Ratchet Effect in the Food Delivery Systems

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Abstract:

The ratchet effect—an economics and behavioural science concept—and the modern food delivery system are examined in this article. The ratchet effect occurs when transient increases in consumption or service levels become permanent expectations, making it hard to return to previous levels. After the pandemic, consumer demand, platform operations, labour dynamics, and service demands have increased in food delivery. The data shows how convenience-driven behaviours, app-based incentives, and marketing drive faster, cheaper, and more widespread delivery services. Gig workers' welfare, urban infrastructure, restaurant economics, and sustainability are affected. The study closes with legislative and technology initiatives to reduce negative externalities while maintaining service quality and accessibility.

Keywords: Ratchet Effect, Food Delivery Platforms, Consumer Behaviour, Gig Economy, Platform Economy, Service Expectations

1. **Introduction to Ratchet Effect**

Food delivery systems lead urban infrastructure development with their unique growth towers. Such systems present new and distinct issues, such as maximising rider and restaurant satisfaction, reducing delivery time, slowing system congestion, and minimising delivery distances. Each of these goals depends on organising a single delivery, which requires selecting a rider, restaurant, delivery route, and pickup time. Restaurant and rider decisions, delivery speed, restaurant preparation and travel time, and delivery distance are all uncertain. These risks might cause cancellations, time-outs, consumer complaints, and congestion during a planned delivery. Replanning is needed to fix these issues and restore the intended delivery. Unfortunately, the random events that trigger replanning are unpredictable, resulting in an unmanageable, irreversible increase in replanning requests, which disrupts the food delivery system.

Future replanning requests serve as a ratchet to change current anticipated delivery (Denisov et al., 2008). It filters a few reevaluable prepared deliverables. This ratchet process usually produces scheduled deliveries that require rigorous replanning, creating a positive feedback loop. The internal structure of a delivery also affects its trajectory because planning errors and replanning procedures are time-consuming and spatiotemporally asymmetrical (Grossert et al., 2016). Highway traffic, food delivery, ride-sharing, and other human-society systems use continuous real-time graphing of multiple execution variables to identify affected and unaffected sub-processes. Resilience-based planning and management of complex interacting processes require understanding feedback.

2. **Overview of Food Delivery Systems**

As urbanisation and digitalisation have revolutionised food consumption, food delivery systems have changed too. Urban food delivery requires a complex logistics infrastructure. Due of its rapid growth, food delivery systems are attractive academic and managerial topics (Klumpp & Ruiner, 2019). Similar services are used worldwide, notably in Shanghai. This study maps and characterises a Shanghai food delivery system using delivery data. Clusters connect transporters and providers for fast, short-distance delivery. The analysis of system structure, dynamics, and cost flows shows that a food delivery system is a milk-run-like multi-source, multi-to-multi-depot, time window delivery problem with a suitable infrastructure and an affordable cost distribution mechanism.

Utilisation and time analysis divides food delivery system processes into order acceptance, on-demand delivery execution, and order fulfilment. When a customer orders food, a transporter who can deliver it on time is chosen and assigned. The carrier delivers the order to the customer within the time restriction after picking it up. Customers receive their meal delivery order when the deliverer comes. Delivery data is then categorised by food consumption sequence, revealing neighbourhood food preferences and templates.

Hierarchical modelling is used to examine food delivery consumption on weekends and weekdays from 11:00 AM to 2:00 PM and 5:00 PM to 8:00 PM to understand delivery system variation. Consideration of the modification and transfer of an urban food delivery system across multiple time thresholds emphasises the potential to better understand system operation and improve system design or control. Hierarchical modelling shows and interprets food patterns in food delivery histories over time thresholds, demonstrating reasonable food consumption. The investigations improve deep and comprehensive understanding of food delivery system operational patterns and regulations, which is essential for modelling and optimising the system.

3. **Food Delivery History**

There were no food websites, online ordering, private “e-mail” communication, electronic bank accounts, or portable mobile phones in the 1990s. Food ordering was rare and technologies were not widely available. The first decade of the millennium saw the internet lose its food delivery industry, and everyone had food. Building competencies, installing infrastructure, developing new technologies including delivery bikes, GPS systems, and a website, and eliminating personal autonomy and interests were necessary (Klumpp & Ruiner, 2019).

The internet changed everything. Restaurants have printed menus on the home page and pre-paid online ordering. First B2C online diner and pizza shops appeared in 1980s. No digital delivery age, mass customer service, delivery now! Cracking China was difficult. Internet and technology were unavailable, infrastructures were underdeveloped or nonexistent, skills were insufficient, private and individual sovereignty was utterly forbidding, and market segmentation was limited to the wealthy elite in 1995 and beyond.

However, these changed in the 2000s or later. Modern technologies are mainstream. Restaurant dining with someone is no longer scary. There are delivery boys on bikes, curried rice and chicken hotel menus are all over the street, and most importantly, the iPhone App store has a button called Apple that searches for the first result. iPhone App orders online, eateries in the three-kilometer neighbouring region are listed with photographs, delivery time, fifteen other

males ordering, fast, hot, and tasty, better than eating in. After payment, the order butter churns out and the big picture is stunning one minute after the “Order direct to restaurant” appointment.

4. **Theory of the Ratchet Effect**

Consumer welfare and strategic thinking theories behind the ratchet effect. Service quality and social wellbeing are the focus of consumer welfare theory, which incorporates the perceived network effect into equilibrium analysis. Service providers represent consumer behaviours like quality decisions and price-setting as a simultaneous game and reach equilibrium under a rigorous common knowledge assumption. Strategic thinking theory integrates human agents' cognitive abilities into game theory and examines how social learning shapes expectations. Based on evolutionary game literature, instantaneous observation-based stochastic approximation learning schemes and generic logic-based static and dynamic best response adaptation schemes are realised through empirical expectation adaptation research.

Methods based on environmental descriptions, models without agents, and deliberative multi-agent frameworks in which agents form environmental beliefs have been used to study the ratchet effect. Classical approaches are intractable when multiple interacting agents are involved due to large dimensions and non-linearity, and when stakeholders have limited environmental knowledge due to idiosyncratic experiences' different degrees of observability.

A novel theoretical framework captures the ratchet effect while maintaining derivation tractability and specification generality, unlike the previous approaches. A rational and stationary environment model, a basic agent model with restricted processing, and a semi-empirical agent model comprise the new framework. Enviromodel is a concise mathematical representation of joint distributions of a population of agents' previous domain generated using machine learning. The basic agent model defines agents that process environment information and act. The semi-empirical agent model directly approximates enviromodels based on agent experiences, avoiding model formulation. In the semi-empirical agent model, agents' behaviours are critically quantified and represented by a random sample of the environment, causing the ratchet effect.

5. **Mechanisms of Ratchet Effect**

Besides these approaches, quantum and classical optics systems have shown the use of protocol global phase changes to control the ratchet effect. In the latter situation, a nonlinear system can tune initial circumstances on system output (Grossert et al., 2016). Below, we observe that these choices lead to more complex phenomena, including the \textit{double ratchet} effect, specifically a bimodal output distribution.

