



Customer-Centric Meal Delivery Processes

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Track: Digital Customer Experiences and
Interactions

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Motivation

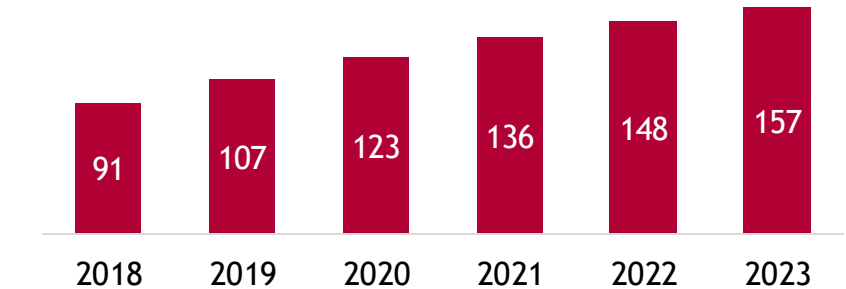
Differentiation in Meal Delivery occurs on the last mile

- Adoption of platform-to-consumer food delivery increases while market consolidates and overall high competition. (Kessler, 2020)
- Customer relationships and service excellence as differentiator. (Vakulenko et al., 2019)
- Today's OR route optimization focuses on short-term goals, i.e. efficiency. (Ioannou et al., 2001)
- Service Quality is subject to individual customer preferences and requires prioritization.



How can the meal delivery routing process be enhanced by incorporating long-term customer-centricity?

Global revenue forecast in million US\$: +11.4%



Source: Statista (2019)



Source: IONOS Deutschland, 2020, <https://youtu.be/n5H8MeCl6As>

Artifact Construction

Customer-Centric Route Generation (C2RG)

