

Algorithmic Food – How “Software is Eating the World”¹

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Abstract

In this paper, we explore how algorithms have empowered customers and promoted their preferences, while turning the sourcing of food from the purchase of a valuable good into a simple transaction. Focusing on the generative character of algorithms in the organizing of food, we study the changing nature of food retailing in the UK over the last 20 years. Theoretically we focus on the role that algorithms and thus technology have played in the transformation of the organizing of food and shed new light on how the latter has undergone tremendous changes. Our study enhances the current understanding of the impact big data has and will have on many organizational aspects and demonstrates that we need to have a better and more critical understanding of its consequences.

1. Introduction

The use of algorithmic technologies and more generally big data enjoys an ever-growing popularity among businesses, regulators, and scientists alike [1]. As recently summarized by Introna [2], “computerized systems – often expressed as “algorithms” or “code” – seem to be organizing our lives and opportunities without our explicit participation, and seemingly outside of our direct control”. This trend is likely to continue as companies are increasingly using algorithms to better serve customers and their needs by relying on algorithmic knowing in their decision-making processes [3]. While the idea of capturing customers by measuring them is not a new phenomenon, possibilities have grown due to recent advancement in how data can and is being processed [4].

In the context of “food organizing”, we have witnessed a complete shift of how food is made available to customers. Algorithmic technologies have radically transformed the practices of food retailers as explained by the following statement of a consultant in the grocery-retailing field:

“Instead of retailers choosing their ranges from products available, the data started flowing to the opposite direction. The needs of customers are now reflected directly onto the suppliers and producers.”

In particular, the introduction of customer loyalty programs has radically changed how data is being

gathered and what kind of data companies gain access to. Whereas food retailers used to collect data on what consumers buy (‘what products are sold’), they now collect data on the how’s of purchasing by combining diffused and distributed data and by analyzing the interactions between purchasing behavior and other observable information. Collecting customer data has become the norm since the British retailer Tesco introduced the first customer loyalty program in 1995 [5]. The central idea of these programs is to organize food selling more effectively and to enhance customer experience by responding to market demands [6]. Today, the way food is brought into consumers’ shopping bags resembles a just-in-time endeavor, and data and information are the new “power” houses as argued in a recent Food Logistics article:

“In today’s omnichannel retail environment, consumer-focused retailers meticulously monitor everything from transactions and demographics to what people are saying in social media circles. Information is power. It is essential to survival.”

In contrast to the attention that customer data attracts in practice as well as in marketing research, theorization and detailed empirical investigations focusing on how algorithms and big data have impacted and are consequential for the organizing of food are rare. So far, research interested in the role of big data in the retailing business has revolved around questions on how to best design customer loyalty programs in light of profit maximization and effectiveness [6], its impact on marketing practices and on consumers studying ethical concerns [7], questions of well-being [8], or governance aspects [2]. Research on the organizing of food more broadly has for example focused on the increasing economization and financialization of the global food market [9] [10], changes in food consumption [11], or questions relating to labor and quality in food markets [12].

To shed light on how food is organized from an organizational perspective, we study the introduction and spreading of algorithmic technologies drawing on data from the UK food retail market. We are particularly interested in how algorithms have changed the scene – moving from a focus on products to customer behavior to data analytics. Theoretically, we draw on a performative perspective on technologies and thus a practice-based understanding of the recursive interaction between people and technologies over time [13] [14].

1. Wall Street Journal, “Why Software Is Eating The World” by Marc Andreessen, August 20, 2011

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Studying the generative character of algorithms in the organizing of food, we explore how algorithms have empowered consumers and promoted their preferences while, at the same time, turning the sourcing of food from the purchase of a valuable good into a simple transaction. Our paper, consequently, focuses on how algorithms are perceived and lived by food retailers and how this has changed the nature of food retailing in the UK over the last 20 years.

The paper's contribution is twofold. First, by zooming in on the use of algorithmic technology in the food retailing business, we shed light on how food has become heavily technologized over time. Examining the agentic power of algorithmic technologies in the organizing of food adds to our understanding of the generative and transformative nature of technologies [15] [14]. The particular focus on big data and algorithmic technologies contributes to how such technologies are changing the way organizations function and it points to the challenges and opportunities that lie ahead of us [16] [3]. Second, our study highlights how food is turning into a simple transaction that is being dealt with. This adds to current research on how food markets have become increasingly driven by financial and economic considerations [9].

