

Digitalization and Work Organization in New Urban Food Delivery Systems

Matthias Klumpp¹ and Caroline Ruiner²

¹FOM University of Applied Sciences Essen, Germany, and EUI Florence, Italy

²Ruhr University Bochum, Germany

matthias.klumpp@fom.de; caroline.ruiner@rub.de

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ABSTRACT

Food distribution in general and within urban areas in particular requires a state-of-the-art logistics system. One important aspect is the level of centralization, which has shifting optima owing to emerging digitalization and peer-to-peer concepts. This study offers insights regarding the digitalization effects for innovative food logistics solutions. Findings are based on two case studies from (1) new urban distribution systems (Foodora, Lieferando, and Deliveroo) and (2) Foodsharing in Germany. Results focus on the digitalized fast and short-term coordination between suppliers, transporters, and customers, and reveal interesting influences on work organization and management of workers in food distribution.

Keywords: *Urban food systems; food logistics; digitalization; work organization; management*

1 Introduction

The efficiency of centralized and decentralized distribution is a topic of perennial discussion in logistics (Holzapfel, Kuhn and Sternbeck, 2018; Morganti, Dablanc and Fortin, 2014). In this context, well known arguments relate to customer proximity and availability of goods as well as transportation capacities and costs (Park, Park and Jeong, 2016; Schiffer, Schneider and Laporte, 2018). However, in the course of digitalization, the situation has changed owing to the interconnectedness of suppliers, transporters, and customers (e.g. “peer-to-peer-systems”, Masoud and Jayakrishnan, 2017; Santoso and Nelloh, 2017). Food distribution systems, particularly those in urban areas, employ new solutions of fully digitalized work and transportation systems (Chen, Hsu, Hsu and Leed, 2014; Soysal, Bloemhof-Ruwaard, Haijema and van der Vorst, 2018; Widener et al., 2017). This paper explores digitalized delivery systems in order to provide insights regarding the effects of innovative urban food logistics solutions on work organization and management of workers.

Our empirical findings are based on two qualitative studies in Germany based on responses of workers and volunteers of new urban delivery systems like (1) Foodora, Lieferando, and Deliveroo and (2) Foodsharing. Foodora, Lieferando, and Deliveroo and other urban delivery services transport freshly cooked food ordered from restaurants to private customers. In contrast, Foodsharing targets the reduction of food waste by regularly collecting food from supermarkets and other food sale points and distributing it to people.

Although these organizations differ markedly in terms of being for-profit private companies versus non-profit volunteer organizations, both business types are organized mainly through smartphone apps and online platforms. Especially in the food sector, such new digitalized and decentralized logistics solutions might facilitate fast, short-term, and efficient coordination between suppliers, transporters, and

customers (Hirsch, Meyer, Klement, Hamer and Terlau, 2017). In addition, fully digitalized work in food transport systems could challenge traditional work organization and the management of workers. While this potential is exemplified by organizations in the platform economy (Bergvall-Kåreborn and Howcroft, 2014; De Stefano, 2016), such expectations are far from being thoroughly investigated and empirical data is largely missing for the food logistics market.

The contributions of this paper are (a) its focus on urban food delivery and distribution processes in light of digitalized work organization, (b) its topical focus on centralization versus decentralization tendencies in the wake of digitalization of transportation processes in urban food distribution, and (c) its empirically based insights into work organization and management in innovative and digitalized start-up and volunteer organizations in the food sector.

The paper has the following organization. Section 2 describes the present body of knowledge and recent trends in food logistics. Section 3 outlines the state of the art regarding work organization and management in light of digitalization developments. Section 4 presents the empirical setup, methods, and results regarding two interview studies in urban food logistics in Germany. Section 5 presents a discussion and an outlook regarding the findings in the food delivery systems and work organization context.

