekers compete for providers' contributions. An important research opportunity is to examine how a platform should screen and select campaigns by considering competition among seekers. On one hand, running too many campaigns may lead to less exposure for each campaign and a larger dispersion of providers' contributions; therefore, it may reduce the success probability of each campaign. On the other hand, as the number of campaigns increases, the number of trials for a successful campaign increases; therefore, it may increase the number of successful campaigns, and hence, it may increase platform commissions. Similarly, a platform should select the right assortment of campaigns to maximize the contributions and success of campaigns. It is not clear how different assortments of campaigns interact with each other's and providers' attention. Thus, it is of interest to examine whether and how a platform should screen and select campaigns proposed by seekers.

This section provided a brief review of recent literature and then proposed a set of OM research questions as summarized in Table 4. Because online platforms are based on different innovative business models, the proposed research questions are non-traditional. We hope that these questions will motivate OM researchers to develop exciting and novel research in the area of online platforms.

## 5. Conclusions

Motivated by the success and risk factors of online platforms stated in Section 3.2, this paper has defined and classified these platforms and described the mechanisms by which these platforms create value for different user groups and capture value for themselves. This paper has also examined the recent literature on each type of platform and proposed research questions for OM scholars to explore.

In addition to the questions proposed in Table 4, several emerging issues will inspire future research. First, *trust* is a challenging issue for online platforms. For example, consider an e-commerce platform, such as Alibaba's Taobao. Wang and Armstrong (2017) reported that, despite the fact that Alibaba has sued its sellers for selling counterfeit goods in 2017, 50% of goods sold on Taobao are still fake or infringing on the intellectual property rights of others. In the same vein,

many users are concerned about the safety of meeting someone online, especially when the true identity of users is difficult to verify and authenticate online. To overcome the trust issues, some online platforms are using blockchain technology (i.e., a distributed ledger managed by a P2P network collectively adhering to a protocol for recording, verifying, and validating new entries). Specifically, by applying the blockchain technology, an online platform can track and trace a product in a supply chain<sup>17</sup> or a person within a social network. For example, on a blockchain-powered online dating platform called Matchpool, users act as “matchmakers” for their friends and niche groups by creating “pools.” To join a pool, depending on its customized rule, a participant might need to pay an entrance fee or subscription fee; the matchmakers receive dividends from revenue generated from their pools.<sup>18</sup> However, it is of interest to examine the impact of the blockchain technology on users’ trust level of different online platforms. For instance, can blockchain technology reduce the sales of fake products online? Will users feel more secure if they transact on platforms powered by the blockchain technology? These questions beg for answers as more firms are adopting this technology.

Second, this paper discussed online platforms by focusing on web-based or mobile-based platforms. However, the mobile platform can open up new avenues for OM researchers, because mobile phones are more accessible and affordable than internet access on desktop computers, especially in developing countries. More importantly, mobile platforms offer real-time location data of the users that can enable online review platforms, such as Yelp, to create more value by offering real-time location-based advertisements to target customers. Also, online dating platforms, such as OkCupid, have unveiled a geo-location app to help connect singles living near each other. Hence, it is of interest to examine how online platforms can leverage real-time location data of their users to create more value for user groups and capture more value for themselves.

Third, an online review platform is an efficient way for user groups to form affinity groups so that they can share their personal experience. However, personal experience is subjective, and it is not verifiable. As such, legitimate concerns exist about fake reviews. However, other types of platforms based on more objective comments can be validated by experts. Specifically, in emerging markets, nongovernmental organizations and governments have established various P2P knowledge-sharing platforms that are intended to enable farmers to post and respond to queries about farming techniques. Unlike the review platforms discussed in Section 4.4, the suggestions provided by farmers can be examined and rated by

experts (see, for example, Chen et al. 2015 for Avvaj Otalo and Xiao et al. 2017 for WeFarm). When comments and reviews can be rated by independent experts and/or other peer farmers (after they followed the advice), it is of interest to examine if farmers are more willing to offer better advice to other farmers.