Ratchet transport in one-dimensional (1D) overdamped systems subjected to spatially asymmetric or $3D$ temporal sinusoidal disturbances has been extensively studied during the past two decades. After pioneering work on ratchet mechanisms in mechanical and transport systems, quantum optics systems including cold atom, BEC, and photonic lattices have been developed to study ratchet effects in quantum systems. Recently, qubit-based quantum ratchets containing Rydberg atoms and superconducting qubits have been realised.

The ratchet phenomenon generates directed transport without net forces. The symmetry consideration can explain the complete physics with a small set of system characteristics. In

various domains, the ratchet effect has been examined and believed to occur in many circumstances. The rattling of particles in fractured clay soil gives an idea of how it occurs. At a microscopic level, rough surfaces exhibit ratchets, a group of neighbouring dislocations or impurities with a specific length scale. Initially, classical ratchets operated solely on potential fluctuations induced by Brownian motion of the barriers.

The notion is fluctuations between well-defined values with an invariant average. The old analogue of hot sterling ratchet your gain while the environment cools.

5.1. **Positive Feedback Loops**

The ratchet effect begins with positive feedback loops. Average delivery time should match current delivery time in a well-functioning food delivery system. In contrast, rider availability breakdowns cause a positive feedback loop that worsens delivery times. This algorithm calculates how much a rider availability breakdown affects system deliveries.

After a breakdown in rider availability, the time to catch up is measured as $D^* - (D + \Delta D)$, where D is the time taken to complete the delivery before the drop, D^* is the steady state value of the delivery time after the change, and ΔD is the difference in delivery time before and after the drop. This positive feedback loop might cause substantial food delivery system deterioration. This robust, widely used mechanism requires only one system model assumption and is applicable, which is vital for practical applications.

This work quantifies and characterises this effect in a simple stochastic model to examine how the positive feedback loop reduces basic food delivery systems from the rider's perspective. With a sequence of steady states, a stochastic model of riders quitting is created. The self-regulating safety net in this model ensures that riders are returned based on both average delivery time and acceleration to prevent runaways. Due to rising rider rates, the positive feedback loop changes the average steady state delivery time. Thus, it captures many key aspects of day-long crashes in practice. Numerical simulations reveal how model system emergent states, with mean time remaining and diverging variance as the feedback loop tightens, mimic real systems.

5.2. **Threshold Impact**

Second, thresholds that firms must exceed to respond produce a ratchet effect. Firms respond most disproportionately to rising thresholds. Two states of the world are assumed for a firm: poor, where capacity is c, and excellent, where capacity is $c^{**} \geq c^* > c$. By raising capacity from c to c^* or c^* to c^{**} at prices p^{**} and p^*, the firm expresses demand. Costs are output losses and presume predictable costs. The firm signals when prices rise in good times. It can do this by earning the high price and increasing capacity.

Once output capacities are enhanced, costs cannot fall unless a firm departs the market. The good firm expects that increasing capacity when prices are high will affect future pricing probability. After moving to a lower capacity, the worst situation for a firm is that in the next era, the bad firm climbs up and signals production reduction by raising capacity. Alternatively, it may game higher capacity. The value of an exit or price reduction for threshold investments is determined. Greater demand alters supply, as explained. Hierarchical Threshold Model adjustments also work. The sequentiality of acts and company value may not decrease.

A firm will lower output in response to price cuts, which puts it at a disadvantage. The price indicates surviving enterprises switching from low design thresholds. One scenario explains why word pairs and games have no price reduction. Demonstrations with the ability to host functions reveal that population-based models are edge-reversible. Most typically described is the ratchet effect problem. High operated capacity over state spans are more robust for such a corporation in good times. The thresholds must be low enough at the start of activities to prevent population counteractions to shocks.

6. The Impact of Technology on Food Delivery

Technological advances are transforming food delivery. Due to societal advances and information access, customers are more quality-conscious and demanding. The consumer products industry has grown, and clients anticipate cool drinks, fast dining, and safe deliveries (Jaykumar, 2018). These changes are driving food delivery networks to create new transportation methods (Klumpp & Ruiner, 2019). However, delivery system language is expanding, and food mobility vocabulary has stalled. This motionless ratchet pump requires multidisciplinary analysis of system structure and fresh models across industries.

Fast food delivery systems have created a food delivery culture that is spawning new delivery concepts and food supply networks. Information technology has revolutionised urban food delivery and order processing. On-demand delivery is being used for groceries, flowers, apparel, fast food, and beverages. This tendency is projected to continue, reflecting a global shift towards speedier logistics. Food sourcing origins for on-demand delivery systems are being recognised at higher levels, and economic, environmental, and social performance factors are under pressure to be included throughout logistical systems. Challenges are rising as food industry logistics participants compete. Food delivery companies must serve better in a competitive market. Failure to adapt to changing markets and client expectations will certainly lead to their demise.

Introduce and model new technology-driven food delivery system improvements. This will show how much and how quickly the food sector must adapt to survive. The problems and opportunities of entertainment systems in food supply chains, early development of novel food delivery models, and logistics organisation improvements are also explored.

6.1. Mobile apps

Modern society is interested in mobile apps. In recent years, these apps have gained popularity significantly. These apps are becoming essential to everyone. Mobile apps connect all walks of life. It covers business, communications, education, health, fitness, banking, etc. (Akai Nettey, 2018). The change in working circumstances, fast living, and workplace stress has changed modern people's mindset. People gladly accept these technological improvements and their benefits. Mobile health and fitness apps are doing well. Health and fitness are becoming major concerns. Stress, blood pressure, heart attack, diabetes, and obesity are spreading like banyan branches. Maintaining weight loss requires measuring food consumption. Proper food consumption requires nutritional knowledge. Currently, food-intake apps are difficult to use. Using a camera to capture food and display meal details is not been considered in applications. The suggested camera-based food intake measurement mobile app recognises meals based on food images. The user sees the processed output and food nutrients.

The camera-based mobile app captures food images and gives text-based meal data. The output includes the food name, category, and nutritional value. The projected nutritional outputs are calories, protein, fibre, carbs, and fat. Android powers the app's front-end. The image is processed in MatLab. High-quality Web Services combine work. The proposal involves creating a camera-based food intake app for smartphones. Technology has enabled improvements in all fields. Food Delivery System is one example. Food Delivery System is the delivery of vendor-prepared food to customers. Mobile meal delivery solutions are popular today. Current food delivery smartphone apps are known for their influence. New on-demand food delivery systems have evolved in reaction to the success of enterprises that use food outlets as vendors, delivery agents, and bulk consumers. These applications connect merchants and consumers/users via an automated platform while excluding the food delivery system owner.

6.2. **Data Analysis**

Businesses are responding to massive risk assessments as consumers' expectations change in meal delivery. Globalisation of tastes, urban food transit, new dietary habits, and competition between meal delivery services and food shops using delivery services are raising customer expectations substantially. Consumers increasingly purchase multiple food sources and want fast delivery, especially fresh food. Fast-moving needs create a ratchet effect that affects customers, businesses, and logistics, increasing food travel in cities. The delivery challenge among food delivery service providers is the subject of this research.