The paper is structured as follows. The next section offers an introduction to the rise of big data and algorithms in organization studies and positions our research in the broader discussion of technology-in-use and its transformative power. After a brief account of the methodological choices that drove our data collection and analysis and a chronological overview of customer loyalty programs in the UK, we present the empirical findings of our study. We do so in the form of narratives with interwoven interpretations that elaborate on the changes that food retailers have undergone and how the increased use of customer data has shifted the focus from (food) products to customers and the best use of data. This is followed by an interpretation of how it becomes increasingly unclear who is in charge of the process – technology or management. To conclude, we discuss how algorithmic technologies have led to the technologizing of food and turned food into a simple transaction good. We conclude the paper by providing a set of key implications for future research as well as for practitioners.

2. Theoretical Background

2.1. Algorithms and Big Data: origins and meaning

The origin of big data can be traced back to the 1940s and the idea to quantify the growth rate in the

volume of data as well as the growth of scientific knowledge. When Price coined the “law of exponential increase” in data availability, discussions emerged on the limits of storing capacity as well as of human capacity to absorb and make use of the data collected. While the focus has since remained on issues of data storage and use, the notion of big data became increasingly prominent in the early 2000s when the computational capacities resulted in the development of many new methods in data analysis [18]. These analytical methods together with the ever-increasing amount of data have led to a vivid discussion in and beyond the social sciences on whether big data is the biggest innovation in computation in the last [19] decade.

Technically speaking, the term ‘big data’ refers to technologies, systems, practices, methodologies, and applications related to the acquisition, storage, integration, analysis, and deployment of massive amounts of diverse data to support business decision-making [4] [1]. The switch from analog to digital data, coupled with better technology and the advancement in analytical methods, has triggered an evolution in measurement that is “as profound as what the microscope did to biology and medicine” [20] and provides competitive advantage to firms through enabling higher efficiency, productivity and innovativeness. According to Gartner's global CIO survey, customer service, marketing and sales are the top drivers of big data initiatives, and half of all surveyed firms indicated customer-centric outcomes as their top priority. Specifically, the combination of machine learning tools and the willingness of consumers to share personal information through different channels, generates customer insights that were previously not available [22]. The analysis of finely grained data helps identifying subtle trends and patterns in individual customer attitudes and behavior and enables firms to not only knowing their customers as a demographic segment but to understanding them as individuals.

From an organization studies perspective, big data and its underlying algorithms impact how organizations run and optimize their processes, do business and secure profits as well as how they organize and manage more broadly speaking. As summarized by Constantiou and Kallinikos [16], “the developments with which big data is associated establish a new and distinctive context for data generation and use” – moving from types of data to their usage [23]. Accordingly, algorithmic and data-driven management challenges many assumptions by changing the relationships between organizations and their workers, between organizations and their customers and stakeholders, and between organizing and what is being organized.

While these relationships start to attract more scholarly attention, empirical research is still scarce

and big data remains a practice driven phenomenon [24]. Indeed, the existing research focuses on challenges that the use of big data creates. For example, Sivara-ja et al. [25] distinguish challenges related to the characteristics of the data, to the analytical processes, and to managerial decision-making. Besides the question of how to best make use of algorithmic technologies and how they are changing business and society, several scholars stress the importance of using big data as organization and management scholars [24]. One context where we see an increasing awareness of the potential of big data is in solving societal and environmental issues [3] [26]. This literature relates to our interests in the changes the organizing of food has undergone and how food retailing has become algorithmic.

2.2. Algorithmic technologies-in-use

Whereas the discussion about big data and algorithmic technologies is rather new, questions about the role of technology in organizing are well-established [28]. The mainstream view has been that technology is an exogenous factor that forms the basis for human activity, and ultimately for social change and, as such, technology has been conceptualized as a fact or stable entity. However, differing views have also shed light on the generative and transformative nature of technology. Most prominently, Science and Technology Studies (STS) have provided ample evidence that new technologies do not enter the world ready-made [29]. Rather, they are interpreted and appropriated by relevant social actors within their specific context and within existing practices [31].

