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# Digitalization and Work Organization in New Urban Food Delivery Systems

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## ABSTRACT

The implementation of food distribution in general and especially within urban areas requires a state-of-the-art logistics system. One decision therein is the level of centralization, with shifting optima due to emerging digitalization and peer-to-peer concepts. This study presents insights regarding the effects of innovative food logistics solutions with digitalized logistics. 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 – with interesting influences on work organization and management of workers in food distribution.

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

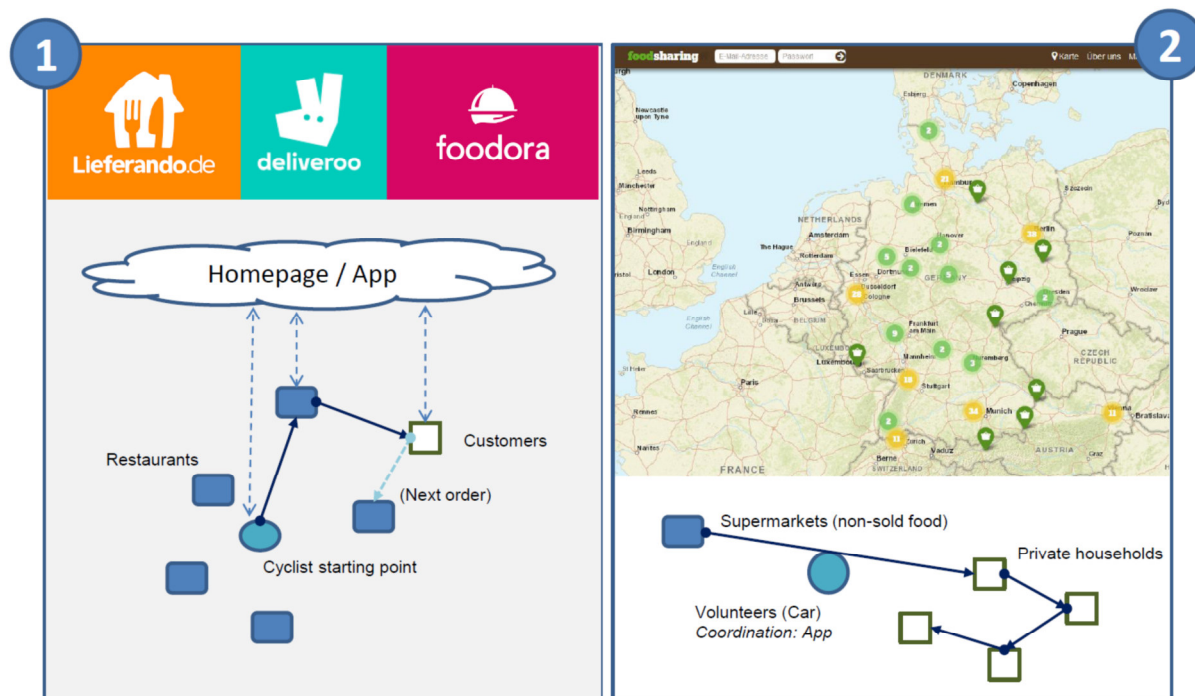
## 1 Introduction

The efficiency of centralized and decentralized distribution concepts is a perennial discussion in logistics (Holzapfel, Kuhn and Sternbeck, 2018; Morganti, Dablanc and Fortin, 2014). In this context, well-known arguments are 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 due to the interconnectedness of suppliers, transporters and customers (e.g. “peer-to-peer-systems”, Masoud and Jayakrishnan, 2017; Santoso and Nelloh, 2017). Especially food distribution systems in urban areas show 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). It is the objective of this paper to provide insights regarding the effects of innovative urban food logistics solutions on work organization and management of workers by exploring digitalized delivery systems.

Empirical findings are based on two qualitative studies in Germany with workers and volunteers of new urban delivery systems like (1) Foodora, Lieferando and Deliveroo and (2) Foodsharing. The two innovative urban food distribution systems are depicted also in the following Figure 1. On the one hand, Foodora, Lieferando and

Deliveroo as well as other urban delivery services transport freshly cooked food ordered from restaurants to private customers. On the other hand, Foodsharing targets the reduction of food waste by regularly collecting food from supermarkets as well as other food sale points and distributes it to people. Although these organizations differ decisively – (1) as for profit private companies versus (2) as nonprofit volunteer organization – both are mainly organized through smartphone apps and online platforms (see Figure 1).

