Dataspace super-apps

To be referenced as: Schlueter Langdon, C. 2024. Dataspace super-apps. Research Note (RN_DCL-Drucker-CGU_2024-09, v3), Drucker Customer Lab, Peter Drucker School of Management, Claremont Graduate University, Claremont, CA

Table of Contents

Executive summary

Every software application or app requires data. New dataspaces facilitate super-apps by making data accessible not only within a single domain, supply chain, or market channel but also across various vertical sectors, such as automotive, infotainment, and retail. This research note defines the concept of a super-app and its business impact. It examines how this concept continues the evolution of information system capabilities from Web1 to Web3 and how this progression has influenced business models. The final sections highlight key lessons learned from early multi-million dollar implementations, offering insights on achieving quick returns today while balancing current success with future growth.

What is it: Definition

A software super application, or "super-app," integrates diverse services and features within a single application (Willing 2024, Rosencrance 2023). Unlike traditional apps with a single focus, super-apps offer a comprehensive feature suite across domains, including messaging, social networking, and e-commerce. Originating in Asia, notably with WeChat in China, they emerged to meet the diverse needs of mobile-first users (Vaswani 2021, Heuzeroth 2021). They benefit from the evolution of apps towards more modular and decentralized designs, allowing them to function as platforms for a mini-app ecosystem (see section Software app evolution: From Web1 to Web3). Gartner likens it to a Swiss army knife — an app with a range of component tools or mini-apps that can be used and remove as needed (Perri 2022).

Key characteristics of super-apps include (a) a unified user experience, (b) extensive third-party integrations, and (c) the ability to handle multiple tasks without switching apps.

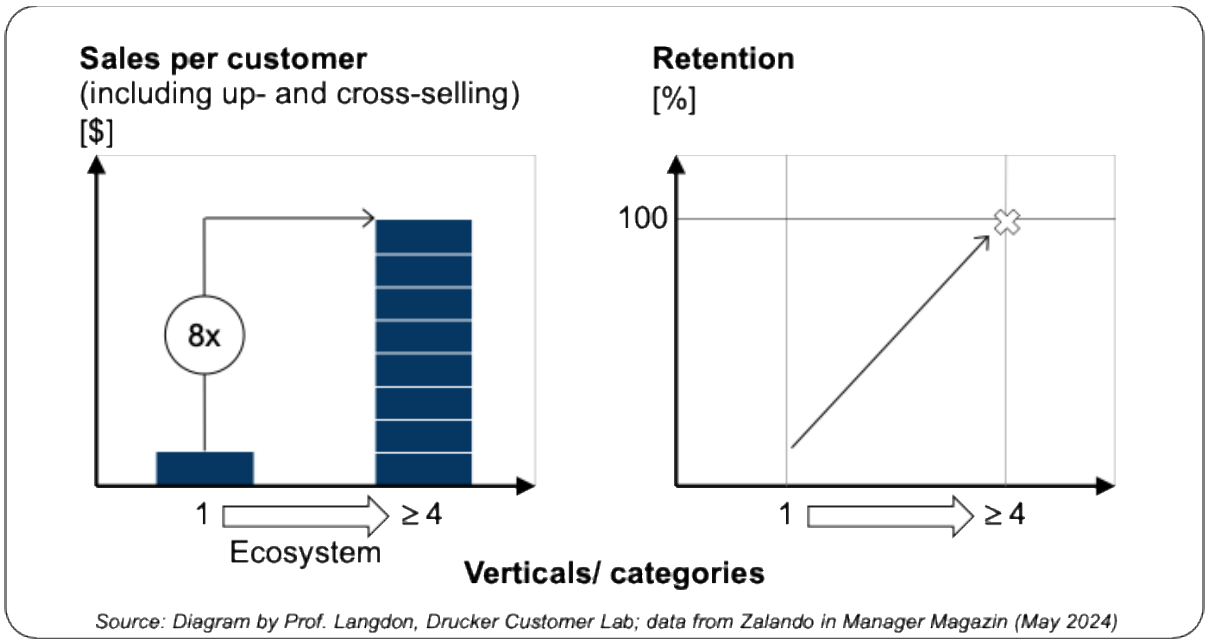


Figure 1: Ecosystem economics with super-apps – sell more, keep customers

Why important?