The shift of attention toward social actors, and to what these actors do, has led to interesting insights. Orlikowski [13], for example, shows how technology and actors change and adapt to each other in a reciprocal way. Using structuration theory, she recognizes the situativity and the role of agency in these mutual constitution processes [30]. Barley [15] in his study on the engagement of different actors in two separate hospitals with CT scanning technology found that radiologists and technicians used the newly implemented technology differently, leading to distinct structuring dynamics and power relations. Following these accounts, several scholars have stressed the importance of addressing technology without giving ontological priority to either social or material aspects and instead focusing on their entangled and performative nature [27]. In this view, non-human and human actors are considered mutually constitutive in their unfolding and thereby generative and transformational [32].

Currently we are witnessing how big data – as so many technologies before – has the potential of changing the way organizations function. And while the data

revolution is real, we are still making sense of its consequences for organizing. The question remains open whether the ubiquitous use of algorithmic data is just the latest technology of which we can look at the consequences or whether we need new theories and methodologies to approach the phenomenon. While this paper focuses on how food retailing and therefore food as such have become algorithmic, big data is so pervasive that it is hard to grasp its full impact on society. Nevertheless, the use of big data seems to be the incorporation of what is meant by socio-material assemblages [33].

2.3. The research question

Algorithmic technologies represent a challenge to food retailers and other organizations alike. Whereas new organizations often naturally build on algorithmic technologies, established companies are increasingly integrating them into their existing business practices. The increasing reliance on technology and data availability stands in contrast to the mantra of food retailers to continuously enhancing customer experience. The objective of this paper is to zoom in on this encounter between food, data and customers by studying how the introduction and use of algorithmic technologies is perceived by those responsible for its implementation and management within the food retail business. Hence the question that this paper sets out to answer is: how does this encounter unfold in practice?

3. Methodology

3.1 Empirical context

In recent years food has received increased attention in different disciplines ranging from sociology, studying for example labor and food quality in light of globalized markets [12] or current changes in food consumption [11], to economics focusing on the role of capital in transforming the food industry [10] [34], to environmental studies interested in topics such as environmental change [35] or food waste [36]. Organization and management studies have far less embraced the topic despite the many paradoxes, problems, and potentialities associated with its organizing. In this paper, we are particularly interested in the increasing use of algorithmic technologies in managing customer data by food retailers that has transformed the way in which food is organized today and will be organized in the future. This change in practices has led to the creation of new processes, identities, and cultures on an organization-specific level and finally resulted in a more field level transformation.

The case of UK food retailing provides a particularly interesting empirical setting as it can be considered the frontrunner in this transformation. UK retailers have embraced the technological change early on and can today be considered as the space where decision-making processes of most companies have, to a certain extent, become embedded in customer data analyses. As a result, the focus of food retailers and suppliers has shifted at the field level from products to customers with different loyalty programs operating as vehicles for change. The transformation was initiated by Tesco in 1995 when it launched its Clubcard [5]. The launch arguably provided Tesco with a valuable edge that was instrumental in steering the company into new profitable business areas, forcing the other retailers to follow suit after. After the exploratory phase during which computing power limited the use of data, the focus soon shifted on its exploitation, not only by the retailer, but throughout the supply-chain. Finally, we saw the phase during which several of the data analyses became automated by algorithms and were thus embedded as drivers of change within the organizations. During these phases of development, retailers and suppliers have shifted their attention from products toward the total customer experience, the so-called end to end journey from processing the raw materials to sourcing the product to the end customer and by taking into consideration the customer service, the speed of the service, inventories, waste. Currently customer behavior is seen as the key driver of development, with data being automatically collected and analyzed at every touch point (store, app, website, contact center, email and social media) in ever greater volumes.

3.2. Empirical approach

From 2015 to 2017, the first author was participating in a government funded research project on the digitalization and use of data in the UK grocery-retailing sector. For the purpose of creating an understanding on the field-level changes, extensive amounts of documentation from company archives and public sources were collected and analyzed. Further, the research team ran workshops and conducted interviews with people working in the sector. Building on this work and for the particular purpose of this paper, we conducted 13 additional interviews with managers and senior executives from all the major companies operating in the UK retail market. In choosing the interviewees, we particularly focused on informants who have been closely involved in the introduction of the use of customer data and its impact on the offer of goods and services.