2 Food Logistics Concepts and Trends

Food logistics systems can be structured according to three constitutional elements. First, standard elements comprise logistics concepts similar to many other transportation and distribution concepts, such as those regarding the questions of warehousing locations, transport capacity, or intermodal setups (Alibeyg, Contreras and Fernández, 2016; Alises and Vasallo, 2015; De Jong, Kouwenhoven, Ruijs, van Houwe and Borremans, 2016; Nossack and Pesch, 2013). Second, specific elements characterize food distribution systems, such as those pertaining to cold storage and freshness requirements for food determining the transport timeline and defining equipment characteristics (for example, vehicles with cooling systems), which usually increase the operational cost levels in food distribution (Engelseth and Sandvik, 2017; Vik and Kvam, 2017). Third, elements govern the question of last mile and urban delivery in the form of restrictions such as low- or zero-emission and noise regulations or prohibited entry such as that in pedestrian areas, which are undergoing revival (Li, Chen and Prins, 2016; Schiefer and Hamann, 2017).

Challenges presented to food logistics in the last decade include – but are not restricted to – the following topics (Wieland, Handfield and Durach, 2016), which are important as background for operational questions such as those relating to digitalization or centralization as these topics provide the competitive framework for every organization that hopes to succeed in the food logistics market.

- *Increasing regulatory impacts and frameworks:* Like the Hazard Analysis and Critical Control Points (HACCP) regulation, encoded in the FAO/WHO Codex Alimentarius and legally implemented in the European Union on 1 January 2006 with the regulation No EG 852/2004, many regulatory items require compliance of all actors within a food transport chain. While for HACCP no legally binding certification mechanism is in place, the standard has developed into a major competitive challenge and constitutes a formal requirement for any logistics actor in the food sector.
- *Increasing customer demands regarding quality, variety, and delivery speed, especially for urban food distribution systems:* As an example, the growing online retail sector has trained customers to expect nearly instant delivery times for all products (referring to the concept of “sofortness”, Fedoseeva, Grein and Herrmann, 2017). Today, same-day delivery concepts are in place or in preparation for nearly all B2C consumer products in larger metropolitan and urban areas throughout the world. The availability of nearly instant delivery raises customer expectations regarding speedy food delivery and fosters the increasing requirement of a greater variety of food quality and sourcing origins for products such as exotic fruits and vegetables as well as complete meals.
- *Increasing sustainability requirements and evaluations from both the government and the market:* The triple-bottom-line concept posits that logistics actors must incorporate economic, environmental, and social performance indicators into their evaluation, management, and steering concepts for modern supply chains and distribution (Brockhaus, Kersten and Knemeyer, 2013; Fawcett and Waller, 2014; Voytenko, McCormick, Evans and Schliwa, 2016; Wang and He, 2017; Zijm and Klumpp, 2016). The social dimension in particular has implications for workers’ rights and safety issues in transportation chains as well as for the food sector (Stefani, Lombardi, Romano and Cei, 2017).
- *Increasing competition levels for food transportation and logistics can be recognized, especially in urban areas:* The entry of new competitors, such as specialized food delivery systems relying on bicycles, or the shifting of traditional contract logistics providers from other product segments into food distribution has increased the number of suppliers of logistics services in the food sector. As a

result, competition based on cost, price, and speed is increasing and is serving a growing number of customers who order food online or otherwise consume delivered food and meals in urban areas.

From a theoretical perspective, a meta-question relates to the centralization level of food distribution systems: Whereas in the past coordination of transport and warehousing resources was implemented on a quite central level, this coordination is currently shifting toward decentralization (Chen et al., 2014; Soysal et al., 2018). This change is enabled by new communication technologies such as social media and smartphone applications as well as new decentralized computing and decision-making and cooperation devices (swarm intelligence, intelligent stock keeping units etc.; Kadavevaramath, Chen, Shankar and Rameshkumar, 2012; Mavrovouniotis, Li and Yang, 2017). These changes imply that increased use of digital technologies like smartphone apps for all employees enables and supports decentralization of logistics planning, decision-making, and operations.

3 Digitalization and Work Organization

Digitalization in logistics helps to connect suppliers, transporters, and customers and to coordinate transports more efficiently. It also has a fundamental impact on work organization and the management of workers in this context. Digitalized work settings imply the availability of real-time information, enabling greater knowledge sharing with stakeholders to build customized relationships (Avolio, Kahai and Dodge, 2000). One of the main challenges leaders face is how to efficiently integrate information technology systems in organizations to support the management of workers.