Under the labour and health difficulties produced by major swings in the work cycle and logistics intensity of food delivery, the delivery challenge increases the number of cars, which increases emissions, noise, air pollution, and urban congestion. A model-based reinforcement learning approach that learns sophisticated route distributions for multiple vehicle food deliveries addresses delivered distances, costs, and customer preference satisfaction while ensuring fair and timely delivery is proposed to address this complex issue. This method relies on digitalisation to integrate consumer and vendor data and respond quickly to changing needs. Experimental investigations show that time series predictions can be made, and model-based assessments show knowledge capture and sharing benefits.

Significant hurdles remain to a successful practical application. To gain business operators' and behavioural managers' trust, model-based agent techniques must be generalised, informative, quick, and intelligible. Capturing and conveying qualitative characteristics of observed patterns is crucial. A hybrid agent paradigm that combines statistical and mechanical models and simulates their interdependencies could solve this problem. Second, established predictions and learnt routing behaviour may lead to suboptimal outcomes, requiring delicate consequences against deviating behaviours or preference considerations.

7. **Food Delivery Consumer Behaviour**

The study examines Indian food delivery app consumer behaviour. Food delivery aggregators' speedier food delivery methods are convenient for time-pressed folks and those who prefer home-cooked meals in tough times. However, client happiness and behaviour are complex delivery app attributes that must be assessed. To study meal delivery consumer behaviour, restaurant diversity, food packaging quality, application design, and user interface were identified. 300 meal delivery app users from various Indian states were surveyed quantitatively. Restaurant variety increases meal delivery app pleasure, according to statistical studies.

Customers like and use the applications when they find different restaurants. Premium and durable food packaging methods that maintain food quality and temperature improve consumer satisfaction with meal delivery apps. Food provided in good packaging remains a customer choice, whereas poor packaging compromises freshness and leads to alternative choices (Jadhav et al., 2023). Application design and user interface favourably affect food delivery app consumer behaviour. A user-friendly design interface and easy navigation enhance app usage satisfaction and user numbers, according to consumers. Higher usage frequency improves customer behaviour, but difficult app attention inhibits use. Consumers want food delivery apps to revamp layouts, structure collar icons, lower text size, and improve font and button contrast labels to improve interface navigation. Food delivery app user happiness is influenced by user interface, restaurant variety, and food packaging quality. However, food delivery companies could improve application design and user experience to retain customers based on qualities and improve customer happiness.

7.1. **Change Preferences**

Analysing public meal delivery preferences is a departure from the preceding section's focus on delivery firms. Food delivery firms use these preferences more than traditional restaurants, therefore they are less likely to alter. Consumers anticipate new features from meal delivery businesses despite its long history. One of the biggest changes is restaurant liberalism. A traditional restaurant in one location is usually better than several in separate locations. As behaviour evolves from ingrained to rational thinking, aberration-seeking may not be adequate to preserve market shares. This adjustment will increase demand fluctuations.

New physical distance-related restaurant choice characteristics include consumption-purpose relevance, social distance, and food kind. Conventional restaurants have these factors, while meal delivery services do not. Such expanding needs suggest two food delivery system options: a combine-type system that delivers meals from many restaurants to the home and a consumption-focused system. If these restaurant choices in conventional ones can be reflected in food delivery systems, then popular meal delivery systems may not last forever.

Thus, food delivery firms choosing restaurants to deliver strengthen popular meal delivery services. Current meal delivery firms are universalistic; customers choose from all registered eateries. To limit dining options, recommended restaurants could be limited to two or three based on basic parameters. Restaurant selections are limited, but food delivery options are not.

7.2. **The Social Media Effect**

Media platforms are useful for advertising, consumer connections, and scalable intervention operational contracts. Social media, with over six billion users, gives organisations valuable customer data and a direct lead generation channel. Food delivery companies might sidestep segmentation by targeting specific clients during incremental marketing launches in growing cities. Customer input on social media ranges from praise to criticism, unlike traditional media. Digital networks also allow food delivery companies to promote and make money with billboards. Online feedback is a digital signal with near-infinite resolution as consumer preferences change. Food delivery services can change prices or enhance restaurant commissions based on such feedback (Klumpp & Ruiner, 2019).

Small platform changes slow new implementations. Providers use customers, restaurants, couriers, or intermediaries to design monetary policy. Platform growth statistics may not reveal

provider efficacy, but stakeholder analysis illuminates one-sided feedback systems. The cost of customer acquisition may depend on restaurant commissions, which rise when growth slows. As platforms develop, cheaper client acquisition methods are curtailed or abandoned, often leading to higher restaurant commissions or a loss of user-friendly activities, hurting customers or restaurants. Understanding food delivery system growth requires considering how one-sided feedback mechanisms' incentive effects change as stakeholder bases mature. It is also important to consider how regulatory settings affect incentive effects.

8. **Economic Impact of Ratchet Effect**

The food delivery system is expanding in established and developing countries due to increased digitisation and technological start-up investments. Many third-party apps connect food businesses with clients as delivery platforms. With the rise of these platforms, delivery apps and food restaurants have a win-win relationship: owners can increase customer volume without opening more stores and customers can enjoy local restaurant food faster and more conveniently. Due to this symmetry, McDonald's introduced online listings and delivery in 1997, and now practically every restaurant does. Delivery apps dominate this industry by taking a cut of every order, but food company owners rarely set the commission rate.

Though these platforms can be efficient in numerous ways, economic ramifications must be considered. The delivery app has significant market power, thus food vendors must offer competitive prices to stay in the platform ecosystem. They raise their retail price first to avoid the application's price hike, but this tactic fails. Instead, delivery apps and eateries will spiral into pricing and commission rate rises. In food delivery, the ‘ratchet effect’ of mutual consent of inflation has seen the zero commission orders policy continue in the face of high customer acquisition payoffs and significant infestation of rival local delivery apps.

According to surveys, 69% of takeout and restaurants utilise one third-party app. Restaurants say high delivery fees are one reason they're hiking pricing due to shift to operation-only delivery services. Instead, customers flock to competitors for cheaper, slower meals. This disrupting industry benefits from the ratchet effect, but it has wider ramifications. Less competition and customer concentration increase restaurant fees, whereas at least ten establishments boost them.

8.1**. Market Dynamics**

On-demand multi-sided platforms use their own algorithms to optimise demand generation and execution, where the rules of these market agents are the commodity of exchange and the gap between their calculation and execution involves hidden contingencies and latencies. Even these transient latencies are contractually defined in nature, extent, and duration by platform norms that dictate market behaviour. Such reasoning can be discussed using New Zealand food delivery platforms as examples. How riders, restaurants, and customers fit into numerous overlapping marketplaces shows the varied objectives but structural restrictions that inform algorithms that keep the market creating more than it consumes. Reframing the acquired data as computed commodities returned to platform reveals commodity form arrangements that delay food delivery rider contractual operation. Thus, two features are examined: how food delivery operates topologically over media that record rider and order locations, and how marketing action values food delivery for speed and commodity form.