Since we were interested on how data has changed the processes, practices and values related to food, a

qualitative inductive approach seemed appropriate [37]. We designed a list of semi-structured interview questions that were used throughout the interviews conducted. We prompted our interviews to reflect on the meaning of data in everyday life, how its use had changed everyday routines, how it challenged the established identity and culture of their organizations, how this affected people and organizations operating differently, and how the customers reacted to it. The interviewees were asked to provide their views on the phases of change that the field and individual organizations have undergone, to explain and illustrate why and how the changes have happened, as well as to discuss the cause-and-effect relationships within the field. The interviews lasted between 30 minutes and 2 hours and resulted in approximately 14 hours of interview material. All interviews were transcribed verbatim. Once we had completed the inter-views, we compared them amongst each other as well as with the previously collected secondary data, and in cases of contradiction, sent the transcribed interviews back to the respondents for further clarification. The interviews provided a consistent picture and no major contradictions arose. We stopped the process after 13 interviews when no new insights emerged and we considered saturation of our particular focus to be achieved.

3.3. Analysis

In an iterative process during which both authors were involved, we analyzed and coded the interviews individually and cross-checked our readings, going back and forth between theoretical concepts and empirical data. We began our empirical analysis by thematic coding that enabled us to divide the past development into three distinct phases that were introduced earlier. Thereby, the data guided our narrative analytical approach during which coherent as well as paradoxical themes emerged. All of our interviewees emphasized the increased role of customers in the development of food retail and supply organizations as well as stressed the importance of customer data as a tool for managing and developing their organizations adapting to the changing environment. Paradoxically, the interviews also implied that the increased technology focus has caused organizational decision-making to lose leadership visibility while it has become embedded in technology and algorithms. Despite the fact that the data analytics were designed as a tool for management, it did not seem any longer obvious who was in charge of the system – the data or the managers. After identifying this paradox, we were able to further narrow down the scope of our analysis when investigating how the change has unfolded during the identified three phases. Our data does not represent a realist account but rather

an inductive narrative based on how managers and senior executives have interpreted the change and envision the future.

4. From focusing on products to customers to data

We will now present how our different informants view the changes that the retailing industry has gone through over the last 20 years and since the introduction of a systematic tracking of customer data. Looking at the three different phases in the development, we focus on how people narrate and interpret the impact of algorithmic technologies on the organizing of food. The final section of the findings focuses on how the increasing focus on data use and analysis creates a paradox of power or said differently leads to the question of “who is in charge?” – data or managers?

4.1. Phase 1 – Introducing customer data

In the mid-1990s, grocery retailers in the UK started to rethink how they had collected and used customer data. The real starting point was when Tesco introduced its customer loyalty card (Clubcard). The idea was to gather information on who their customers were, thus shifting the focus from product sales to who buys what, when, and where. This approach reflects Tesco’s motto at the time being: “No one tries it harder for the customer”. Before introducing customer cards and other means to track customers, the retailers had mainly looked at the sales and margins of products as well as factors such as distribution and weighted sales data in order to make decisions on what to offer. Asked about how data was gathered back then, one interviewee answered:

“Typically, a branch manager would sit down and have a monthly meeting or whatever with their boss, the Regional Head of Operations. They would look at the P&L, they’d talk about sales, they’d talk about wastage, they’d talk about pay, which are the kind of elements on the profit and loss account [...] but never about customers, unless you count sales as a customer measure.” (L)

As another interviewee (J) summarized, 20 years after the introduction of the Clubcard, Tesco had about 83 million club members despite the fact that there are only about 65 million people living in the UK. Whereas Tesco’s focus lied very much on introducing and using its Clubcard, Waitrose started its data collection by introducing a large-scale customer survey called “Measuring the Magic”. Historically focused on customer satisfaction and the in-store experience of customers, the survey replaced the long used “mystery

shopping” approach. One manager summarized how the change impacted the scale and reach of the available data at Waitrose as follows:

“We would assess the customer service experience via one mystery shopper coming in once a month against a set of criteria. We paid those customers, whereas now we are hearing from 30,000 customers a week.” (A)

The customer survey is still today a crucial means to gather information from customers. To keep them motivated in participating and thus helping to improve the service, Waitrose offers its customers, who are members of their loyalty card program, free coffee and newspapers. Nevertheless, the response rates are currently suffering and Waitrose has therefore started to make more use of its customer card as well as other initiatives that rely on algorithmic technologies. Customers can for example define ten products for which they get a twenty percent discount. In case that a customer never buys one of the chosen products, he or she is being automatically informed that it might be beneficial to change the personal picks including suggestions based on the shopping history.