Super-apps represent a significant disruption to traditional business practices, continuing the evolution of IT's impact on business strategy and operations, such as with Web1 and Web2 (see section From Web1 to Web3: Business impact):

a) Strategically, super-apps can be a game changer. They can present a "blue ocean" opportunity, a yet unexploited or uncontested marketspace (Kim & Mauborgne 2004), by delivering a leap in user value and a seamless experience. Leading digital consultants, such as Accenture and McKinsey, hightlight importance of super-apps for **digital transformation** and **ecosystems** in particular (Accenture 2023, Chung et al. 2020). Super-apps enable companies to capture and retain customers within a single ecosystem, driving increased loyalty and higher lifetime value. This integration creates opportunities for cross-selling and upselling, enhancing revenue potential. Figure 1 illustrates the quantitative beneftis of an ecosystem strategy. Selling in four or more categories is increasing sales exponentially and retention to about 100%.

b) Operationally, super-apps **streamline processes** by centralizing services, reducing the need for multiple platforms, and lowering IT maintenance costs. They also facilitate better data collection and analytics, offering insights into customer behavior and preferences, which can inform more effective marketing strategies and product development. Adopting a super-app approach allows to economize on an ecosystem's club setup by shifting **from 1:1 connections to 1:many APIs** (application programming interfaces).

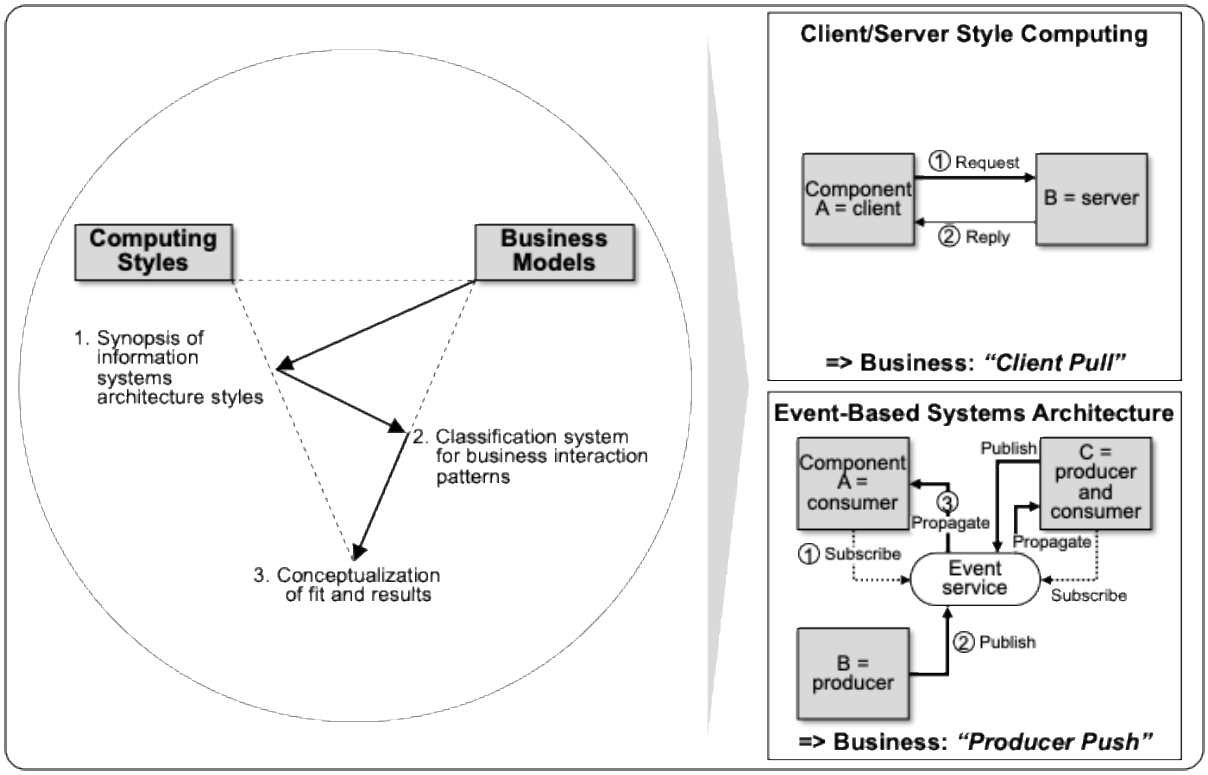


Figure 2: 'Form follows function' design – Fitting architecture to business for scalability (Schlueter Langdon 2003b, pages 285 and 290)