Food delivery companies in account-based markets acquire data via phone calls, messages, and app downloads from restaurants and customers. Food delivery apps receive orders in live markets, but riders' speed-determining action is only sped up through the app. Thus, riders' interactions with market nodes are strictly conditioned. In doing so, the rider's market access moves from demand to order, where the intersection of points in a common area or the co-presence of riders and orders is a product of their separate markets providing data on their state and preparedness for market action. However, food delivery algorithms work by calculating transaction and interpretation of data, rider-order prioritisation, and service demand (Richardson, 2020).

8.2. **Price Strategies**

On-demand food delivery requires pricing. Food delivery services link consumers and food merchants through price mechanisms, giving them collective control over a huge business situation and non-negligible control power. Food delivery pricing evolves by creating a flexible price that can vary within an upper and lower bound as long as objectives are not clearly violated. Meaningful characteristics affect food ordering. Capacity-based pricing, heat spikes, peak hour price hikes, and food delivery companies' privileged knowledge for specific merchants are other pricing methods.

Delivery providers may raise prices to make a quick profit after understanding spiking information. Such instances demonstrate how pricing techniques can have a locally strong and collective ratchet effect. Ratchet effect on food delivery platform is shown by examining pricing mechanisms, their evolution and effects, and modelling and analysing salient scenarios of pricing tactics like size-hike, food delivery provider co-hike, spikes, and spiking information possession. A food delivery system connects consumers, food delivery providers, and food merchants, with a meal delivery provider setting pricing to ease transactions. Changing prices and shaping techniques will alter food delivery system transactions.

A ratchet effect with controlled and irreversible performance modification is claimed in the food delivery system. A food ordering scenario with time-discrete, downward-fixed prices is shown. Parallel scenarios arise from meal ordering scenarios in the food delivery system. The strategic-type meal ordering supplier consistently shows price policy adaptability. The ratchet effect in the food delivery system is shown by examining proposed pricing mechanisms using performance change measurement, emergence-matching relationship, controlled irreversibility, and sustainable entry descriptions, which goes beyond constraints in loop-backed evolution, passive information arrival, and efforts to lower costs in pricing adjustment or product quality upgrade.

9. **Food Delivery Platform Case Studies**

Many meal delivery platforms in urban regions allow city dwellers to quickly and easily satisfy their food cravings while creating opportunities for food service and transport organisations, notably e-commerce platform users. There are many meal delivery platforms that meet customer needs 24/7 (Klumpp & Ruiner, 2019). Many meal delivery companies will diversify as e-commerce grows. Chains and independent restaurants can provide meal services. There are several food service suppliers and food and logistics companies that deliver food to customers. Diversity in information flow, product delivery, and customer demand clarification at the supply and receiving nodes results from this diversity.

Many tiny transport organisations that connect restaurants and consumers can keep electricity and data, but internet platforms can keep market share and user data by closing the system (Parwez, 2022). Cities vary in city size, item mix, area density, limits like diseased regions and commuting, driver choices like brand image and worker organisation, and vehicle types and route planning. Rich influencing elements make online scraping, user messaging, and field observations easy sources for social scientific research, while map APIs and city open platforms provide traffic flow and map data.

A transit and assessment model using many methods is needed for a rich, diverse, and open food delivery system. The following work uses computational models for varied supply patterns, learning models for various demand features that balance social efficiency and equity, and simulation design with great interpretability in urban similarities to improve group profit. A static controlled model with rich supply design and static demand mechanism will use fair and flexible evaluation measures.

9.1. **UberEats**

Ratchet Effect describes food delivery. The food delivery platform example explains the notion. With technology and a competitive food delivery business, mainstream meal delivery platforms have an unparalleled potential to acquire rich behavioural data from all participants and act as gatekeepers.

Over time, dominant platforms profit from this privilege without sharing the economic gains with the ecosystem. Too small and impotent, independent food delivery services have suffered tremendous losses. Many cases suggest that dominant food delivery platforms' commission rates rise to 30%, followed by independent ones and government interest. Caps and regulation on conventional meal delivery platforms have driven many out. The ratchet effect persists with new players. Accounting in food delivery systems shows some garbage revenues, and less-than-expected delivery effectiveness is common everywhere, which may lead to the disappearance of more independent platforms and unhealthy marketplace growth if a balance is not found by introducing checks to the ratchet trap that stops recentres from ‘freezing’ the business.

One platform appears to be a popular meal delivery platform in a busy market ready for global expansion. Since it employs unfair punishments and self-reinforcing networks to exclude outsiders, it gains the most wealth in these networks. Mediators are used to keep restaurants open after they pay big businesses. Large delivery networks can cross-subsidize outside their non-resumable operational area through agent-based outsourcing, boosting their vitality and maintaining outlet preference for large venues. Unfair competition exploits labour and hinders resistance.

9.2. **DoorDash**

DoorDash is a popular "technological success story," founded in a college dorm and developing into a nationwide company. The co-founders met in a business school. They recruited many co-founders early on in their pursuit for early venture funding, which was difficult given the meal delivery business model's lack of evidence. The procedure was natural for the team. Like other IT towns, it had huge potential as a college town. DoorDash stayed customer-focused to maintain the mindset. The early co-founders who focused on “ratcheting up” venture funding were replaced by “operator-focused” team members. Money poured into doughnut trucks and

grocery A-frames. A gig-economy pizza delivery disaster on Friday night led to a legendary same-day delivery offer. DoorDash implemented no-frills, per marks, per pie, discount-offered operations because upward route dependant behaviour outperformed competitors' “creative” business model approaches. The corporation toppled the competitor to the East Coast of New York using the “zero marginal costs” method, later extended to near-total quarantine clientele increases.

The “creative business model” strategy that had driven DoorDash's quick growth was abandoned, as financial experts properly queried when the lavish recruiting at the expense of profitability and customer delight would end. Later, commissioned evaluations stated that the service would be successful in providing households with a sustainable food fitout and an incentivised connection to local restaurants, including a component to prevent rising restaurant ownership. However, moves between company groups like drivers, customer care reps, and restaurants were harder than expected. Following its “global mission” and anti-competitive successes over the initial wave of food delivery competitors, full-automation resistance began, resulting in the first rounds of layoffs. This trend was accelerated by new contracting players and cheaper spirits supply. DoorDash may remain a “cautionary tale” for college-aged inventors. Old industry shopfronts defeated fast-casual restaurants on similar grounds. Digital native companies may need to “get up early” to react.

9.3. **Grubhub**

Grubhub is a leading US meal delivery service founded in 2004. Grubhub started as an online meal ordering service but now delivers food. With Just Eat Takeaway's acquisition of Grubhub Holdings, Grubhub operates only in the US. Grubhub lets users search online or use the app to order food from restaurants. Restaurants without delivery services can use Grubhub. Grubhub organises restaurant-to-customer meal delivery couriers.