We were particularly interested in what changes the move to algorithmic technologies has already entailed. What has been the reasoning behind this process? And how does the adoption of algorithmic technologies impact other work processes and practices within the organizations? Asked about what changed in how data is collected, several interviewees gave very detailed accounts on how they gather information through the use of different technological tools and how this helps in better understanding customers. They explained how we can see the way “customers interact with the propositions” (C) made by the retailers, or how the customers react to new technological offers. The Quick Check technology that allows customers to scan what they buy while walking through the store and just paying at the end provides a good example. One interviewee told us about a common way of how the technology plays out in the stores:

“She was an elderly lady. She arranged her bags in the trolley and then set off round the shop, going very, very slowly, very deliberately, scanning. [...] The reason she is doing that is because she doesn’t want to go quickly.” (L)

Ironically, while the technology was designed to provide the customer with a faster shopping experience and the retailers with a product-by-product path of the customer walking through the stores, many customers have used the technology to slow down.

Enhancing the customer experience was an important factor in many initiatives that the interviewees talked about. However, in providing details about what was happening, many accounts remained very focused

on the how's of data collection showing difficulties to link it to the impacts on the practices of the organization at large or on how things are done in individual supermarkets. Instead, many interviewees deliberated about how the data is not yet used as it could be. Evidence from our interviews, in some companies this might be due to the fact that the focus still seems to lie on how data is being gathered. In other companies, different algorithmic technology-driven initiatives seem to be done separately from each other, not yet allowing a strong integration of the collected data. One interviewee mentioned that he was "shocked at how few of these organizations really could explain the basic things they were trying to do" (C) and referred to how organizational silos prevented companies from gaining more insights from the data.

A third aspect that emerged from the interviews is that store managers reason differently than those working on the data analysis. The store managers often base their decisions on their prior experiences and their accumulated knowledge. In some cases, their intuition proves right as in the example of introducing a pager for certain counters that would buzz when your stuff would be ready. As one interviewee recapitulated the situation:

"It didn't prove successful. So we had customers say 'It didn't improve my experience' and store managers calling it 'clunky, adding an extra element to the process'." (A)

While this particular technology was supposed to make the pick-up process leaner, it got more complicated and thus also more expensive at the end of the day.

In sum, the different companies have access to a large amount of data, and due to the increasingly available computing power and the knowledge on how to learn from the data, to a pool of customer information that was out of reach until recently; or, as one of our interviewees who worked at Tesco in the late 1990s explained, the computers available at the time could only process "0.5% of the barcode level data" (F). The collected data would then have to be extrapolated to provide a general view on the behavior of customers.

4.2. Phase 2 – Working with customer data

As more detailed customer data became available and computational power increased, retailers were able to analyze a much larger amount of the data collected and to make inferences about previously hidden relationships. Based on the newly gained insights they began to develop so-called customer segmentation models, which were first based on geographic and demographic aspects and later also on behavioral variables. In a nutshell, these models divide customers into

groups according to their needs and preferences. When first introduced, this was a large shift from the product-based segmentation used up until then and it initiated a new era in which food retailers started to switch their perspective from a product focus to a customer focus. Based on the new segmentation efforts, retailers would then develop products and services that were believed to enhance customer satisfaction. With time, retailers gained a more detailed and nuanced understanding of their customers; a trend that has been further enhanced by today's technological opportunities through which they were able to provide more and more customized offerings. As one interviewee said:

"The biggest change that came about with the growth of data [...], is that you're now able to much more effectively connect their behaviors and attitudes." (D)

Another interviewee emphasized that, while the available information on customers is definitely useful for the retailers as such, it becomes even more powerful when used by the various actors throughout the supply chain.