Software app evolution: From Web1 to Web3

From an information systems (IS) perspective, super-apps continue the trend of 'softwarization' (Schlueter Langdon 2003a)—the use of software to automate business activities. This trend is accelerating as 'software is eating the world' (Andreessen 2011). In terms of IS architecture, it extends the adoption of **decentralization**, the shift from monolithic to **microservices** architectures, and the rise of cloud and **software-as-a-service (SaaS)** computing:

1. **Web1**: In the mid-20th century, enterprises relied on vertically integrated mainframe computing, with centralized **mainframes** running custom-built, monolithic applications. The 1980s and 1990s saw a shift to **client-server** (C/S) architecture, decentralizing computing power and fostering modular software development on personal computers (Schlueter Langdon 2003b). Figure 2 illustrates how the C/S architecture compares with a different one, the publish-subscribe (Pub/Sub) design, turning client pull into producer push. In the late 1990s and early 2000s, this shift was further accelerated by the arrival of the **Internet**, marking the Web1 era. This period saw the proliferation of web-based C/S enterprise applications, which often featured lightweight frontends in JavaScript and heavy backends written in Java (History of the Web, W3C, link).
2. **Web2:** In the 2000s and Web2 period, technologies like Microsoft's .NET facilitated the adoption of Web- and **microservices** architecture[1], breaking down monolithic

[1] The author received Webservices research funding from Microsoft 2002-2004.

applications into smaller, independently deployable services accessible through Application Programming Interfaces or APIs (Schlueter Langdon 2003c). Together with the arrival of cloud computing pioneered by Amazon Web Services (AWS) in the 2010s these microservices transformed enterprise IS architecture to become more flexible and scalable without losing efficiency of tight integration (Schlueter Langdon 2006). Adoption was accelerated with the arrival of **Docker containerization** for consistent and efficient application deployment (Docker, link), and **Kubernetes** for orchestrating these containerized applications at scale, enabling robust, automated management of complex application ecosystems (Kubernetes, link).

3. **Web3:** Today in the European Union (EU), **data** is becoming more decentralized (no central storage) and federated (a unified view and coordinated access to data stored across independent systems with individual autonomy) due to regulations such as the General Data Protection Regulation (GDPR) and data sovereignty initiatives that require data to be stored and processed within the EU. This decentralized data, associated with Web3 (McKinsey 2023) and enabled by dataspace technology, a peer-to-peer system for trustful data sharing, enhances data sharing across organizations and industries, fueling super-apps. Examples include Catena-X (CX), the first open data ecosystem launched in automotive and the Mobility Data Space (MDS) focused on smart city and mobility use cases. Catena-X is particularly noteworthy for ecosystem scaling, as it provides 'Keep It Together' (KIT) frameworks to accelerate the integration of new use cases (link). KITs help ensure alignment with Catena-X standards, including semantic models, logic and schemas, APIs, and communication protocols.