Figure 1: New Urban Food Delivery Systems.



As a result, especially in the food sector, such new digitalized and decentralized logistic solutions might facilitate fast, short-term and efficient coordination between suppliers, transporters and customers (Hirsch, Meyer, Klement, Hamer and Terlau, 2017). Likewise, fully digitalized work in food transport systems could challenge traditional work organization and the management of workers. But such expectations are far from proven and empirical data is largely missing.

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

This paper is organized as follows: Section 2 describes the existing body of knowledge and recent trends in food logistics. Section 3 outlines the state-of-the-art regarding work organization and management in the light of digitalization developments. Section 4 presents the empirical setup, methods and results regarding two interview studies in urban food logistics from Germany. Section 5 presents a discussion and 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, there are standard elements of such logistics concepts similar to many other transportation and distribution concepts, e.g. 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, there are specific elements for food distribution systems, e.g. due to cold storage and freshness requirements for food urging 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). A third field is the question of last mile and urban delivery with dedicated restrictions such as low- or zero-emission and noise regulations or entry prohibitions such as for example in pedestrian areas – with a recent revival of such concepts (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):

- 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 from 1<sup>st</sup> of January 2006 with the regulation No EG 852/2004, many regulatory items require compliance of all actors within a food transport chain. Though for HACCP for example there is no legally binding certification mechanism in place, the standard has developed into a major competitive challenge and 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: For example, the growing online retail sector has trained customers to expect near-instant delivery times for all products (referring to the concept of “sofortness”, Fedoseeva, Grein and Herrmann, 2017). Same-day delivery concepts are in place or in preparation for nearly all B2C consumer products specifically in larger metropolitan and urban areas throughout the world today. This has impacts on customer expectations towards speedy food delivery – as well as the increasing requirement of a larger variety of food quality and sourcing origins like exotic fruit, vegetables and meals.
- Increasing sustainability requirements and evaluations from government as well as market sides: According to the triple-bottom-line concept, logistics actors are required to include economic as well as environmental and social performance indicators into their evaluation, management and steering concepts for modern supply chains and distribution concepts (Brockhaus, Kersten and Knemeyer, 2013; Fawcett and Waller, 2014; Voytenko, McCormick, Evans and Schliwa, 2016; Wang and He, 2017). Especially the social dimension has raised discussions and implications e.g. regarding workers’ rights and safety issues in transportation chains, also for the food sector (Stefani, Lombardi, Romano and Cei, 2017).
- Finally, increasing competition levels for food transportation and logistics can be recognized, especially in urban areas. Induced by the entry of new competitors like specialized food delivery systems by bike or the shifting of traditional contract logistics providers from other product segments into food distribution, the number of suppliers for logistics services in the food sector has increased. Therefore, cost, price, and speed competition is increasing and serving a growing number of customers ordering food online or otherwise consuming food and meals in urban areas.

From a theoretical framework perspective, a meta-question is the centralization level of food distribution systems: Whereas coordination of transport and warehousing resources was implemented on a quite central level in the past, currently a shift towards more decentralized coordination can be observed (Chen et al., 2014; Soysal et al., 2018). This is enabled by new communication technologies (social media, smartphone applications) as well as new decentralized computing, decision and cooperation devices (swarm intelligence, intelligent stock keeping units etc.; Kadadevaramath, Chen, Shankar and Rameshkumar, 2012; Mavrovouniotis, Li and Yang, 2017). From that it can be stipulated that an increased use of digital technologies like smartphone

apps for all employees do enable and support *decentralization* of logistics planning, decision-making and operations.

### 3 Digitalization and Work Organization

Digitalization in logistics not only helps to connect suppliers, transporters and customers and to coordinate transports more efficiently but 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). Against this background, one of the main challenges leaders face is how to efficiently integrate information technology systems in organizations to support the management of workers.