The initial development of this new type of collaboration can once more be traced back to Tesco. The suppliers of Tesco became interested in the data that Tesco had and it was a turning point when retailers "start to try and get that data flowing through your supply chain" (M). One of the interviewees stressed that sharing the data very much changed the relationship between retailers and suppliers, which historically had been characterized by the leading question of "how cheaply" a retailer can get a product and, on the other hand, on how valuable a brand the supplier provides as this would enable the retailer to ask for a higher product price. One interviewee reflected on the development in the following way:

"I think what some of the pioneers in this area realized was that, despite the fact that they're always going to negotiate on price, there was actually benefit in working together because at the end of the day, it was a combination of the efforts that delivered the customer experience." (M)

In 2002, Tesco made a deal to allow their data analytics company Dunnhumby to give anonymized access to insights of their data to Fast-Moving-Consumer-Good (FMCG) companies. This enabled Tesco to work much closer with suppliers such as Unilever, Procter & Gamble, Mars, Heinz, etc. and to develop a common understanding of "how they thought about their insights" (F).

Several interviewees suggested that working based on the same data and shared insights was most impactful when it came to "new product development and around ranging and assortment" (F). For example, when an item was sold to a customer, a data stream

was created to inform replenishment and reorder functions. Sharing data with suppliers thus helped in further integrating the production, the supply, and the sales functions and made the influence of customer behavior more visible in the entire supply chain.

As we were interested in how this unfolded in practice and how it was beneficial for the retailers we asked our interviewees to describe the particular use of these data streams. For example, at Sainsbury's pretty much all of the suppliers now have access to customer behavioral data through joint ventures. While the suppliers do pay for data access, the benefit comes from the joint analysis and interpretation of the same metrics in terms of sales performance, which enables retailers and their suppliers to discuss about ways to increase sales and revenues not just for the supplier, but also for the retailer. To illustrate this relationship, one interviewee talked about promotions. For a very long time, retailers focused on promotions that often led to substitution behavior among their customers. If you have a special offer for Coke, you will sell more Coke but less Pepsi. The customer might buy a bit more because they positively react to the deal, but in reality "the retailer sells the same amount of stuff" (M). Therefore, what the retailers are increasingly pushing their suppliers to do is to design and fund promotions in such a way that these actually increase the total category purse rather than just the sales of a specific product while decreasing another.

4.3. Phase 3 – Data-driven decision-making

According to our discussions with the different interviewees, the most recent advances in the use of data relate to the automation of the processes such as collecting data and analyzing data. It seemed that the longer a retailer has worked with customer data in a systematic way, the more automated the processes became. While discussing the future direction in terms of data usage, one of our informants stressed that the services will and should be mainly embedded in algorithms:

"I think our viewpoint, my viewpoint, is that you should wherever possible be guided by how customers experience things rather than just how you happen to be set up." (F)

For him, algorithms that are customer-centric are the most reliable source for making decisions as they are based on customers' actions and not some random store manager relying on his "gut feeling" as another interviewee referred to it (J)

Another trend that rose above was the timeliness of the data. The majority of our interviewees emphasized the role of real time data. As everything needs to be done more efficiently, human agency is not anymore

considered to be the best way of providing this. As we were explained: "in order for retail and supply chain analytics to work effectively, companies need to have complete oversight over materials at every point in the supply chain" (field-note). To do this, businesses have for example recently leveraged automated data collection algorithms. This way, an organization can quickly and accurately determine where any given item is and divert it to the right location in real time according to customer needs.

One such example comes from online shopping. One of the interviewees explained that people often start an online shopping list and up to the day of delivery they add more and more items. However, one problem that retailers face is that customers buying online only buy what is on their list, while those who take a shopping lists to a physical store buy more products than they have on their list. With the help of algorithmic technologies, retailers engaged in developing ways to help customers not to forget things when they shop online and to provide them with inputs similar to what they experience in stores as one interviewee explained:

"What we did was we analyzed people who would made a big purchase online, and then within the next couple of days had been into a store to buy just one or two items with the idea that this would be an indication of the types of products that people might have forgotten." (F)

Ultimately, the idea is to provide the customer with a single experience that nicely integrates the advantages of physical and online shopping. At Tesco, this is today a small but appreciated service creating revenues and it is completely based in algorithms.