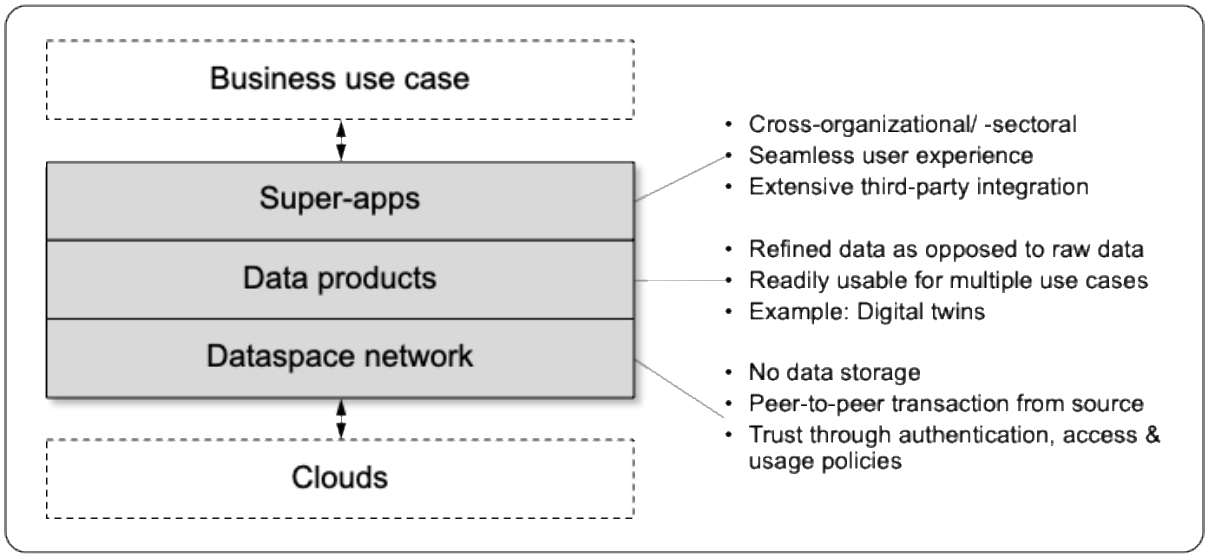


Figure 3: Data ecosystem software stack (derived from Schlueter Langdon & Schweichhart 2022, pages 494-496)

From Web1 to Web3: Business impact

The evolution of technology from Web1 to Web3 has profoundly transformed business models and operations. While Web1 introduced static websites and **e-commerce**, Web2

brought interactive, **two-sided platforms** that enabled user-generated content and monetization of social networking. Today, Web3's decentralization of the data layer, combined with data sovereignty protection, enables cross-organizational data products and data chains, such as **digital twins with primary supply chain or scope-3 data**. This better data fuels super-apps like tracing faulty parts into final products, and tracking of a product's carbon footprint. Figure 3 illustrates how dataspace network technology is sitting on top of clouds to make data available for novel data products and cross-organizational data chains to fuel super-apps. The dataspace network resembles a container shipping system for data. A container protects what is inside and works everywhere, on sea and land, and ports around the world. What product or data asset you place in it and to whom you send it for what purpose or application is between you and the receiver. This three-layer view is a simplified perspective rooted in well-established information systems literature (such as Turban et al. 2022); and it aligns as a subset with the seven abstraction layers of the Open Systems Interconnection (OSI) model, a reference framework from the International Organization for Standardization (ISO) that provides a common foundation for coordinating standards development to facilitate system interconnection (ISO/IEC 7498-1:1994). Here are several highlights from our research and advisory work along the Web1-3 business impact.

1. **Web1 – Digital channels & 'content versus pipes':** The author launched his career at Anderson Consulting/ Accenture and relocated to the firm's Silicon Valley office on Palo Alto's Page Mill Road when the world's first Web browser company, Mosaic Communications, went public as Netscape in 1995. It was the right time and place to cover this Web1 transformation for German clients in business publications such as Manager Magazin (Preissner 1995, page 94), Handelsblatt (Schlueter Langdon 1998, 1996), and Frankfurter Allgemeine Zeitung (Schlueter Langdon 2001). With colleagues next door who pioneered **e-commerce** innovations, such as BargainFinder, the world's first **shopping agent** on the Web (Anker 1995), we were in a privileged position to generate valuable insights for decision-makers. Our research uncovered fundamental cause-and-effect relationships and patterns, including the '2-3-6' framework to navigate channel conflicts and the strategic debate of 'content versus pipes.' This debate examines whether the value in digital platforms derives from the content they deliver or the infrastructure and user software (pipes) that distribute it (Schlueter Langdon & Shaw 2002, 1997).
2. **Web2 – Personalization & smart products:** With Web2, we expanded our research deeper into sales and distribution channels, focusing specifically on marketing's pursuit of targeting ever smaller market segments. This evolution ranges from 'long-tail' opportunities and 'niches that can add up' (Anderson 2006) to 'micro-segments' (McKinsey 2016) and 'mobile micro-moments' (Google 2015). Marketers have long aspired to achieve mass customization (Gilmore & Pine 1997), one-to-one personalization (Peppers et al. 1999), or segment-of-one marketing (Edelman 1989). Ultimately, this aligns with Peter Drucker's vision of a customer-centric business, where marketing 'knows and understands the customer so well that the product or service fits him and sells itself' (Drucker 1973, p. 64). Our research has become influential in the automotive industry by allowing to 'do more with less': We have improved the in-car feature user experience (UX) and JD Power customer

satisfaction scores through strategic decontenting, designing for **habit formation**, and the development of first smart features that respond automatically or provide personalized recommendations (Crosby & Langdon 2014, 2017; see also our master class MGT 317: Creating Smart Products, link). This was achived by 'meshing' and transforming structured engineering data from onboard microcontrollers and unstructured in-car video footage into real-life feature usage measurements with **behavioral variables** using advanced analytics and artificial intelligence (AI). It enabled Drucker-esque, customer-driven optimization of user journeys and corresponding feature design, including onboard vehicle navigation or satnav, entertainment, and seat adjustment, ultimately contributing to "The World's Best Car", "Best Interior", and "Mobile Excellence" awards (see "Calculator" Powered by AI: Auto Interior & UX, link).