Especially the new paradigm of e-leadership helps to understand tasks and challenges since it refers to leadership in digitalized work settings (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 the workers, and to encourage their self-management capabilities. There are certain opportunities associated with e-leadership, such as (a) the ability to instantly communicate one-on-one with workers independent of their location; (b) the capability to use 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 with challenges such as (a) communicating effectively through the electronic medium; (b) building trust with someone who is only present virtually, (c) creating a viable electronic presence, and (d) controlling performance (DasGupta, 2011).

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

So far, the concept of e-leadership has not been applied to logistics although this field is predestined in view of its highly dynamic nature, level of digitalization and the inevitable existence of virtual work teams even on a regional basis. Moreover, the discussion on 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 hand. In order to promote the positive outcomes of digitalization in work organization and management, it is essential to foster the perceived organizational support (POS) of workers and to organize the employment relationship correspondingly (Eisenberger, Huntington, Hutchison and Sowa, 1986). POS is the degree to which employees believe that the organization values their contributions and cares about their well-being. The dominant theoretical basis for this reasoning is social exchange theory assuming that each party offers something in an exchange relationship seen as valuable 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, to commitment and innovation (Eisenberger, Fasolo and Davis-LaMastro, 1990).

Regarding the exchange between leaders and subordinates, this would likewise help to develop a high-quality leader-member-exchange (LMX) as these two concepts are strongly interrelated (Graen and Scandura, 1987; Liden and Graen, 1980; Liden, Sparrowe and Wayne, 1997; Wayne, Shore and Liden, 1997). However, LMX is rather concerned with the actual relationship between leaders and subordinates while POS rather focuses on

the organization per se. In the context of increasing digital workflows and e-leadership it remains unclear how POS can be ensured in view of only communicating through electronic media and virtual presence, which leader behaviors are perceived as supportive by (more or less) 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

##### 4.1 Method Outline

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 contains 10 semi-structured interviews with cyclists of urban delivery services (Foodora, Lieferando and Deliveroo). In the second study, we interviewed 14 volunteers participating in Foodsharing in Germany.

The interviewees were recruited through social networks on the internet (i.e. foodsharing.de, Facebook), as well as a notice hung out at local spots, and by directly contacting them. Subsequently, both gatekeepers and the snowball principle assisted in the recruitment of other interviewees. 17 of the respondents were male, 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**

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

Table 2: Sample of Foodsharing Interviewees

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

The interview guidelines we used started with a narrative stimulus, and then we addressed the respondents' experiences with regard to the organization of (volunteer) work, digitalization, and the cooperation with others (co-workers, leaders). Finally, we questioned 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. 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, coding rules for the categories were explicated and examples identified. 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 the revision of categories and coding agenda, the final code scheme was applied to all materials and the results interpreted.

#### 4.2 Empirical Findings

The following core results can be derived from the conducted interviews in the two cases of (1) Foodora, Lieferando and Deliveroo urban cyclist delivery drivers as well as (2) the Foodsharing example. We structure these findings according to the contribution areas of this paper, namely (a) digitalized food distribution systems, (b) centralization versus decentralization, and (c) work organization and management.

- (a) Urban fresh food delivery by cyclists by Foodora, Lieferando or Deliveroo is based on online ordering facilities through dedicated delivery service websites; once an order is posted, decentral prepositioned cyclists are ordered by smartphone app to the specific restaurant to pick up freshly cooked food and

deliver it instantly to the customer. The logistics and transportation situation in such urban food distribution systems can be described as *exceptions rule* – it is for example due to most (1) cyclist interview results (e.g. double drivers for large orders) interesting, how many exceptions take place on a day-to-day basis, from bike theft to wrong address communication from customers, from late meal completion with overcrowded restaurants to bad weather and traffic hurdles. Therefore, it can be derived that human intervention (troubleshooting in close cooperation of leaders and subordinates) for such cases is essential for viable and effective food distribution systems in urban areas. Consequently, the business potential for standardization and rationalization might be low.

