One Future of Auto is Airlines – The “3 Plus 2” Fix

Fall 2019, Chris S. Langdon, PhD, Research Associate Professor, Drucker School, CGU, chris.langdon@cgu.edu, https://research.cgu.edu/drucker-customer-lab/

From Symptoms … to Prescription

Auto is out, mobility is in. People will still buy cars, buy fewer and excitement is moving on … for sure in densely populated urban spaces and developed countries, maybe less so in rural areas and emerging markets. Such a shift has occurred before with other well-known technologies, like radio, for example. Radio technology and radio broadcasting as a business were a sensation; until television arrived. Video didn’t kill the radio star as prophesied in the hit song by The Buggles, the first music video on Music Television or MTV in 1981, yet TV greatly diminished radio’s importance. And today TV itself is being pushed out of the limelight by mobile video platforms like Youtube and Netflix. So, what to do in auto, *how to* transition toward mobility? And *how to* win? Instead of jumping to conclusions, we adhered to the standard routine at a doctor’s office and had written first about ...

(1) the symptoms “Digital Service Shift and 7 Gaps” (see Blog Auto 1), and then about
(2) a diagnosis “Power Shift to Data” (see Blog Auto 2).

Now, we follow up with a prescription. Like in medicine there may be many ways to cure a disease. Same with auto: there are many transition paths into mobility. The solution discussed here offers two great advantages: First, it is a familiar fix. It had been invented in the airline business, another transportation business - and with spectacular success. While history won’t repeat itself exactly, applying the lessons learned can help avoid mistakes and save time. Secondly, the fix is very manageable because it’s modular and scalable (“3 plus 2”). In a nutshell, the migration toward automobility could be summarized as “one future of auto is airlines.” Why airlines, what happened?

Last Century’s US Airline Deregulation

In 1978 US president Jimmy Carter signed the Airline Deregulation Act into law (Statue-92-pg1705, https://www.congress.gov/bill/95th-congress/senate-bill/2493). It was the first piece of deregulation (affecting routes and market entry) that torpedoed business as usual for US carriers. A second piece in 1983 (reducing fares) threatened survival (Kahn 2007). Suddenly, low cost startups invaded the business with much lower fares. Carriers like American Airlines, Delta and United looked like dinosaurs facing extinction. Yet, fast forward 40 years, and those very brands are still alive - dominating the US market. *How* did they survive and dominate?

You Are What You Measure - Start with Results

From the outside little seems to have changed. Today, like 40 years ago, American, Delta and United, buy planes, paint them in their livery, and fly them from A to B. Yet, behind the scenes much has changed. Most importantly, carriers started with changing results. As Peter Drucker,

the legendary founder of management science, said: start with results, the rest will follow (Drucker 1963). 40 years ago, airlines started to **shift from revenue per route to revenue per seat**. What seemed as a minor tweak in a financial spreadsheet required large investments into new services, processes - and the systems and software to automate it all ("softwarization," Schlueter Langdon 2003). Fundamentally, the challenge was twofold: First, optimizing for the new metric - creating algorithms or analytics "engines", which is an analytics or **data science** task; then secondly, providing the data input to an engine and automating it's outcome - deploying the algorithms into a living process, which is a systems and **data engineering** job.