Another example is how retailers have recently developed analytic models that use for example weather data to properly stock store shelves. By looking at historical data on customer behavior and expected temperature trends, the business can accurately predict what customers in a specific region or area will want to purchase and then supply stores and locations accordingly. If warm weather is expected to come to an area after a particularly cold period, retailers will ensure that surrounding stores are well stocked with more barbecue meats and ice cream. Envisioning the future, retailers are currently exploring how to use all the available data. For example, phones have sensors that collect lots of data and that could in "theory be used to record customer data" (F). Or the fact that social media does not only give access to customer data but that customers are using social media in interacting with retailers. Certain customers "consider that if they tweet a dissatisfaction with Tesco" (F) it is the same then calling the helpline.

4.4. "Who is in charge?" – a paradox of power

Despite the fact that all our interviewees agreed on the fact that the perspective shifted from focusing on product data to focusing on customer data, our analysis reflects two apparently competing narratives. Most managers stressed that the use of customer data was nothing but the logical consequence of the fundamental transformation when seeking to manage the customer experience better. Among these interviewees, it was primarily seen as a powerful tool for the managers to improve their offerings. New technologies were seen as reliable and there was a big level of trust in what the data tells. Accordingly, they felt that humans should have a marginal role in the analysis of the data and in their arguments the main driver for collecting the data was “to optimize the proposition based on customer data” (H). The focus of this narrative emphasized the role of technology in empowering management in doing the right thing for the customers and the organization.

The counter-narrative focused on how the power and responsibility was shifted onto the customers as decision-making became embedded in the algorithms. The belief was that not only did the customers actions become a central factor in what was being offered but that this was so unconscious and uncontrolled that it could lead to unexpected problems. One concern was that customer behavior and the reaction become so embedded in the data analysis process that it is no longer visible to managers (F). According to the counter-narrative, store visitors are no longer customers but rather retailers and the algorithmic technologies have morphed them into co-producers and co-suppliers who participate and share responsibilities on production and supply decisions.

These paradoxes indicated that there is certain level of unawareness on who is in charge of the system. For example, one of our interviewees stated that “a customer could never imagine what kind of process a single click online or a beep at the till will start” (field-note). In that sense, food became algorithmic or gets lost in algorithms those responsible are so much focused on how to advance the analytical processes that technologies are “eating” their attention. One consultant talked about how retailers are so taken by how to best analyze the data that they do not anymore ask the business-driven questions.

5. Discussion

5.1. Technologizing food

Our narratives indicate that technology and algorithms in particular have played a key role in trans-

forming the field of food retailers. After the introduction of customer data analytics, computing power has developed immensely and enabled completely new ways of monitoring and organizing the businesses. Whereas the initial challenge related to the capacity of computing power and the ability to reliably extrapolate data in order to provide an overview of the market, the challenge today relates to the combining of vast amounts of data from a variety of data sources to understand an individual customer. During this same journey, data designed for human decision-makers has been transformed into a format for data-scientists and computers. As one of our interviewees explained: “Just because of the scale of it and the complexity... because it’s not structured data, it’s semi-structured data, you couldn’t do it in Excel” (F). Consequently, data has lost much of its managerial transparency and technologized information exchange. Algorithms now provide retailers and suppliers cheaper and faster means for responding to the changing customer needs. As one of our interviewees explained in regard of home delivery services: “So we have algorithms that help try and free up the number of slots for grocery home delivery, we’re trying to optimize things like making sure that I can get that delivery van to you in the quickest possible way” (J). Customer preferences have started being mediated through digital interfaces and algorithms, subtly restructuring and automating food offerings.

Focusing on how algorithmic technologies have changed the nature of the food retailing business enhances our understanding of the generativity of technologies [15] [14]. While in many studies focusing on sociomaterial aspects of organizing we can see how humans and technologies are mutually constitutive, technology seems to be playing a major role relegating human agencies to the boundaries. This said, the particular focus on big data and algorithmic technologies contributes to our understanding of how they are changing the way organization function and what challenges and opportunities lie ahead of us – for example for strategy [16] or how to foster sustainable developments [3].