The food distribution within (2) Foodsharing again emphasizes the relevance of digitalization. The fast growing food sharing movement is based mainly on social media and social networks, every communication and coordination takes place online. To reduce food wastage, volunteers go regularly to supermarkets at decreed dates to collect food that the supermarket has sorted out (and would have been wasted) 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 post collection dates which food-savers can subscribe to. Thus, Foodsharing organization offers the web-based setting for these self-organized interactions. Digitalization in the form of smartphone apps and online platforms facilitates a centralized collection of decentralized responsibilities such as individual tasks and contributions, which have to be self-organized. People who do not have any mobile device cannot participate.

- (b) The stipulated trend towards decentralized decision-making is only partly supported by the qualitative interviews conducted with (1) urban delivery drivers: On the one hand point-to-point transportation from restaurants is truly decentralized with cyclists positioned throughout the city and advancing towards order pick-up points according to online orders from restaurants. On the other hand especially planning, decision-making as well as control are at least at the same centralization level as without digital technologies, maybe even on a higher level as outlined by for example urban cyclist delivery drivers for a nationally centralized GPS position and speed control (in Berlin for all of Germany).

Regarding centralization and decentralization, it is remarkable that (2) Foodsharing has a sophisticated and hierarchical structure of participating volunteers with specific responsibilities. Thus, organizational elements such as membership, hierarchy, autonomy, and sanctions are quite clear in this context. In the course of the growth of food sharing to a considerable size, this tight organization facilitates the achievement of the good purpose and increases efficiency by providing reliability to the cooperating actors, such as companies and volunteers.

- (c) Regarding implications of digitalization for work organization and management, it is interesting that there are specific *prevailing* work habits like the question of cheating (use of “fake GPS” signals by cyclist delivery drivers for example) or the question of unsolicited and spontaneous peer-to-peer-help of cyclists. Many respondents report an alignment of expectations and work habits to digitalized contexts due to the private and ubiquitous, increased use of smartphones and other digital equipment and apps. As people are accustomed to digitalization in a personal environment via e.g. messenger and social media applications, digitalization at work comes to most employees quite natural, especially for younger drivers. Thus, work organization does not change that much process-wise but only in applying new communication technologies (messenger services instead of phone calls etc.). Drivers report a higher satisfaction with such new communication technologies and perceived advantages as for example written delivery addresses in the messenger system, which can be looked up several times and with less mistakes attached than phone calls. There are *new* work environment

developments connected to the use of digitalization technologies such as an at least informally lower hierarchy level, a less formalized leader-subordinate relationship due to ubiquitous (social media) and first-name communication online and a more dynamic online ordering business requiring on-the-spot decisions and close contact to leaders. Leaders are seen as supportive and with a very friendly attitude by the drivers in urban food delivery as (a) they are not permanently (physically) present but “distant”, connected only via messenger or phone communication; and (b) they act as troubleshooters in many situations towards restaurants (delays in food production) or customers (announcing late deliveries themselves), taking “heat” of the drivers themselves. Delivery drivers also highly appreciate the easy application of smartphone app functionalities like e.g. personal scheduling of weekly working times or changes in work shifts among each other.

Regarding work organization and management, the (2) Foodsharing case shows that it is essential to simultaneously facilitate the achievement of organizational and individual goals for a food-related nonprofit organization of volunteers. Across the board, volunteers take part in food sharing primarily for the good cause, but it was also prominently mentioned that the possibility of getting food for free was similarly decisive, as well as the freedom of (self-)organizing the amount and the kind of engagement by means of digitalization and the possibility to actively and democratically participate in the organization and bring in one’s own ideas. In this context, social networks and interactions even limit behaviors which are (too) selfish and self-determined, since the acceptance and consideration of social norms is expected and sanctioned. By means of digitalization, the performance of volunteers is monitored, partly even displayed in rankings, e.g. for most successful food-savers in terms of their amount of food saved. However, the access through social media is perceived as a low threshold for the people interested 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. These responsible persons ensure that the company can rely on the collection and make sure that there are enough people to collect the food the supermarket wants to get rid of. This also means that the responsible person would have to stand in when there are not enough food-savers subscribing to agreed food collection dates.