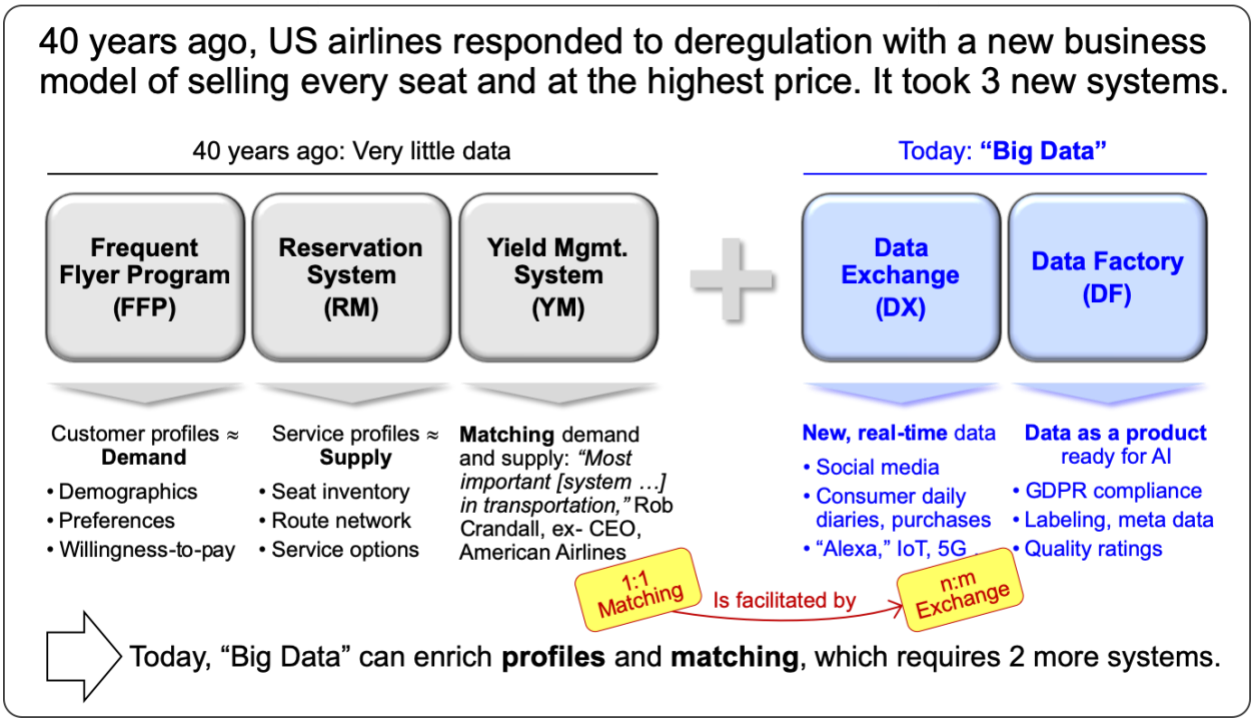

Figure 1: Industrializing the Optimization of Yield per Unit of Consumption

3 Systems: Two for Data, One for Analytics

Shifting from revenue per route to revenue per seat gave birth to three types of systems (see Figure 1):

(1) an airline reservation system (ARS)
(2) a loyalty system for a frequent flyer program (FFP)
(3) a yield or revenue management system (YM).

Why these three systems? At the core of the shift to revenue per seat was the insight that profitability required **selling every single seat and at the highest price possible**, essentially treating seats as perishable goods and customers as NOT created equal. From an analytics perspective the challenge was doable: Matching demand with supply, matching customers with seats. It required coupling inventory management with variable pricing: Use seat inventory to determine supply, use customer profiles to predict demand, then use different price points to clear the market. Finally, learn from results and adjust inventory next time around, for example using a bigger plane or adding a flight.

The problem back then was less with the analytics but more with the data - or specifically, the lack of it. Where to find the seat inventory for a particular destination? How to keep track of different routes to the same destination; for example, 5 seats in Business Class from Los Angeles/LAX to New York/JFK, and 10 seats for the same destination but via Chicago/ORD, and therefore, at a much longer travel time. Airlines created **reservation systems to manage inventory**.

And where to find customer profiles to predict demand and establish price points? Selling each seat and at the highest price requires insights into a customer's willingness-to-pay (WTP). Predicting WTP, in turn, requires data on travel event type (leisure or business), budget (income or travel policy), sensitivity to travel time (daytime departure or red eye), travel duration (non-stop or stopover), convenience (economy class or business) and the decision context (traveling alone or with family) - and all of the above not at some aggregate, average level but for each potential traveler. In order to collect this data airlines invented **frequent traveler programs to create traveler profiles**.