5.2. Food as a transaction

Simultaneously food has become increasingly commodified. Due to technological advances, it has largely become treated as a mindless transaction in the market. Consequently, we have moved further and further away from food being considered as a valuable necessity of life, a source of nourishment, and a cultural feature of society [38], and towards food as any other transaction that companies and their customers conduct. The processes related to the production of food are no longer the only, or even the primary, determi-

nants of food distribution or consumption. As we have shown, the customer focus has led to a situation where all products need to be available at all times. Accordingly, if the customer wants a product, it is shipped from any distance. Distances between the production and eating of food have increased within the global economy. And it doesn't seem to be only the physical distance that food travels in the global supply-chain networks, but it is also the lack of awareness of the conditions of its production as well as the power of who makes the supply decisions and on what basis, as discussed earlier.

While food has become a transaction, it has simultaneously emphasized the financial aspects in food supply increasing the vulnerability of certain countries and individuals [9]. Such financialization of food has distanced producers from customers by stretching the scope of transaction between them [10]. This has furthermore increased the distance between the fundamentals of supply and demand with respect to the pricing of food, such that food is now determined as much by the overall financial measures as they are by the variables that determine the success of its production. These distances seem to have separated the different functions of food supply in our considerations of paradoxes related to food. However, as discussed in our narrative, the same customer data drives change throughout the whole supply network. Therefore, it seems somewhat insufficient to analyze food sales, supply or production processes, patterns or problems in our quest to understand the societal paradoxes related to food. In contradiction, our narratives support the call to see production, distribution and consumption as integrally embedded.

6. Conclusions

6.1. Implications for future research

Our paper gives rise to a set of questions that may be useful for investigating the role of food under the condition of transparency, automation and interaction with its environment, as well as the influence of technologizing in specific contexts.

In our narratives, we have observed a transformation empowered by new technologies and the advent of big data. Despite the fact that the change has to a certain extent influenced every organization operating in the field of UK grocery retailing, the responses within the field have varied a lot. This has furthermore provided some organizations with a competitive advantage whilst it has mainly accrued costs to others. Our research indicates that transformation is not provided solely by the implementation of the best technol-

ogies or a digital mindset but rather, a combination of several variables. In order to understand the direction of technologizing of food in specific contexts, we need further interpretative inquiries into the mediation of technological innovations into practice, and how these mediations change both in the process.

Second, our study invites further reflection on technologies under the conditions of increased transparency. In the age of big data and algorithmic management, the nature of organizing is changing. Cases on the influence of technologizing and other interaction with organizations and their environments, have traditionally considered data as a source of power for its owners. Our paper adds to this conversation by an illustration, where technology has actually shifted power and resulted in a situation where its distribution is unclear – whether the power is on those the data is collected from, on those who own the data, or on algorithms that mediate changes into action. Our study highlights the importance of understanding the dimension of power when implementing new technologies – algorithmic technologies in particular.

Third, we have explored how algorithms have empowered customers and their preferences while at the same time turned food from a valuable good into a simple transaction. Literature has typically focused on how big data can lead to sustainable innovation (e.g. food waste, supply chain efficiency, etc.) and can thus be seen an opportunity. For example, Etzion and Aragon-Correa [3] predict that sustainability reporting will become increasingly data driven, employing a wider array of real-time, data-rich entryways into exploring organizational sustainability performance. They argue that big data is likely to generate more opportunities to get more environmental and social data from firms and simultaneously to gain new opportunities. In contradiction to these overwhelmingly positive suggestions, our study illustrates that such transition may also lead to rather contrary outcomes. Therefore, we argue that there is a lot of space for further research to understand such transitions as well as the dimensions behind the surprising outcomes that may accrue.

6.2. Implications for practice

Academic literature promotes a transition towards digital in which data serves as a tool for making boundaries disappear. As described earlier, the tone of the academic calls seems to be strongly positive and mainly discusses the many new ways of creating efficiency and capturing value. It is often considered that economic efficiency is increased when mediated by technology and algorithms. Our study serves as a reminder of the other side of things and suggests considering more carefully about how data management can

be mediated. While technology plays a significant part in such mediation, it is just one variable influencing the outcome. Technology needs to be complemented by reflections from human agencies and values that provide the boundary conditions for future development. It is important to be aware that there are several challenges associated with these transitions, as well as in the potential issues that they create – particularly in areas such as food that provide us valuable necessities of life.

7. References

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