Next, ambassadors coordinate regional groups and take over all the necessary activities. Ambassadors are a kind of head on a local level. As organizational representatives, they must secure the development of food sharing. They are responsible for coopting new members and training them. They have to keep an eye on the day-to-day business—who is coopted for a food collection at which supermarket—and they must stand in and collect the goods if there are not enough volunteers assigned. This is aggravated by the fact that cars and several people are sometimes needed to collect food. There are often two or three ambassadors per city/region and they share the job and the duties. Organizational representatives such as responsible persons, ambassadors and the board of directors can be approached in the event of problems and usually they are perceived as helpful and friendly. However, the board of directors and an the extended board of directors is partly seen as strict since they are concerned primarily with legal issues, such as contracting with supermarket chains, and have to ensure standardization and reliability of the organization.

## **5 Discussion and Outlook**

This paper analyzes the effects of innovative urban food logistics solutions on work organization and management of workers by exploring digitalized supply chains. Primarily, both food delivery systems investigated (urban food delivery and voluntary food sharing organization) only emerged because of



digitalization. Thus, these cases are predestined to focus on centralization and decentralization tendencies in digitalized work and management contexts. According to the three major contribution areas of this study, the following discussion points can be highlighted:

- (a) Food supply chains are characterized as being quite special and different from other supply chains and industry, mainly due to the freshness paradigm. Therefore, it can be observed that digitalization is opening up new (for profit) business opportunities and (nonprofit) volunteer organizations addressing this special feature of freshness especially in urban areas. Further businesses and initiatives can be expected to emerge around the world in the food sector. This is crucially connected to work organization and e-leadership concepts as for example important advantages like the possibility to organize and lead a multitude of decentrally organized workers (cyclists, volunteers) are fundamental to such new urban food distribution systems.
- (b) Especially the empirical findings regarding decentralization can be seen as important inputs for urban food delivery systems: Though operations and transport is decentralized and this helps efficient logistics operations (e.g. in cyclist propositioning, point-to-point transportation), the planning and decision functions remain very centralized in both cases analyzed. A central team of supervisors and planners (regionally or even nationally) is checking and hierarchically decisioning major resource, planning, scheduling and transport control issues, e.g. if there are scheduling conflicts of delay in transportation. This has to be tested and discussed further in order to avoid misdirecting research pathways as well as business process design because recently the decentralization assumption was prioritized with digitalization.
- (c) Regarding work organization, the cyclists as well as the Foodsharing volunteers especially cherish the digital possibilities for example in easily scheduling their working time taken from their sparse personal time online or via smartphone applications. The topical area of management was addressed mainly in regard to the e-leadership challenges outlined – and for the urban distribution companies it was obvious that leaders present via online communication served in a very positive framework as “support”, intervening in a friendly, friend-like manner if problems with transportations, restaurants and customers arose. Therefore, the proposed challenges of motivating and integrating a large number of distant transporting drivers via digital communication is partly solved by leaders in a “support-friendship role” strengthening the POS and resulting in a rather high-quality LMX relationship. Thus, the findings support the relevance of POS in digitalized contexts for e.g. cyclists and volunteers since leaders act and are perceived by workers as supportive friends. This in turn increases the efficiency of both analyzed organizations as cyclists as well as volunteers report increased motivation respectively engagement levels.

Concluding it can be emphasized that for future food systems research as well as business practice planning and strategy development, digitalization can be expected to bring many advantages to food distribution systems like increased transparency, increased speed and less waste, increased control and lower transportation and warehousing costs – but not the expectation of decentralizing logistics planning and operations. This is important as currently in line with conceptual trends like “Industry 4.0”, “Internet of Things” or “Physical Internet” are propagating the opposite. Therefore, food research should be directed at identifying the real advantages and developments within digitalized food supply chains and avoid the wrong path of blindly following theoretical concept communications without empirical validation.

Limitations of this study include the fact that only start-up and volunteer organizations were present in the two empirical case studies. The transferability of our results would have to be proven with a larger sample containing also general corporations and organizations. In addition, quantitative-empirical research would help

to generalize the findings on transformations in food distribution systems work organization and logistics setups.

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

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