Finally, the matching of supply (with the service profile data from the reservation system) with demand (with the traveler profile data from a loyalty system) is automated with a **yield or revenue management system**. Robert Crandall, former Chairman and CEO of American Airlines, gave yield management its name, calling it "the single most important technical development in transportation management since deregulation" (https://en.wikipedia.org/wiki/Yield_management; for American Airlines, see Smith et al. 1992; for a YM literature review, see McGill & Van Ryzin 1999; for state of YM, Carrier & Fiig 2018).

More Data … 2 More Systems

With a shift in results from revenue per car to revenue per trip, learning from airlines seems a very appropriate first step. Yet, three systems may not be sufficient anymore. The data situation has been reversed. 40 years ago, airlines faced a data drought. Today, there is a glut of data available that can add critical value and should be utilized. 40 years ago, smartphones did not exist. Today, in developed countries almost every adult is using one, and the device itself has evolved into one gigantic datalogger (Dezember 2018). Smartphones have been a key enabler of a trend that has been dubbed **"SoLoMo"** by John Doerr, a partner at influential Silicon Valley venture capitalist Kleiner Perkins in 2010 (Guynn 2013). It summarizes the expansion of digitization into social, local and mobile applications, which has fueled growth of data on consumers and its commercialization for advertising and new service offerings. Companies like Facebook, Google and Uber exemplify this trend. Yet those high-profile firms are just the tip of an iceberg. Today, a vast cottage industry of consumer data brokers has emerged that sells consumer data. For example, a new 2019 law in Vermont that requires data brokers to be registered (Vermont 2018) has already revealed more than 120 vendors of consumer data (Melendez 2019). All this consumer data allows for better customization of offers by evolving from artificial and fictional "personas" with their inherent flaw of bias (systematic error) toward profiles cut from real-life behavioral data of actual and potential customers (McKinsey 2017, Crosby & Langdon 2014). The Figure 2 illustrates the different data types available for constructing profiles today: (1) data on consumers (traditional demographics, government statistics), (2) data on products and services (from vendors), (3) user-product interaction data (behavioral data), and a broad category of (4) context data. The latter ranges from capturing a

consumer's daily diary and friends & family to environmental settings like weather and traffic conditions. For example, Uber's "Pulse of a City" provides a visualization of people traffic data (Belmonte 2015).
And much more data is expected. Again, new technology, such as 5G, a cellular mobile communication standard for higher speeds and bandwidth, and the Internet of Things (IoT) with bots and virtual assistants like Amazon's Alexa, will accelerate data creation (Crosby & Langdon 2017). To further complicate the data challenge, this data growth is happening everywhere:

(a) **within** the enterprise,
(b) **across** a company's ecosystem of partners, and
(c) **external**.