It provides restaurants with a simple, affordable online meal ordering system. The restaurant merely needs to sign an agreement and set up a Grubhub-compatible operation system to partner with Grubhub. Grubhub provides iPads, printers, and broadband connections for restaurants to track orders online. Grubhub charges 15%–30% commission on delivery orders, depending on the category. After an order is placed, the restaurant prepares it, Grubhub assigns a local courier to pick it up, and Grubhub tracks the order status and position and informs the consumer.

Grubhub uses independent contractors and service provider couriers. Grubhub charges a monthly fee based on the amount of hours couriers work for it. Couriers will also get tipped. Community users can easily sign up and utilise their own vehicle or ride-sharing for Grubhub. They can even name their business and operate it. These couriers' operation strategies determine each order.

10. **Food Delivery Regulation Issues**

As food delivery has grown rapidly, a new ecology of independent food delivery firms has formed. Due to criticisms and animosity against conventional food delivery platforms, many advocacy groups and organisations have been formed to promote independent food delivery platforms. Independent food delivery platform operators routinely argue over public policy, but few studies have collected their views. This study is the first large-scale survey of independent food delivery platform providers in the U.S. to understand their public policy

preferences. Independent food delivery platform operators have different views on business-related public policies. Some want public policy to support autonomous food delivery platforms without policymaking. Others advocate enforcement-focused laws to stop mainstream platforms' unfair commercial practices.

These studies analyse the public policy demands of a new ecosystem that has arisen in response to the gig economy, providing a finer perspective on public policy outside industries and suggesting a principle that boosts public policy efforts in similar ecosystems. Few studies have examined the new ecosystem of independent meal delivery services. Future research could better understand independent food delivery platform operators' experiences, histories, and motivations for starting their businesses to open conversations and build relationships to strengthen their advocacy (Liu et al., 2023). Food delivery services' responsibilities in varied geographic and cultural contexts remain unclear as mainstream food delivery services have developed and diversified (Nair et al., 2022).

Future research could also examine 3rd-generation food delivery platform operators at the junction of the two ecosystems as multi-platform delivery-only restaurants and new delivery service markets grow. Finally, independent food delivery services continue struggle with long-standing operational concerns compounded by the epidemic and community exposure and expansion. Future studies can show where independent food delivery companies require help, especially in historically marginalised neighbourhoods.

11. **Food Delivery Sustainability Issues**

The rise of meal delivery apps has caused an unsustainable ratchet effect. Competitive pressures from delivery apps have forced eateries, including those without delivery partners, to offer online delivery. Rapid delivery services require additional riders and restaurant partnerships, therefore delivery service providers switched (Klumpp & Ruiner, 2019). This new “inflated” market cannot last. Operators may abandon the market to avoid losses; restaurants may halt online delivery services because they are hardly profitable; riders may not recoup their vehicle and instrument expenses, etc. Both decision makers and the public seem unable to solve this devastating situation beyond commercial models.

This also puzzles sustainability researchers. In recent years, the call for sustainable food systems has spurred many studies on food supply chain sustainability. Those measures should apply to new delivery services, but little has been done. This study tries to illuminate this shadowy area with conceptual articles, unique case illumination, modelling methodologies, and empirical studies (Collison et al., 2019).

The meal delivery applications make the restaurant delivery service market tense. While some online meal ordering businesses offer delivery, most compete aggressively for market share as fast-to-market players. Besides discounts, promotions, alternate payment options, and app designs, operators' most common technique is to expand the service area at the expense of riders. Even “riders only” campaigns don't make enough runs under tight deadlines. Almost every restaurant upgrades manually or works with a delivery service. Such competitiveness arose in restaurants. Despite high installation costs and operating complexity, automated electronic menus and Bluetooth receivers are launched late. Restaurants with few resources or too many orders per minute struggle to survive.

11.1. **Environmental Impact**

Many love meal delivery apps. Food, groceries, and everything else a city has is available on demand. The rising demand for these apps has increased the number of vehicles working for them and had major environmental impacts. Every new vehicle on the road increases traffic congestion, making it harder for automobiles, buses, ambulances, etc. to deliver on time. Many apps have started global green projects in response to this dilemma. A recent survey found that a large percentage of respondents agreed that companies and organisations could affect climate change, recognised the importance of biodiversity loss regulation, and were willing to spend more time investigating brand sustainability. Neither brands nor actions are silent. One big app declared it will invest in new anti-congestion measures and aim for zero emissions by 2030. Another joined the Climate Pledge Friendly program to promote sustainability. More than 25 tech companies have joined the coalition. As shown above, competing on sustainability alone might inspire copycat and commoditise a harder bottleneck to maintain without overpowering competition. Food delivery companies should avoid imitation-based corporate social responsibility strategies by ensuring their sustainability initiatives cause plausible changes in downstream solution areas or support restaurant behaviour changes to lower emissions.

11.2. **Waste Management**

Garden debris, confused paper bins and takeaway food wrappers go to landfills. Everything going to landfill must be properly regulated, from formulation to ‘engineered’ trash disposal, a new business. However, food waste is the most expensive and last consideration (Papargyropoulou et al., 2014). The ‘rubbish’ is often neglected until it causes problems. As meal takeaway grows worldwide, ignorance is turning to food waste.

Waste-to-resource conversion requires a system. Understanding take-aways and centralising them allows pilot experiments of small-scale composting of fresh food waste. Local councils and universities will collect, sift, test, and compost fast food trash into ‘top soil’ enhanced with charcoal or worm castings before selling it back as a resource with other co-operative eateries. Students should learn about waste management and circular food systems to guide their research. Design students must create a carbon-sequestering, nutrient-rich soil, interface with takeaway outlets, and develop a commercialisation plan. Statistics and literature on waste generation, disposal, biodiversity loss, and soil degradation can support the proposal (Bermudez et al., 2016).

Integrated systems that collect biosolids from takeouts and improve waste management and biodiversity are needed. City precinct basins will segregate lots and chemically and biologically filter water before reuse. Recapturing organic waste from municipal gardens, bakeries, and takeouts before composting may be researched. A food and trash co-op proposal can include capital outlay and rewards analysis. Scum dredges or gantry irrigation systems are options. A completely synergetic design proposal with defined biophilia definitions will expand the concept of integrated biophilic mixed use buildings.

12**. Future Food Delivery System Trends**

Beyond food delivery apps, food delivery systems are promising and innovative. This decrease is caused by lower food delivery purchases and residential broadband and mobile internet access. Catering developments over the next decade include meal delivery systems for all food preparation and delivery outside of full-service restaurants. Consequently, no-sit-in dining may

grow. If full-service restaurants have thousands of screens to communicate with customers, delivery must follow like. Mobile apps, on-demand content, and TV won't be enough to bring food. Longer-form, interactive, and gamified content is booming (Klumpp & Ruiner, 2019). Similar systems are being created to monetise this content. Catering enterprises must partner with content aggregators to access these platforms, like other experiences. Food delivery systems could become media channels by obtaining their own IP or content. Delivery might operate off the grid, using encrypted, peer-to-peer connections to avoid hackers, trolls, and third-party firms micro-targeting food purchases (Jaykumar, 2018).