The new paradigm of e-leadership, which refers to leadership in digitalized work settings, helps to understand tasks and challenges (Avolio and Kahai, 2003; Avolio et al., 2000; Zaccaro and Bader, 2003). E-leadership can be found where collaboration and leader–subordinate interaction take place digitally to direct and supervise workers and encourage their self-management capabilities. Certain opportunities are associated with e-leadership, such as (a) the ability to instantly communicate one-on-one with workers independent of their location; (b) the ability to use a workforce distant from the organization’s location; (c) enhanced organizational performance; and (d) the ability to target better customer satisfaction by providing 24/7 services (DasGupta, 2011). However, e-leadership is also accompanied by challenges such as (a) communicating effectively through the electronic medium; (b) building trust with someone who is present only virtually; (c) creating a viable electronic presence; and (d) controlling performance (DasGupta, 2011).

Regardless of the various opportunities and challenges, two paradoxes emerge from e-leadership related to centralization versus decentralization tendencies in logistics: (a) the interrelation between the individual and the community, as individuals have a great deal of autonomy, potentially leading to isolation; and (b) the interrelation between top-down and bottom-up, since digitalization provides opportunities to give voice to the workforce but hierarchical structures maintain (Pulley and Sessa, 2001).

So far, the concept of e-leadership has not been applied to logistics despite that field’s suitability owing to its highly dynamic nature, level of digitalization, and inevitable existence of virtual work teams even on a regional basis. Moreover, the discussion regarding the efficiency of centralized and decentralized distribution concepts in logistics directly refers to the management of workers, contrasting surveillance and control on the one hand and self-regulation and self-control on the other.

Digitalization in work organization puts emphasis on the perceived organizational support (POS) of workers and the corresponding management of the employment relationship (Eisenberger, Huntington, Hutchison and Sowa, 1986). POS is the degree to which employees believe the organization values their contributions and cares about their well-being. The theoretical basis for this reasoning is social exchange theory, which assumes that in an exchange relationship each party offers something of value and expects an equitable response (Gouldner, 1960). High levels of POS create feelings of obligation to engage in behaviors that support organizational goals. Related research has shown that POS is positively related to job attitudes, performance, and satisfaction, as well as to commitment and innovation (Eisenberger, Fasolo and Davis-LaMastro, 1990). More recent reviews show that in the context of new work organization, employee well-being and non-traditional workers are particularly considered (Baran, Rhoades Shanock and Miller, 2012; Rhoades and Eisenberger, 2002). Achieving POS in non-traditional employment relationships may be more difficult but is nevertheless required. However, because leaders act as agents of the organization, POS is usually geared toward them.

Support from leaders and the exchange between leaders and subordinates has also been assessed in terms of the leader–member–exchange (LMX), as these two concepts are strongly interrelated (Graen and Uhl-Bien, 1995; Liden, Sparrowe and Wayne, 1997; Wayne, Shore and Liden, 1997). Although high-quality LMX produces employee motivation and greater organizational commitment (Anand, Hu, Liden and

Vidyarthi, 2011; Bauer and Erdogan, 2015), LMX is concerned with the actual relationship between leaders and subordinates whereas POS focuses on the organization per se. So far, these two concepts have not been analyzed with respect to digitalization and new work organization. In the context of increasing digital workflows and e-leadership, it remains unclear how POS and high LMX can be ensured through communicating limited to electronic media and virtual presence, which leader behaviors are perceived as supportive by flexible and autonomous workers, and how innovative food logistics solutions are to be designed to enhance organizational performance through customized services.

4 Interview Studies of New Urban Delivery Systems

To explore the work organization and management of workers in modern digitalized food distribution systems, we conducted two interview studies in 2016 and 2017. The first study comprised 10 semi-structured interviews with cyclists employed in three urban delivery services (Foodora, Lieferando and Deliveroo). The second study comprised interviews of 14 volunteers participating in Foodsharing in Germany.

The interviewees were recruited through social networks on the internet (e.g., foodsharing.de, facebook.de) as well as by a notice posted at local spots and by directly contacting them. Subsequent recruitment of other interviewees was through gatekeepers and snowballing. Of the interviewees, 17 respondents were male and seven were female; the interviewees were between 18 and 55 years old. Table 1 and Table 2 provide an overview of the people interviewed.