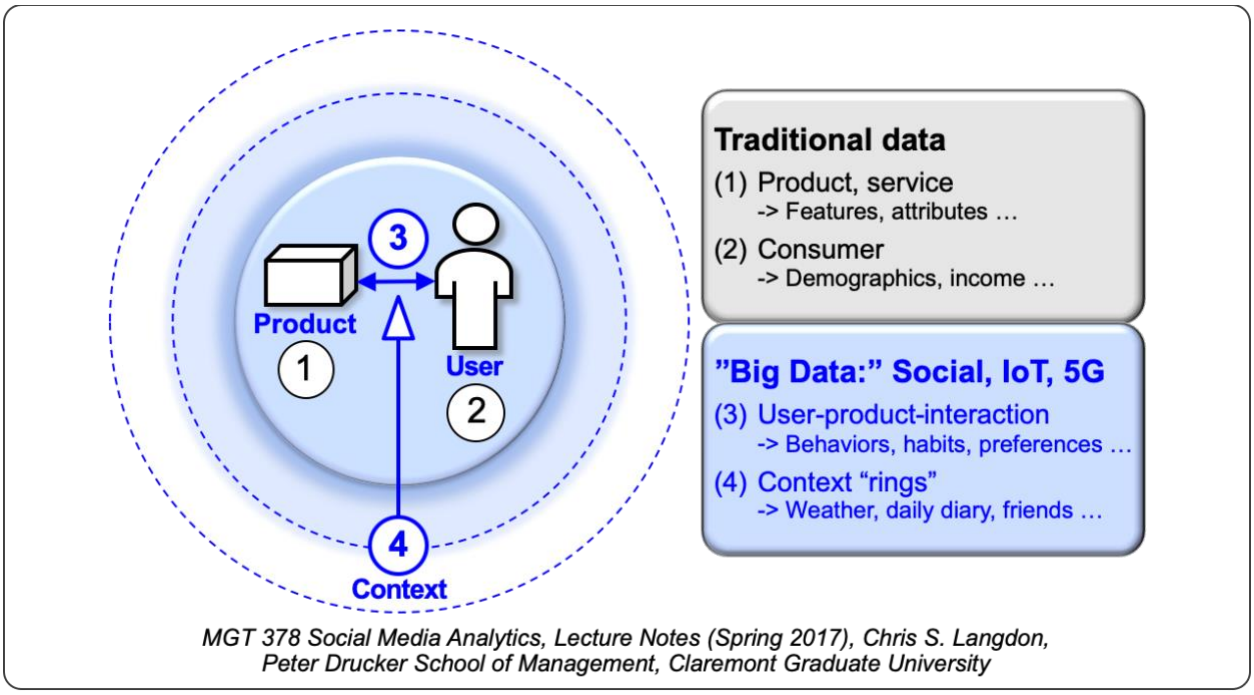

Figure 2: Enriching Customization and Personalization with Big Data

Let's take an automaker, for example. Different departments collect data on the same customer: Market Research, Vehicle Development and - as vehicles are being connected for remote, over-the-air (OTA) updates and telematics - also Services & Parts and Financial Services. And business ecosystem partners are also collecting data on the very same customer: Dealerships, aftermarket vendors, insurance companies, payment processors, and various systems operators (concierge services, fleet maintenance providers, etc.). For best consumer profiles and most beneficial matching of users with "seat inventory" all this data ought to be considered – otherwise somebody else could create a better offer. It is a bit like battlefield intelligence in military applications: a better sensor, such as a radar system or night vision goggles, can create an immediate advantage.

Add a Data Exchange

This is where a data exchange system could add value. Think of it as a marketplace or "supermarket" with data products for data scientists. Today, according to meta research more

than 80% of the time budget of a data analytics project is spent on data wrangling - not with algorithms (Press 2016, Vollenweider 2016). Companies have gone from databases to data warehouses and now to data lakes (Porter & Heppelmann 2015) - and they seem to be drowning in it. How to make consolidate all this data, how to organize it, how to make it available for data scientists? An internal data exchange is one solution. Instead of searching for data across departments and country operations, a data scientist could "shop" for internal data in a central location. This data hub could also connect with ecosystem partners as well as external, commercial data brokers to provide a single "storefront." It could track transactions for ease of auditing. It would also be a smart solution from a compliance and risk management standpoint. Instead of dealing with data regulation in a fragmented fashion, it could be standardized and enforced centrally. In Europe, one example would be compliance with the General Data Protection Regulation (GDPR, European Commission 2018), which aims to give control to individuals in the EU over their personal data. An exchange could handle data anonymization and consent management of personally identifiable information centrally.