Long-standing rivalry between meal delivery apps may become friendly. Food delivery apps collecting higher commissions and hybridising have hurt full-service restaurants as business grows more competitive. Food distribution systems would cooperate. Various in-house catering suppliers may acquire western meal delivery technologies before their widespread use. Understanding consumer behaviour towards food delivery systems is new. These systems and consumer behaviours are changing quickly. Emerging firms will provide insights that academic study cannot match. The system would also pressure food providers to satisfy diverse taste and dietary needs and provide food monitoring and traceability across the supply chain. Food delivery systems would need to leverage big data and user involvement to adapt to this evolving media eco-system. On-demand delivery, dish adaption, and performance must work together to automatically update restaurant menus for weather changes. Real-time customising requires more powerful tech.

Fast delivery is in demand worldwide, especially in Hong Kong, Paris, and London. As individuals acquire used to getting pizza in 30 minutes due to urban life and on-demand delivery, customer expectations for fast food delivery have increased. To satisfy this speed demand, transportation, logistics, and urban architecture must change drastically. Optimisation of leaving routes, experimental road construction, and on-demand mobility could speed up traffic. However, urban food structure literature is unreliable. Increased spatial screening may generate food deserts. Since population density and structure determine delivery radius, transportation infrastructure must be strengthened.

12.1. **Automation, robotics**

Crowdsourcing and internet meal ordering systems exploded in cities. Popular eateries join these platforms, while smaller ones often lose money. To maintain a more variety food offering for city workers near offices, food ordering systems are structured as two-sided market platforms, and a ratchet effect separates restaurants into groups with different quality (Yang et al., 2023).

An n-of-m process and auction-like price that endogenously select a winner are used to improve food quality without adding service. Overbidding can isolate a winner in marketplaces with a big reserve price by coupling ignorant algorithms with smart sellers. Tieing sellers' contest efforts to their performance implements the ratchet effect by making it tougher to win. We then derive optimal methods for both settings. Simulation results reveal the weakest restaurant benefits from three seller encounters but loses profitability fast. Competitive pay reduces employee turnover.

OFD industrial routing challenges include the meal delivery routing problem (MDRP). Over the past decade, the OFD industry has evolved fast and added autonomous delivery trucks, drones, scooters, and sidewalk delivery robots. The MDRP identifies a set of paths on which

an ordered meal can be delivered quickly, with customers served or passed over and vehicle capacity maintained.

In a meal delivery system (MDS) with a dispatcher and a fleet of cars, new meal demands are constantly revealed, similar to many other dynamic vehicle routing problems (DVRPs). MDS efficiently schedules requests for onboarding or stockpiling. The issue is specifying the routing element, which typically comprises an on-board set of requests and a well-designed route.

12.2. **Drone Deliveries**

Due to the growing need for fast deliveries, drone delivery has grown in popularity over the past decade. A drone leaves a depot to deliver a parcel to a customer. This delivery situation has garnered industrial and academic attention. Drone deliveries are either autonomous or vehicle-interactive. The first type involves an airborne drone delivering the parcel to the design location. When modelling an engaged drone delivery scenario, researchers focus on overall operation time. Operator cost can be reduced with efficient models. The other uses vehicle-drone delivery systems. A vehicle-drone system can be delivered in three ways depending on customer-depot distance. Both direct and drone vehicle coordination systems have been developed, and vehicle-drone system performance depends on drone and vehicle cooperation. The parcel distribution plan uses public transport and drones. The drone and bus can increase the delivery area a drone can drop, complicating delivery time.

A drone-based parcel delivery method has been presented. This solution contains a scheduling problem to determine drone delivery times given public transport vehicle routes. Multiple works have explored routing, but algorithms have been proposed to efficiently arrange deliveries. Vehicles can deliver drones closer to customers outside their flight range under the drone–vehicle program. This scheme's drone may wait for vehicles, delaying delivery. It became a drone delivery vehicle routing challenge. A matched vehicle path was divided into vertex pair segments to determine when and where to send the drone for a subsequent delivery (Huang et al., 2020). Similar techniques were used for drone–vehicle split delivery routing with time windows and work relocations. Drone dispatch location and time, vehicle primary routine, and drone delivery time and path are the three sub-problems. For iterative solutions, an adaptive variable neighbourhood search method is suggested.

13. **Consumer Safety, Food Quality**

Meal delivery must be done within 40 minutes. That food must be thrown away and not eaten. Food warming is traditionally used. This technique can sustain food quality for a limited time, but it limits food provider flexibility and reliability. Without adequate solutions, food safety issues will arise. Four methods can prevent food quality degradation after that. Traditional refrigeration slows food degradation by maintaining a low temperature. Food suppliers track time and temperature. Another technique monitors food temperature during delivery and alerts customers to high temperatures. Second, use food preservatives. If preservation quality is confirmed, timeline will change. Proper preservative use makes food edible in a few days, therefore this is enough assurance. Food can also be analysed and checked on the thruster and egress sides. It would be effective to detect food quality safety. Targeted chemical or biological sensors can be utilised, but low-cost solutions are popular. Alternatives include active sensors, which assess.

Food safety means guaranteeing food safety. Nutritional and acceptable food quality is important. First, ensure food safety. This is crucial. To safeguard consumers and grow food markets, food safety must be guaranteed. The majority of foodborne infections can be prevented, but there is no single solution. Food contamination and microbial transmission can be prevented by excellent agricultural and manufacturing practices. With substantial investment and teamwork, a thorough examination of the food manufacturing process can identify the main hazards and control points to prevent, restrict, or eradicate contamination. A formal technique exists for evaluating food risk control.

The key concern is poultry and aquaculture food animal safety, notably bacterial diseases. Current best practice is to monitor food animal bacterial levels from the farm to the point of sale. Food safety issues like spoilage, food-borne diseases, and microbiological quality are discussed in this.

14. **Food Delivery Ethics**

All evidence points to the increasing rise of the meal delivery industry in cities globally, raising concerns regarding food delivery riders' labour rights. This industry relies on dispatchers, consumers, and riders. Initially, dispatchers receive meal orders from consumers, and riders pick up and deliver meals from eateries. How many orders are received and how they are distributed among riders depends on dispatch policies. To maximise efficiency, user experience, and rider labour rights, delivered orders should match rider numbers and locations.

The dispatching algorithms were divided into consumer preference-oriented and platform profit-oriented. First class emphasises customer pleasure with cheap cuisine, fast delivery, and good service. Consumer pleas usually cost riders because all demands would take up a lot of delivery time. Consumer-focused dispatch regulations have caused food waste and rider stress.

Second class focusses on reducing riders to enhance income. However, dispatch algorithms that prioritised greediness changed quickly, and previous algorithms failed to balance rider stability and user enjoyment. Current meal-delivery platform regulations focus on delighting consumers or minimising riders to save money, with limited debates on algorithm design to improve rider working conditions.