As digital platforms continue to flourish in the business world, an excellent opportunity arises for OM researchers to explore numerous exciting research topics and make an impact in this important field.

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## Endnotes

<sup>1</sup> Source: <http://graphics.wsj.com/billion-dollar-club/>.

<sup>2</sup> The first two research articles (Bolton et al. 2005, Michail et al. 2005) that used the term online platforms were published as book chapters. The former used laboratory experiments to examine the implications of “online reputation” for suppliers and buyers to transact over an e-commerce platform, whereas the latter discussed how Egyptian minority groups use online social media platforms for expressing their thoughts freely.

<sup>3</sup> Because the intent is to encourage OM researchers to explore this important area, this study does not provide an exhaustive review of related literature, and we apologize for any unintended omissions.

<sup>4</sup> In addition to these five types of platforms, online gaming platforms are also growing. Graham (2017) reports that the annual revenue of online gaming platforms (e.g., Steam, Xbox Live Marketplace, PlayStation Store) has exceeded U.S. \$100 billion.

<sup>5</sup> For example, Amazon is not an online platform overall, because Amazon owns inventory of its merchandise. However, Amazon Marketplace is an online platform, because it enables third-party sellers to sell their products to consumers by piggybacking on the Amazon website. Similarly, the bike sharing platform oFo in China is not an online platform, because it owns its fleet; however, Uber is an online platform, because it does not own cars.

<sup>6</sup> Social media platforms exhibit strong network effects that propel the exponential growth in terms of the number of users (Cusumano 2011). For example, within 6 years, WeChat reached almost 1 billion users (Lucas 2017).

<sup>7</sup> However, Li and Netessine (2018) discovered that this “positive” network effect may not be true when the user groups are heterogeneous and when searching and matching processes are either time constrained or time sensitive, respectively.

<sup>8</sup> However, Benjaafar et al. (2019) find that, by attracting more workers to participate in on-demand platforms that provide time-sensitive services, labor welfare is nonmonotonic: it first increases in the labor pool size and then decreases.

<sup>9</sup> Despite its \$3 billion annual revenue since 2013, Groupon’s earnings before interest and tax have been negative to 2017.

<sup>10</sup> Li and Netessine (2018) show, consistent with earlier findings, that more product choices can lead to lower sales because of “choice fatigue” (e.g., Kuksov and Villas-Boas 2010).

<sup>11</sup> Here, we consider Uber, Lyft, and Didi-Chuxing as resource-sharing platforms in the sense that the platform does not own physical goods and that the drivers “share” their cars with passengers.

<sup>12</sup>Unlike most places in the world, to be able to drive for Uber or Lyft in NYC, one needs to get a Taxi and Limousine Commission driver license, which is the same license required for a taxi driver.

<sup>13</sup>In some cases, users are required to pay additional fees to access advanced features and options (e.g., Match's "pay-to-respond" model that requires free users to pay to be able to respond to paying users). Some online matching platforms capture value by charging business users for each lead generated by the platform (e.g. Thumbtack) or access to business-to-business (B2B) matching applications that facilitate business contracting opportunities (Gee 2017).

<sup>14</sup>On a related note, reviews that reflect only extreme opinions (i.e., only extremely satisfied and unsatisfied reviews) also negatively affect user utility, albeit in a different way.

<sup>15</sup>In many instances, a seeker may offer multiple levels of pledge prices associated with different reward levels.

<sup>16</sup>However, the seeker still needs to keep the promise by completing the project and paying a commission to the platform (e.g., Indiegogo).

<sup>17</sup>Walmart, Nestle, and Unilever have formed a partnership with IBM to apply blockchain technology to improve the traceability of their food supply chains so that these firms can improve food safety (Hackett 2017).

<sup>18</sup>For details about how matchmakers receive dividends from their pools, see <https://blog.coinfund.io/https-medium-com-flexthought-matchpool-community-owned-social-matchmaking-blockchain-71ae6129f584-71ae6129f584>.

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