Add a Data Factory

As more and more data will be generated within a company using social media, 5G or IoT, another system will be required. Call it a data factory. A data factory is needed to refine raw data into data products (Crosby & SL 2019). Despite the hype surrounding data analytics and Artificial Intelligence (AI), raw data is still confused with refined data. Machine learning and AI methods require refined data products. This is obvious for data scientists but few in management seem to be aware of it. The food analogy can help illustrate the gap. Very few of us pick food from trees or slaughter animals; most visit a supermarket and pick food off the shelf. The food at the supermarket is processed, packaged and labeled. Labels inform about product name, vendor, quantity, ingredients and nutritional value. For example, a "Nutrition Facts" label in the US can easily exhibit 20 rows of data (US FDA 2016). These labels are no coincidence but the result of rules. These rules have evolved together with food processing to ensure product quality to protect consumers, because bad food can be a health hazard. In a nutshell, the food we buy is a product. It is processed, labeled and packaged to be safe for consumption and exchanged for money. Machine learning and AI require data products. So, data could learn from food. For data to become a product it needs to be processed, labeled and prepared to be safe for use and exchange. This data productization can be accomplished economically with a data factory. For example, very often raw data lacks description or meta data. In order to "put it on a shelf," to categorize or make it available for search the raw data needs to be labeled or cataloged. This can be accomplished using AI-powered solutions, which exhibit high set up but moderate variable cost, so volume processing is economical. Other challenges that require solutions with high fixed cost are quality scoring and sizing. Quality scoring is well established in many areas, such as credit and bond scoring – but not with data; despite the critical importance of data quality – garbage in, garbage out (GIGO).

"3 Plus 2" Is Happening Now

The shift in performance results from revenue per vehicle to revenue per trip can be managed and automated using several systems (target metrics may evolve, for example, to revenue per minute or negative churn exhibited by users; today, airlines are measured based on PRASM,

passenger revenue per available seat mile). US airlines invented three types of systems - two for data and one for analytics - to master a similar shift 40 years ago:

(1) an airline **reservation** system (ARS) for service inventory,
(2) a **frequent flyer program** (FFP) for customer profiles, and
(3) a **yield management** system (YM) to match customers with service offerings.

Today, with the wealth of consumer data from smartphones and social media, two additional systems will be required, particularly considering the anticipated data glut from 5G and IoT technology. Such new systems include:

(4) a **data exchange** to pool data, and enrich customer and service profiles, and
(5) a **data factory** to economize on data refinement and compliance management.

Pioneers have already launched into this future. Airlines themselves are evolving systems capabilities to enrich profiles with "social media sentiment analysis, shopping queries, stated preferences versus actual behavior" (Sabre 2015, Fig. 4, p. 11) and other "attribute-level" data in order to expand personalization into "ancillary purchases" of cabin class upgrades, preferred seating with extra leg room, fast track security screening, onboard food and beverage, in-flight Wi-Fi, lounge access, etc. (McKinsey 2017). In big cities mobility is already evolving from a self-organized affair toward a more seamless experience involving different modes of travel. Figure 3 exemplifies how a simple trip from A to B could evolve toward seamless mobility increasing user benefits and provider margins (results based on our "Mobility-as-a-Service Calculator").