15**. Global Market Comparisons**

Online food delivery transformed urban dining. For decades, restaurants were places to gather with friends and family for food and drink. Food platforms have transformed restaurants into fulfilment units overnight, allowing customers to eat from nearly any restaurant without visiting it. This amazing change in dining experience is matched by a significant transformation in restaurant work. A network of strangers using handheld electronic gadgets has replaced personnel and customers in the same location. City dwellers may now see delivery riders gathering around delivery doors to pick up App-ordered meals and take them to an unknown place.

Many scholars worry about late urban modernity with mobile meal delivery. Media exposés on delivery workers' mistreatment followed revelations of underpaid or uncontracted labour. Many feel that this business needs reform. Despite the ethicality of the problem, an overly normative view is creating tension. The simple observation that something is wrong does not prevent conflicting views of what ‘right’ means, what reform should occur, and for whom.

Academic literature on food logistics, especially retail and delivery, is abundant. The internationalisation of supermarket food retail has been studied, but many of the analytical frameworks are applicable to food services. This requires reviewing the remaining academic literature and applying principles like the ratchet effect and path dependency to food services. The comparison then includes food delivery system case studies. The report concludes with a research agenda on food delivery system expansion drivers and effects.

15.1. **North America**

Since 2000, North American food delivery systems have changed how food is purchased, consumed, and perceived. While transportation systems can transport food from farm to table over long distances, urbanisation and technological advances have created food delivery systems that can deliver food to a person's door within minutes of their order, sometimes before they can pay, and often without regard for quality or hygiene. Food delivery became hyper-convenient in US and Canadian cities because to convenience-driven applications and delivery companies. As a surveillance state, app-driven convenience has economically isolated customers from their food systems, hurting restaurant owners, front-line workers, and delivery couriers while allowing questionable service providers to thrive. The rapid growth of food delivery app firms and their tech-stack-enabled processes created an overpowering neurological feedback loop. Other things being equal, prolonged bistable stimulus exposure favours one percept and causes perceptual ratchets. Ratchet effects describe the difficulty of escaping addiction-like consumption behaviours and service dependency. Research now suggests a food delivery ratchet that makes consumers excessively loyal to food delivery systems, their ordering apps, a limited number of service providers that satisfy them, and a limited number of specific food dishes they order repeatedly. Only rare bear markets can break such dependencies, but not with sustained success, especially with fresh competitive curve balls. Scepticism greeted internet meal delivery apps in most US and Canadian cities. Cities experienced record vacancies in dining rooms as rents rose and new eateries opened. Many restaurants were wary of on-demand delivery because they feared higher commissions from delivery platforms and lower-quality customer experiences, but companies that best adapted to consumers' hyper-convenience drove them out of business. Soon after crushing incumbents with massive discounts, one company created an economic moat by collecting delivery order data from most city restaurants, making direct delivery impossible. Even eateries with on-site delivery crew had to accept the app's constant reductions, risking insolvency. One land-grab company raised up to $2.5 billion from venture capital companies at $13 billion values in a short time. Frivolously paying customers to buy their affection, something unequalled by any other food sector technology so far, and the vast food delivery ratchet that came with it had arrived and established popularity. Many other current services have encountered excessive order frequency, order amount, recommended restaurants, income, and app installations due to self-perpetuating geometric progressions. Most importantly, as newsfeed-like UIs reinforced psychological gratifications, users found it hard to opt out of highly engaging apps or resist impulsively clicking on promos, and were often driven to behaviour they could never have controlled.

15.2. **Europe**

Due to breakthroughs in worldwide digital communications technologies, cheap mobile devices, and a large investment boom, online meal delivery businesses have grown rapidly during the previous two decades. From $100 billion in 2020 to $200 billion in 2026, the worldwide internet food service business is expected to treble. This enormous expansion is projected to transform the food service and delivery industry and its stakeholders.

Four mega-trends are increasing the demand for online food delivery services worldwide: changing demographics (young adults in urban areas use them more than older generations in regions with low adoption); increased customer consumption; the popularity of mobile internet devices (mobile apps have been a key enabler of the rapid growth); and the growth of third-party platforms. Each extra platform might disadvantage current competitors by raising the delivery charge, or possibly cause market collapse if new firms entered frequently.

Stage-based models with exogenously given and endogenously produced demand arrival processes have shown several dynamic phenomena, including multi-firm oscillatory ratchet effects under homogeneous businesses. Slow responses and overexploitation by some enterprises have been recorded with the rapid rise of immediate meal delivery services, which can lead to market collapse. Despite these attempts, key aspects of real-world internet meal delivery businesses remain unstudied.

15.3. **Asia-Pacific**

Asian meal delivery services are among the fastest-growing worldwide. Food delivery services have grown in emerging countries like India, China, Thailand, Vietnam, and Indonesia due to widespread smartphone usage and tech-savvy customer bases. Japan and South Korea spend 10 times more per person on meal delivery than India or Thailand. This gap suggests meal delivery businesses in smaller mature markets have great development potential. Around half of the Asia-Pacific food delivery services market was in China in 2018. However, Indian meal delivery businesses are projected to increase rapidly. It is expected to expand over 20% during the predicted period, compared to 4% for China. By 2027, these five countries will make up two-fifths of the Asia-Pacific food delivery services industry.

In 2018, restaurants led the Asia-Pacific food delivery services market with 84% of the market value. The Asia-Pacific food delivery services market was dominated by two companies. Swiggy and Zomato in India and Naver-won in South Korea were domestic players. Few significant firms dominated the food delivery supply chain. Some big food delivery service providers left Asia-Pacific regions, and most firms worked in one portion of the supply chain.

16**. Delivery Workers' Role**

Riders drove food delivery system growth. Appropriated from bike courier companies, delivery professionals begin a shift by logging into an app, which advises them where to travel in a set up of separate and time-limited stages (Richardson, 2020). When they arrive at a restaurant, they check in, wait for their order, pick it up and go straight to the drop-off point. Customers and restaurants agree delivery times in advance, but the company assigns the order to a delivery rider. Delivery riders may view orders when they log in to the app, but they will not be encouraged to choose one. Best-calibrated delivery systems will pick up orders from diverse restaurants quickly. They can wait longer due to this flexibility. As responsiveness is tailored

to the delivery rider's pace and location, scheduling is done through a large pool of delivery riders, making it unclear who will reply to an order. When this goes well, delivery riders may not realise they are part of a broader food delivery system with orders from thousands of restaurants and constantly monitoring their positions and tightening their unused time. Order equity indicates their confluences and delivery riders' uneven allocation to other participants in the system.

A restaurant check-in changes the delivery rider's pace and adds unpredictability to the shift. Order ETA is no longer dependent on delivery rider distance or capability. Rider(s) will check order status before arriving at the restaurant. A restaurant that misses the time limit and passes the order elsewhere is registered and provisionally investigated at the check-in.