Table 1.
Sample of Cyclist Interviewees

| | C1 | C2 | C3 | C4 | C5 |
|----------------------------|-----------|-----------|-----------|-----------|------------|
| Gender | M | M | M | F | M |
| Year of birth | 1992 | 1995 | 1978 | 1997 | 1991 |
| Occupation | Cyclist | Cyclist | Cyclist | Cyclist | Cyclist |
| Working for delivery since | 2017 | 2017 | 2017 | 2017 | 2017 |
| Income p.a. | < 12,000€ | < 12,000€ | < 24,000€ | < 6,000€ | N/S |
| | C6 | C7 | C8 | C9 | C10 |
| Gender | M | M | M | M | M |
| Year of birth | 1989 | 1993 | 1999 | 1993 | 1994 |
| Occupation | Cyclist | Cyclist | Cyclist | Cyclist | Cyclist |
| Working for delivery since | 2017 | 2017 | 2017 | 2017 | 2017 |
| Income p.a. | N/S | < 6,000€ | < 6,000€ | N/S | < 12,000€ |

Table 2.
Sample of Foodsharing Interviewees

| | F1 | F2 | F3 | F4 | F5 | F6 | F7 |
|------------------------------------|-----------|-------------------------|-------------------------|-------------------------|-----------------|------------------|------------------|
| Gender | F | M | M | F | M | F | M |
| Year of birth | 1989 | 1963 | 1962 | 1981 | 1968 | 1982 | 1985 |
| Occupation | Student | Freelance journalist | Freelance journalist | Translator and coach | Un- employed | Office worker | Office worker |
| Engaged in Foodsharing since | 2015 | 2012 | 2012 | 2014 | 2015 | 2014 | 2015 |
| Income p.a. | < 12,000€ | < 12,000€ | < 12,000€ | < 40,000€ | < 12,000€ | < 40,000€ | < 40,000€ |
| | F8 | F9 | F10 | F11 | F12 | F13 | F14 |
| Gender | M | F | M | F | F | M | M |
| Year of birth | 1988 | 1992 | 1987 | 1983 | 1992 | 1990 | 1988 |
| Occupation | Student | Student | Student | Office worker | Student | Student | Student |
| Engaged in Foodsharing since | 2016 | 2016 | 2009 | 2016 | 2015 | 2013 | 2015 |
| Income p.a. | < 12,000€ | < 12,000 € | < 40,000€ | < 25,000€ | < 12,000€ | < 40,000€ | < 40,000 € |

The interview guidelines we used started with a narrative stimulus. We then addressed the respondents' experience with regard to the organization of (volunteer) work. Moreover, we asked them about the cooperation with co-workers and leaders and how interaction developed in the wake of digitalization. Finally, we probed regarding opportunities and risks regarding new urban food delivery systems. In total, four interviewees participated, of which only one was present in any given interview. The interviewees had the choice of a face-to-face or telephone interview. Altogether, eight interviews were conducted by telephone and 16 face-to-face. All interviews were audio-recorded, transcribed, and anonymized.

The data evaluation relied on qualitative content analysis (Mayring, 2000), which is an approach of systematic, rule-guided qualitative text analysis. We included a deductive application and an inductive development of codes. Subsequently, we explicated coding rules for the categories and identified examples, such as use and handling of technology, effects of digitalization on work engagement, effects of digitalization on the collaboration with colleagues and effects of digitalization on the relationship with leaders. Finally, we formulated definitions for each code, found examples, and defined coding rules. Correspondingly, the coding system was constantly checked and modified, inductively expanded, and revised. After revision of the categories and coding agenda, we applied the final code scheme to all materials and interpreted the results.

5 Empirical Findings

The following results can be derived from the qualitative interviews in the two cases of (1) urban cyclist delivery cyclists employed by Foodora, Lieferando, and Deliveroo as well as (2) volunteers working on behalf of Foodsharing. We structure these findings according to the contribution areas of this paper: digitalized food distribution systems, centralization versus decentralization, and work organization and management.

Digitalized Food Distribution Systems

Urban fresh food delivery by cyclists employed by Foodora, Lieferando or Deliveroo is based on online ordering facilities through dedicated delivery service websites. Once an order is posted, decentrally prepositioned cyclists are ordered by smartphone app to the specific restaurant to pick up freshly cooked

food and deliver it immediately to the customer. The logistics and transportation relating to these urban food distribution systems could be described as subject to an exceptions rule. For example, many exceptions occur on a day-to-day basis, from bike theft to wrong address communication from customers, from late meal completion by overcrowded restaurants to bad weather and traffic hurdles. Therefore, in such cases human intervention (troubleshooting in close cooperation of leaders and subordinates) could be essential for viable and effective food distribution systems in urban areas. Consequently, the business potential for standardization might be low.