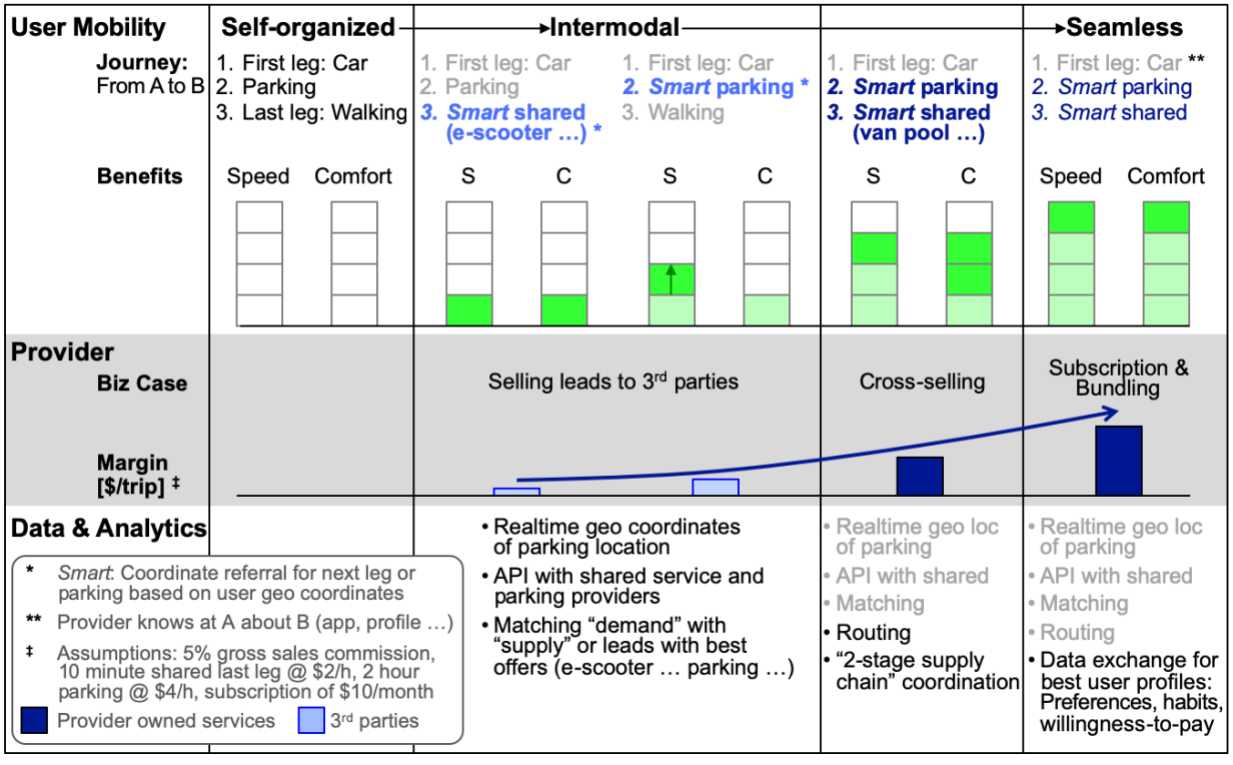

Figure 3: Economics of Seamless Mobility

New last mile solutions, such as shared bikes and e-scooters, and location data could allow for intermodal offers. Instead of walking to a destination after parking the car, the driver could accept an offer for a shared e-scooter nearby. Combining such last mile solution with a parking

recommendation, the driver could be navigated to an empty parking spot with a scooter nearby. Leading mobility and travel companies are creating the systems required for these personalized (1-to-1) services bundles. Uber has built “proprietary marketplace […] technologies [… that] include demand prediction, matching and dispatching, and pricing” (Uber 2019, p. 162). TUI, the world’s largest travel and tourism company, is building its own yield management system (YM) to personalize its hotel offers. According to its CEO, Fritz Joussen, “first tests have shown that 30% of customers are willing to pay five to ten Euro more per night for their preferred room” (Manager Magazin 2019, p. 68). TUI even plans to offer its new YM capabilities as a global platform service to third parties. In closing and to highlight the YM trend as well as to link back to the “what data could learn from food” analogy used earlier for the data factory, McDonalds, the iconic fast food pioneer, “in its largest acquisition in 20 years” (Patton 2019), has purchased Dynamic Yield, a YM company (Bloomberg 2019). So, mobility companies can benefit from a proven blueprint that decomposes the complexity of automating the shift toward revenue per trip into a manageable set of system modules.

References

Belmonte, N.G. 2015. The Pulse of a City: How People Move Using Uber Engineering. Uber Engineering (August 18), https://eng.uber.com/pulse-of-a-city/

Bloomberg. 2019. McDonald's to Acquire Dynamic Yield, Will Use Decision Technology to Increase Personalization and Improve Customer Experience (March 25), https://www.bloomberg.com/press-releases/2019-03-25/mcdonald-s-to-acquire-dynamic-yield-will-use-decision-technology-to-increase-personalization-and-improve-customer-experience

Carrier, E., and T. Fiig. 2018. Special Issue: Future of Airline Revenue Management. Journal of Revenue and Pricing Management (April) 17/2, https://link.springer.com/journal/41272/17/2/page/1

Crosby, L., and C. Schlueter Langdon. 2019. Data as a Product to be Managed. Marketing News, American Marketing Association (April), https://www.ama.org/marketing-news/data-is-a-product/

Crosby, L., and C. Schlueter Langdon. 2017. Why Marketers Must Keep Pace With Smart Technology. Marketing News, American Marketing Association (November), https://www.ama.org/marketing-news/why-marketers-must-keep-pace-with-smart-technology/