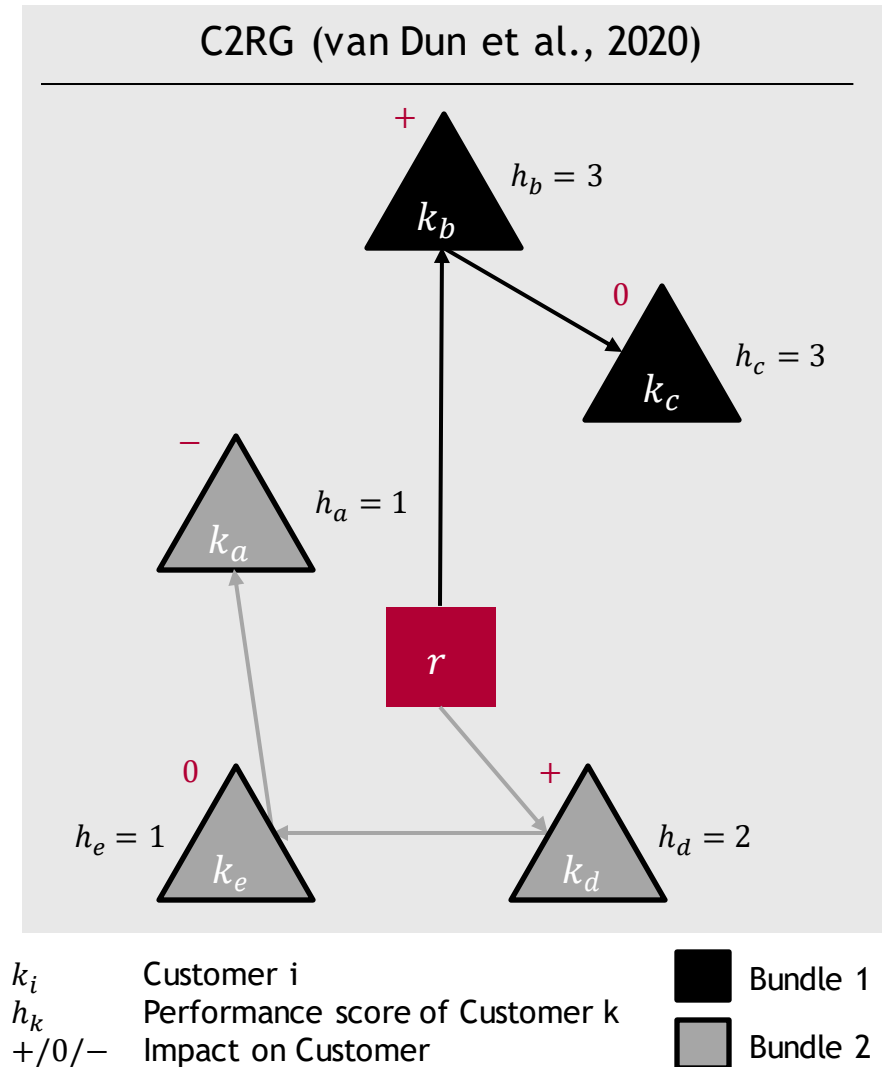
Customer-Centric Information Systems

Design and configure an IS on-demand to match customers' needs and learn from their behavior. (Liang and Tanniru, 2006)

Design Objectives for C2RG (Following DSR reference Process, Peffers et al., 2007)

Incorporate customer relationship into the order-route bundling and control the pickup-to-door time:

- 1 Incorporate prioritization of customers
- 2 Allow for parameterization, ...
- 3 ... while maintaining operational efficiency
- 4 and balance short- and long-term goals



Artifact Evaluation

Instantiation as Software Prototype

Instantiation with fair treatment of customers in mind.

- Regardless of their ease of reachability.
 - Based on their historical track record.
- ✓ On average, the ready-to-door time slightly increases whereas the standard deviation decreases.
 - ✓ Applied concepts of customer-centricity to last-mile delivery processes.
 - ✓ Provided a configurable model for individual enhancements.

Results from Demo with Real-World data:

| Segment | Share of orders | Measure | MDRP | C2RG | ΔMDRP |
|--|-----------------|---------|---------|---------|----------|
| All customers | 100.0% | mean | 0:15:09 | 0:15:24 | +0:00:15 |
| | | std. | 0:03:24 | 0:03:19 | -0:00:05 |
| Recurring customers ¹⁾ | 86.6% | mean | 0:15:00 | 0:15:03 | +0:00:03 |
| | | std. | 0:03:54 | 0:03:48 | -0:00:06 |
| Customers experiencing direct impact ²⁾ | 59.1% | mean | 0:15:54 | 0:15:58 | +0:00:04 |
| | | std. | 0:04:21 | 0:04:10 | -0:00:11 |

1) more than one order

2) experienced a change in delivery

Limitations & Outlook



- **Apply to further real-world cases**
e.g. Multiple depots, couriers as independent agents
- **More suitable proxy parameters for configuring service processes in last-mile delivery,**
e.g. customer-satisfaction, top-tier customers
- **Uncover further interdependencies,**
between CRM and OR in CCIS
- ...

Sources (1/2)