16.1. **Working Conditions**

Food distribution systems have labor-right difficulties. Users ordered meals from restaurants, and riders picked them up. Riders were active in early food delivery systems and earned similar wages as social workers. Instead of labour protection, platform dispatching was modelled as an optimisation problem that maximised consumer advantages or minimised meal-delivery platform costs. Reinforcement and deep learning models proposed and trained dispatching policies. Whether dispatching policies improve labour rights and working conditions is hardly questioned.

Rider rights must be protected for media, riders, and governments. Like taxi and Smart Logistic dispatches, food delivery systems based on competence and data analysis should guarantee their labour rights. Riders' independence and freedom of working hours must be curtailed, as seen above with fixed hours. Laws also limited collective labour rights such maximum overtime, which might be met by company or industry cooperation (Weng & Yu, 2021). Model showed concentrated on other rights and referred to indirect labour rights protection. Ride-fatigue power or similar platforms could be shared with larger game model enforcement mechanisms before meeting collective labour rights in the self-regulated model. Game theory should teach norms like fair order arrival time allocation among food delivery systems, restaurant capacity reservation, and others. Producers can guarantee a take-home pay depending on capacity and set a rider fatigue threshold. The two thresholds allow non-feed-back dispatching strategies to learn any particular dispatch a priori with LALD constraint.

16.2. **Gig Economy Change**

The demand side of gig-economy marketplaces has a ratchet effect like revenue systems. High demand attracts new customers, who maintain a high baseline demand. Short-term low demand periods allow market newcomers to establish themselves and gain market share (Marie Daniels, 2017). New entrants may also raise awareness of rival services to lower prices in the incumbent market. Low demand periods will hinder the ratchet effect due to menu prices and consumer infrequent service use (Hu & Fu, 2021). However, the incumbent platform has a strong incentive to cut prices during heavy demand. Once an equilibrium high demand level is reached, the platform architecture encourages one-time price rigging. This attack raises prices slightly across all service categories. A legal backing for the platform against such an action would undoubtedly reveal consumer demand reductions. Thus, the market must decide whether to prevent price manipulation proactively or reactively.

Mechanically directed price schedule selection reduces and stabilises prices, reducing the demand side ratchet effect. Service category decision cycles maintain local price levels like revenue scheduling. However, unlike revenues, service category demand levels may not be so high that schedules fail to assign service requests. In part, demand levels cannot be externally set high enough to generate so many service requests that the assignment becomes computationally loose or cannot be allocated. Instead, all demand levels are reduced by the same amount daily until they reach zero. The motivation to tamper with service levels in a way that encourages socially harmful demand tampering is reduced when prices stabilise at levels needed for capacity utilisation.

17. **Conclusion**

Ratchet effect effects in food distribution systems are mixed. Generally, good robot delivery systems lead to stable exploitation strategies. Only codelivery with restaurants lowered food prices to cut customer service fees, lowering Jeny's revenue. An order simulation feature improved the robot food delivery system. Despite some operators raising their service fee or restaurant commission, micro-mobility systems seem to have little impact. The cap of orders per minute seems to have helped all operators maintain quality, but it may have boosted the minimum drivers needed. Not much research supports a ratchet effect on food distribution systems. Social acceptability and labour regulation systems have a ratchet effect. Operators offer various forms of social acceptance systems, either as app features or as a framework for effective social systems. Both food delivery systems include social acceptance structures that manage the system and demand to deliver fair compensation quickly. The systems may have broken down without this pressure, unable to recruit drivers (Klumpp & Ruiner, 2019).

References:

Denisov, Flach, & Hänggi (2008). Ratchet-transported cold atoms in optical lattices: Symmetries and Mechanisms.

https://doi.org/10.48550/arXiv.0801.4264

2016. Grossert, C., Leder, M., Denisov, S., Hänggi, P., & Weitz, M. Coherent quantum rocking ratchet transport resonance control experiment. ncbi.nlm.nih.gov

M. Klumpp. 2019; Ruiner, C. Digitalisation and Work Organisation in New Urban Food Delivery Systems. https://ideas.repec.org/

V. Jaykumar, 2018. Online Breakfast Delivery Aggregation Business Landscape in Bangalore: First-Time Entrepreneurs' First Move Advantage. An online journal of business and management, Vol 10, No 19 (2018).

R. Akai Nettey 2018. College peer-to-peer food vending, ordering, and delivery. Applied project submitted to Ashesi University Department of Computer Science, April 2018, for partial fulfilment of Bachelor of Science in Computer Science.

S. Jadhav, R. Titus, T. Babu, and R. Chinnaiyan, 2023. Indian Consumer Behaviour on Food Delivery Apps. https://arxiv.org/

L. Richardson, 2020. Platforms, markets, and contingent calculation: flexible meal delivery. The Wiley Online Library

S. Parwez, 2022. A delivery worker's view of COVID-19 and digital food platform labour precarity. ncbi.nlm.nih.gov

Y. Liu, A. Liaqat, and A. Monroy-Hernández, 2023. Should Policymakers Participate? Understanding US independent food delivery platform public policy opinions and needs. https://doi.org/10.48550/arXiv.2303.15415

A. Nair, R. Yadav, A. Gupta, A. Chakraborty, S. Ranu, and A. Bagchi, 2022. Gigs with Guarantees: Fair Food Delivery Wages. Thirty-First International Joint Conference on Artificial Intelligence (IJCAI-22) Special Track on AI for Good Proceedings

M. and T. Collison, I. Myroniuk, N. Boyko, and G. Pellegrini, 2019. Updates on Food Logistics Transformation for Short Food Supply Chains. DOI: 10.7896/j.1909 Studies in Agricultural Economics 121(2):102-110

E. Papargyropoulou, R. Lozano, J. K. Steinberger, N. Wright, and Z. B. Ujang, 2014. Food surplus and waste management using the food waste hierarchy. Journal of Cleaner Production 76 (2014): 10.1016/j.jclepro.2014.04.020

C. Bermudez, J. Behrens, S. Marripudi (2016). Food Consumption Ethics. Written for the 2016 ASABE Annual International Meeting in Orlando, Florida, July 17-20, 2016.

Hai Yang, Yuchen Du, Tho V. Le, and Joseph Y.J. Chow, Analytical Model for Large-Scale Design of Sidewalk Delivery Robot Systems with Bounded Makespans. Access the abstract at SSRN: https://ssrn.com/abstract=4829764 or http://dx.doi.org/10.2139/ssrn.4829764.

Huang H., V. Savkin A., & Huang C., 2020. Schedule a parcel delivery system using an aerial drone and public transportation vehicles. ncbi.nlm.nih.gov

Weng, W. & Yu, Y., 2021. Meal delivery platform labour rights. DOI:10.48550/arXiv.2109.14156

K. Marie Daniels, 2017. Controlling Self-Scheduling. DISSERTATION in Operations, Information, and Decisions for the Graduate Group in Managerial Science and Applied Economics Presented to the University of Pennsylvania Faculties in Partial Fulfilment of the Doctor of Philosophy 2017 Requirements

Hu, K. & Fu, F., 2021. Gig Economy Labour Strategy Evolution under Technology, Policy, and Market Influence. Games, 2021, 12(2), 49; DOI: 10.3390/g12020049