Crosby, L., and C. Schlueter Langdon. 2014. Technology Personified. Marketing News, American Marketing Association (February), 18-19

Dezember, R. 2018. Your Smartphone’s Location Data Is Worth Big Money to Wall Street. The Wall Street Journal (November 2)

Drucker, P. 1963. Managing for Business Effectiveness. Harvard Business Review (May),

https://hbr.org/1963/05/managing-for-business-effectiveness

Guynn, J. 2013. Nextdoor raises $60 million from Kleiner Perkins, Tiger Global. Los Angeles Times (October 29), https://www.latimes.com/business/technology/la-fi-tn-nextdoor-nabs-60million-investment-from-kleiner-perkins-tiger-global-20131028-story.html

Kahn, E. 2007. Airline Deregulation. In: Henderson D.A. (ed.). The Concise Encyclopedia of Economics (CEE) (2nd edition), https://www.econlib.org/library/Enc1/AirlineDeregulation.html

Manager Magazin. 2019. Wir verändern uns dramatisch – Interview mit TUI CEO Fritz Joussen (Mai), 67-69

McGill, J.I., and G.J. Van Ryzin. 1999. Revenue management: research overview and prospects. Transportation Science (33/2) (May): 233-256.

McKinsey & Company. 2017. How airlines can gain competitive edge through pricing (December), https://www.mckinsey.com/industries/travel-transport-and-logistics/our-insights/how-airlines-can-gain-a-competitive-edge-through-pricing

Melendez, S. 2019. A landmark Vermont law nudges over 120 data brokers out of the shadows. Fast Company (2019-02-03), https://www.fastcompany.com/90302036/over-120-data-brokers-inch-out-of-the-shadows-under-landmark-vermont-law

Palmer, M. 2006. Data is the New Oil. ANA Marketing Maestros (November 3), https://ana.blogs.com/maestros/2006/11/data_is_the_new.html

Patton, L. 2019. McDonald's $300 Million Tech Deal Will Revolutionize Menus. Bloomberg (March 25), https://www.bloomberg.com/news/articles/2019-03-25/mcdonald-s-300-million-tech-deal-is-its-largest-in-20-years

Porter, M. E., and J. E. Heppelmann. 2015. How Smart, Connected Products Are Transforming Companies. Harvard Business Review (October), https://hbr.org/2015/10/how-smart-connected-products-are-transforming-companies

Press, G. 2016. Cleaning Big Data: Most Time-Consuming, Least Enjoyable Data Science Task, Survey Says. Forbes (2016-03-23)

Sabre. 2015. The Evolution of Customer Data - How data driven personalization will change the game for airlines. White Paper, Texas (June 1), https://www.sabre.com/insights/the-evolution-of-customer-data/

Schlueter Langdon, C. 2003. Does IT Matter? An HBR Debate. Harvard Business Review (April), http://www.johnseelybrown.com/Web_Letters.pdf

Smith, B.C., J.F. Leimkuhler, and R.M. Darrow. 1992. Yield Management at American Airlines. Journal on Applied Analytics (22/1), https://pubsonline.informs.org/doi/pdf/10.1287/inte.22.1.8

Uber Technologies, Inc. 2019. 2019 Form S-1 Registration Statement (April 26). https://www.sec.gov/Archives/edgar/

US Food & Drug Administration. 2016. Changes to the Nutrition Facts Label (May 27). https://www.fda.gov/food/food-labeling-nutrition/changes-nutrition-facts-label

Vermont Office of the Attorney General. 2018. Guidance on Vermont's Act 171 of 2018 Data Broker Regulation (2018-12-11), https://ago.vermont.gov/wp-content/uploads/2018/12/2018-12-11-VT-Data-Broker-Regulation-Guidance.pdf

Vollenweider, M. 2016. Mind+Machine: A Decision Model for Optimization and Implementing Analytics. John Wiley & Sons: Hoboken, NJ