- Ahmadi-Javid, A., E. Amiri and M. Meskar (2018). "A Profit-Maximization Location-Routing-Pricing Problem: A Branch-and-Price Algorithm." *European Journal of Operational Research* 271 (3), 866-881.
- Alan Eera (2017). Optimization Algorithms for Meal Delivery Operations. URL: <https://www.slideshare.net/alerera/optimization-algorithms-for-meal-delivery-operations> (visited on 11/28/2019).
- Berbeglia, G., J.-F. Cordeau and G. Laporte (2010). "Dynamic pickup and delivery problems." *European Journal of Operational Research* 202 (1), 8-15.
- Braekers, K., K. Ramaekers and I. van Nieuwenhuysen (2016). "The vehicle routing problem: State of the art classification and review." *Computers & Industrial Engineering* 99, 300-313.
- Buhl, H. U., R. Klein, J. Kolb and A. Landherr (2011). "CR2M—an approach for capacity control considering long-term effects on the value of a customer for the company." *Journal of Management Control* 22 (2), 187-204.
- Deliveryhero (2018). Delivery Hero sells food delivery operations in Germany to Takeaway.com for cash and shares and reinvests for further growth. URL: <https://www.deliveryhero.com/delivery-hero-sells-food-delivery-operations-germany-takeaway-com-cash-shares-reinvests-growth/> (visited on 29-Nov-19).
- Fornell, C., M. D. Johnson, E. W. Anderson, J. Cha and B. E. Bryant (1996). "The American Customer Satisfaction Index: Nature, Purpose, and Findings." *Journal of Marketing* 60 (4), 7.
- Galbraith, J. R. (2005). *Designing the Customer-Centric Organization: A Guide to Strategy, Structure, and Process*. San Francisco: Jossey-Bass.
- Gartner (2019). Is Your Organization Customer Centric? URL: <https://www.gartner.com/smarterwithgartner/is-your-organization-customer-centric/> (visited on 11/28/19).
- Gregor, S. and A. R. Hevner (2013). "Positioning and Presenting Design Science Research for Maximum Impact." *MIS Quarterly* 37 (2), 337-355.
- Henger, R. and C. Oberst (2019). Immer mehr Menschen verlassen die Großstädte wegen Wohnungsknappheit. IW-Kurzbericht Nr. 20.
- Homburg, C., M. Droll and D. Totzek (2008). "Customer Prioritization: Does It Pay off, and How Should It Be Implemented?" *Journal of Marketing* 72 (5), 110-130.
- Ioannou, G., M. Kritikos and G. Prastacos (2001). "A greedy look-ahead heuristic for the vehicle routing problem with time windows." *Journal of the Operational Research Society* 52 (5), 523-537.
- Jayachandran, S., S. Sharma, P. Kaufman and P. Raman (2005). "The Role of Relational Information Processes and Technology Use in Customer Relationship Management." *Journal of Marketing* 69 (4), 177-192.
- Kessler, N. (2020). Delivery Hero: Kommt jetzt die Mega-Übernahme? URL: <https://www.deraktionaeer.de/artikel/commerce-brands-unicorns/delivery-hero-kommt-jetzt-die-mega-uebernahme-20202264.html> (visited on 11-Jul-20).
- Khan, M. M. and M. Fasih (2014). "Impact of Service Quality on Customer Satisfaction and Customer Loyalty: Evidence from Banking Sector." In: *Pakistan Journal of Commerce and Social Sciences*, p. 331-354.
- Liang, T.-P. and M. Tanniru (2006). "Special Section: Customer-Centric Information Systems." *Journal of Management Information Systems* 23 (3), 9-15.
- Liu, W. and W. J. Florkowski (2018). "Online Meal delivery services: Perception of service quality and delivery speed among Chinese consumers." In: *Annual Meeting of Southern Agricultural Economics Association (SAEA)*. Ed. by M. Reed and S. Saghaian. Jacksonville, Florida.
- Luxen, D. and C. Vetter (2011). "Real-time routing with OpenStreetMap data." In: *Proceedings of the 19th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems*. Ed. by D. Agrawal. New York: ACM, p. 513.

Sources (2/2)