The food distribution within Foodsharing also hints at the critical relevance of digitalization. The fast-growing Foodsharing organization is based mainly on social media and social networks, with all communication and coordination taking place online. To reduce food wastage, on decreed dates volunteers go regularly to supermarkets to collect food that the supermarket has sorted out (and would have thrown away) and take it home, distribute it among people and institutions interested, and/or deposit it at local pickup spots. The food collections are organized in such a way that a person responsible for operations posts collection dates that volunteers can subscribe to. Thus, Foodsharing offers a web-based setting for these self-organized interactions.

Digitalization in the form of smartphone apps and online platforms might facilitate a centralized collection of decentralized responsibilities such as individual tasks and contributions, which have to be self-organized. People who do not have a mobile device cannot participate, so elderly people, for example, might be excluded.

Centralization versus Decentralization

Regarding the trend toward decentralized decision-making, the qualitative interviews yielded surprising results. In the case of urban delivery cyclists, point-to-point transportation from restaurants is in many cases decentralized, with cyclists positioned throughout the city and advancing toward order pick-up points according to online orders from restaurants. However, planning, decision-making, and control seem to be at the same level of centralization as firms without digital technologies and perhaps on an even higher level, as in the case of urban cyclist delivery cyclists with a nationally centralized GPS position and speed control team (in Berlin for all of Germany).

Regarding centralization and decentralization, Foodsharing's sophisticated hierarchical structure of participating volunteers with specific responsibilities is remarkable. Organizational elements such as membership, hierarchy, autonomy, and sanctions might be quite clear in this context. During Foodsharing's growth to a considerable size, this tight organization has facilitated the achievement of Foodsharing's good purpose and has increased efficiency by providing reliability to the cooperating actors, such as companies and volunteers.

Work Organization and Management

Regarding implications of digitalization for work organization and management in new urban food delivery services, specific work habits seem to prevail, as in the case of cheating (use of "fake" GPS signals by delivery cyclists, for example) or the unsolicited spontaneous peer-to-peer help of cyclists. Respondents report an alignment of expectations and work habits to digitalized contexts stemming from the private and ubiquitous use of smartphones and other digital equipment and apps. As people have become accustomed to digitalization in a personal environment, such as with messenger and social media applications, digitalization at work comes quite naturally to most employees, especially younger cyclists. Thus, the organization of work might not change markedly except in the application of new communication technologies (e.g., message services instead of phone calls). Cyclists report greater satisfaction with such new communication technologies and perceive numerous advantages, such as working from written delivery addresses in the message system, which can be looked up several times and with fewer mistakes than when relying on phone calls. Possibly, new work environment developments connected to the use of digitalization technologies will emerge, such as an informal, lower hierarchy level, a less formalized leader-subordinate relationship and first-name communication online, as well as a more dynamic online ordering business requiring on-the-spot decisions and close contact to leaders. The urban food delivery cyclists see their supervisors as supportive and as having a very friendly attitude even though they are not physically present but are connected only via message service or phone communication. In many situations the leaders intervene to engage with restaurants (delays in food production) or customers (announcing late deliveries themselves), taking "heat" off the cyclists. Delivery cyclists also greatly appreciate the easy application of smartphone app functionalities, such as personal scheduling of weekly working times or making changes in work shifts among the cyclists themselves. As can be recognized from these examples, even with digital workflows and e-leadership POS can be secured by direct responses from back office workers – whereas the direct involvement of leaders could be less important. High LMX is expected to be achieved differently in digital work contexts, e.g. by direct first-

name communication via social media and leader behavior being perceived as supportive through direct availability.