- March, S. T. and G. F. Smith (1995). "Design and natural science research on information technology." *Decision Support Systems* 15 (4), 251-266.
- Oliver, R. L. (1999). "Whence Consumer Loyalty?" *Journal of Marketing* 63 (4_suppl1), 33-44.
- Peppers, K., T. Tuunanen, M. A. Rothenberger and S. Chatterjee (2007). "A Design Science Research Methodology for Information Systems Research." *Journal of Management Information Systems* 24 (3), 45-77.
- Reyes, D., A. Erera, M. Savelsbergh, S. Sahasrabudhe and R. O'Neil (2018). "The Meal Delivery Routing Problem." *Optimization Online*.
- Rust, R. T., C. Moorman and G. Bhalla (2010). "Rethinking marketing." *Harvard business review* 88 (1/2), 94-101.
- Sander, N. (2017). "Germany. Internal Migration Within a Changing Nation." In: *Internal Migration in the Developed World*. Ed. by T. Champion, T. Cooke and I. Shuttleworth. Routledge, p. 226-241.
- Schrage, M. (1994). On-Line Pizza Idea Is Clever but Only Half-Baked. URL: <https://www.latimes.com/archives/la-xpm-1994-08-25-fi-31168-story.html> (visited on 11/18/2019).
- Shah, D., R. T. Rust, A. Parasuraman, R. Staelin and G. S. Day (2006). "The Path to Customer Centricity." *Journal of Service Research* 9 (2), 113-124.
- Sheth, J. N., R. S. Sisodia and A. Sharma (2000). "The Antecedents and Consequences of Customer-Centric Marketing." *Journal of the Academy of Marketing Science* 28 (1), 55-66.
- Sonnenberg, C. and J. vom Brocke (2012). "Evaluations in the Science of the Artificial - Reconsidering the Build-Evaluate Pattern in Design Science Research." *Design Science Research in Information. Advances in Theory and Practice* 7286, 381-397.
- Statista (2019). eServices Report 2019 - Online Food Delivery. URL: <https://de.statista.com/statistik/studie/id/40371/dokument/food-delivery/> (visited on 11/16/2019).
- Steiner, E. (1994). PizzaNet -- the killer app. URL: <https://web.archive.org/web/20120609100313/http://www.interesting-people.org/archives/interesting-people/199408/msg00057.html> (visited on 11/18/2019).
- United Nations, Department of Economic and Social Affairs, Population Division (2019). *World Urbanization Prospects: The 2018 Revision*. Custom data acquired via website.
- Vakulenko, Y., P. Shams, D. Hellström and K. Hjort (2019). "Service innovation in e-commerce last mile delivery: Mapping the e-customer journey." *Journal of Business Research* 101, 461-468.
- van den Hemel, C. and M. F. Rademakers (2016). "Building Customer-centric Organizations: Shaping Factors and Barriers." *Journal of Creating Value* 2 (2), 211-230.
- Xiang, Z., C. Chu and H. Chen (2008). "The study of a dynamic dial-a-ride problem under time-dependent and stochastic environments." *European Journal of Operational Research* 185 (2), 534-551.
- Yildiz, B. and M. Savelsbergh (2019). "Provably High-Quality Solutions for the Meal Delivery Routing Problem." *Transportation Science* 53 (5), 1213-1499.

BACKUP

Results

| Segment | Share of Orders | Measure | MDRP | C2RG | ΔMDRP |
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| Quantile | Cumulated Route Adjustments | Avg. Impact on Route | MDRP | C2RG |
|----------|-----------------------------|----------------------|---------|---------|
| 5% | -0:18:00 | -0:05:20 | 0:14:53 | 0:27:45 |
| 10% | -0:11:12 | -0:01:25 | 0:14:08 | 0:17:09 |
| 15% | +0:00:00 | 0:00:00 | 0:14:34 | 0:14:36 |
| ... | | | | |
| 85% | +0:00:00 | 0:00:00 | 0:14:20 | 0:13:46 |
| 90% | +0:09:15 | +0:01:06 | 0:15:59 | 0:13:47 |
| 95% | +0:18:38 | +0:03:49 | 0:16:01 | 0:14:34 |

| Segments | Share of orders (%) | MDRP avg. time (mins) | C2RG avg. time (mins) | Δ Time (mins) |
|--------------|---------------------|-----------------------|-----------------------|-----------------|
| A | 10.82% | 0:24:12 | 0:23:18 | -0:00:54 |
| B | 89.18% | 0:13:36 | 0:14:12 | +0:00:36 |
| Total | 100.00% | 0:14:48 | 0:15:12 | +0:00:24 |