Regarding work organization and management, the Foodsharing case results show the criticality of simultaneously facilitating the achievement of organizational and individual goals for a food-related non-profit organization of volunteers. Across the board, volunteers take part in Foodsharing primarily to serve a good cause, but respondents also frequently mentioned that the possibility of getting food for free was similarly decisive, as well as the freedom to self-determine the amount and kind of their engagement by means of digitalization and the possibility of actively and democratically participating in the organization and bringing in their own ideas. In this context, social networks and interactions actually limit behaviors that are overly selfish and self-determined, since the acceptance and consideration of social norms is expected and sanctioned. The volunteers' performance is monitored through digitalization, and even partially displayed in rankings, such as those for most successful volunteers in terms of the amount of food saved. Access through social media is perceived as a low threshold for the people interested in volunteering and helps to smoothly integrate the volunteers' engagement into their day-to-day activities. To organize food collections, people responsible for individual cooperating companies are necessary to ensure that the company can rely on the collection and be certain that enough people are available to collect the food the supermarket provides. Often cars and several people are needed to collect food. Organizational representatives and the board of directors can be approached in the event of problems and usually are perceived as supportive, helpful, and friendly, indicating a high POS and LMX.

6 Discussion and Outlook

Through an exploration of digitalized supply chains, this paper analyzes the effects of innovative urban food logistics solutions on work organization and management of workers. Primarily, the two food delivery systems investigated – urban food delivery by cyclists and a volunteer-run food sharing organization – emerged only because of digitalization. These cases focus on centralization and decentralization tendencies in digitalized work and management contexts. The cases illustrate the three major contribution areas of this study.

Food supply chains are characterized as differing significantly from other supply chains, mainly owing to the requisite for freshness. Digitalization is opening up new opportunities for businesses and non-profit volunteer organizations to address this special feature of freshness, especially in urban areas. Around the world, new businesses and initiatives can be expected to emerge in the food sector. This occurrence is crucially connected to work organization and e-leadership concepts, as shown by recent research on socio-technical innovations in this field (Fischer, 2017). Specifically, decentralization of work organization (cyclists, volunteers) is fundamental to such new urban food distribution systems.

This study's empirical findings regarding decentralization have important implications for urban food delivery systems. Although in both cases operations and transport are decentralized, making logistics operations such as cyclist prepositioning and point-to-point transportation more efficient, the planning and decision functions remain strongly centralized. A central team of leaders and planners checks and hierarchically decides major resource, planning, scheduling, and transport control issues, such as in the event of scheduling conflicts or delays in transportation. This approach should be tested further in future research. This is closely related 'urban sprawl' and geography setups in this context (Aljohani and Thompson, 2016).

Regarding work organization, both the urban food delivery cyclists and the Foodsharing volunteers especially appreciate the digital possibilities, such as easy online or smartphone scheduling of their work. The topic of management was addressed mainly in regard to the e-leadership challenges outlined. For the urban distribution companies, it was obvious that leaders present via online communication served very positively as support, intervening in a friendly, friend-like manner if problems arose with transportation, restaurants, or customers. The potential challenges of motivating and integrating a large number of dispersed transport drivers via digital communication are partly met by leaders in a support-friendship role, strengthening the POS and resulting in a high-quality LMX relationship (Baran et al., 2012; Martin, Thomas, Legood and Dello Russo, 2017). Thus, the findings support the relevance of POS in digitalized contexts since leaders act and are perceived by workers as supportive friends. This perception promotes the efficiency of the two organizations analyzed in the study as cyclists as well as volunteers report increased motivation and engagement levels.

In conclusion, digitalization can be expected to bring many improvements to food distribution systems, including increased transparency, increased speed and reduced waste, increased control, and lower transportation and warehousing costs – but not the decentralization of logistics planning and operations.

This finding is important, as currently conceptual trends – such as Industry 4.0, the Internet of Things, and the Physical Internet – are propagating the opposite expectation. Therefore, food research should be directed at identifying the real advantages and developments within digitalized food supply chains and avoid blindly following theoretical concept communications without empirical validation.

Limitations of this study include the fact that the two empirical case studies comprised only start-up and volunteer organizations, constraining the generalizability of our results. In addition, quantitative empirical research would help to generalize the findings on transformations in the organization of work and logistics setups in food distribution systems.

Implications for management include the advice to reevaluate the interconnection between centralization and decentralization in the context of a digitalized work organization, and especially to develop the relationship between supervisors and subordinates to increase the POS and LMX, and therefore worker motivation and process efficiency. Finally, further research on the impact of digitalization in logistics on work organization and management could reveal implications for other urban distribution concepts outside the food sector.

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