3. **Web3 – Digital transformation & emerging ecosystems:** A business ecosystem is a dynamic network of interconnected organizations, individuals, and other stakeholders that collaboratively create and deliver value beyond what any single participant could achieve alone (Schlueter Langdon 2024). Essentially, it embodies the concept that combined efforts produce results greater than the sum of individual contributions—the 'one plus one equals three' promise. However, since Moore's foundational work in the 1990s, the concept has advanced in theory but lagged in practice (Moore 1996, 1993). This is changing with Web3's distributed and federated data: Data has long been the lifeblood of modern enterprises, evolving from 1950s data processing for credit card transaction to advanced analytics and generative AI. This is very evident with generative AI: Without cats in the training data, a generative AI model will not produce or infer results involving cats. Now, digital transformation is paving the way for increasingly software-driven competition. For example, in the automotive industry, the focus has shifted from discussing products in terms of horsepower and torque to emphasizing software-defined vehicles (SDVs). As ecosystems are distributed in nature, today's dataspace-based, trustworthy cross-organizational data sharing is turbo-charging digital transformation to provide the matching infrastructure needed for scalable ecosystems. Figure 2 highlights the importance of the 'form follows function' design principle for information systems—an idea advocated by management guru Peter Drucker already in the 1960s: "We must decide on our information needs and how the computer can meet those needs. To do this, we must understand our operating processes and the principles behind them", Drucker 1967). We are fortunate to be involved with Deutsche Telekom at this pivotal time, as it is at the center of dataspace activities. Our key dataspace development projects include (Schlueter Langdon & Schweichhart 2022):
   - 2019 - 2022 **RealLab Hamburg**[2], winner of the 2022 Innovation Award Real Laboratories of the German Federal Ministry of Economic Affairs and Climate Action (link). For our case study including ITS World Congress papers:
     —> Auto 5: Mobility super-app disruption, link

[2] The author was Principal Investigator for Deutsche Telekom's involvement.

- 2021 - 2024 **Gaia-X 4 Future Mobility** (GX4FM), a family of six projects[3]
  —> Gaia-X Explainer (2-pager), link
- 2021 - 2024 **Catena-X** Consortium (€250 million, 28 partners, including BMW, Mercedes-Benz, Volkswagen)[4]
  —> Catena-X Explainer (2-pager), link

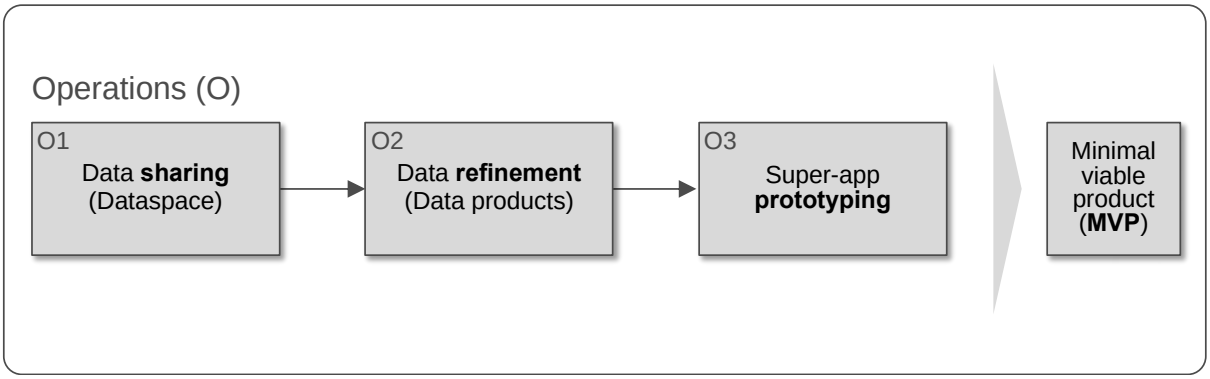


Figure 4: 3 steps for monetizing dataspace investments

'Million dollar' lessons learned: 3 steps to successful MVP today

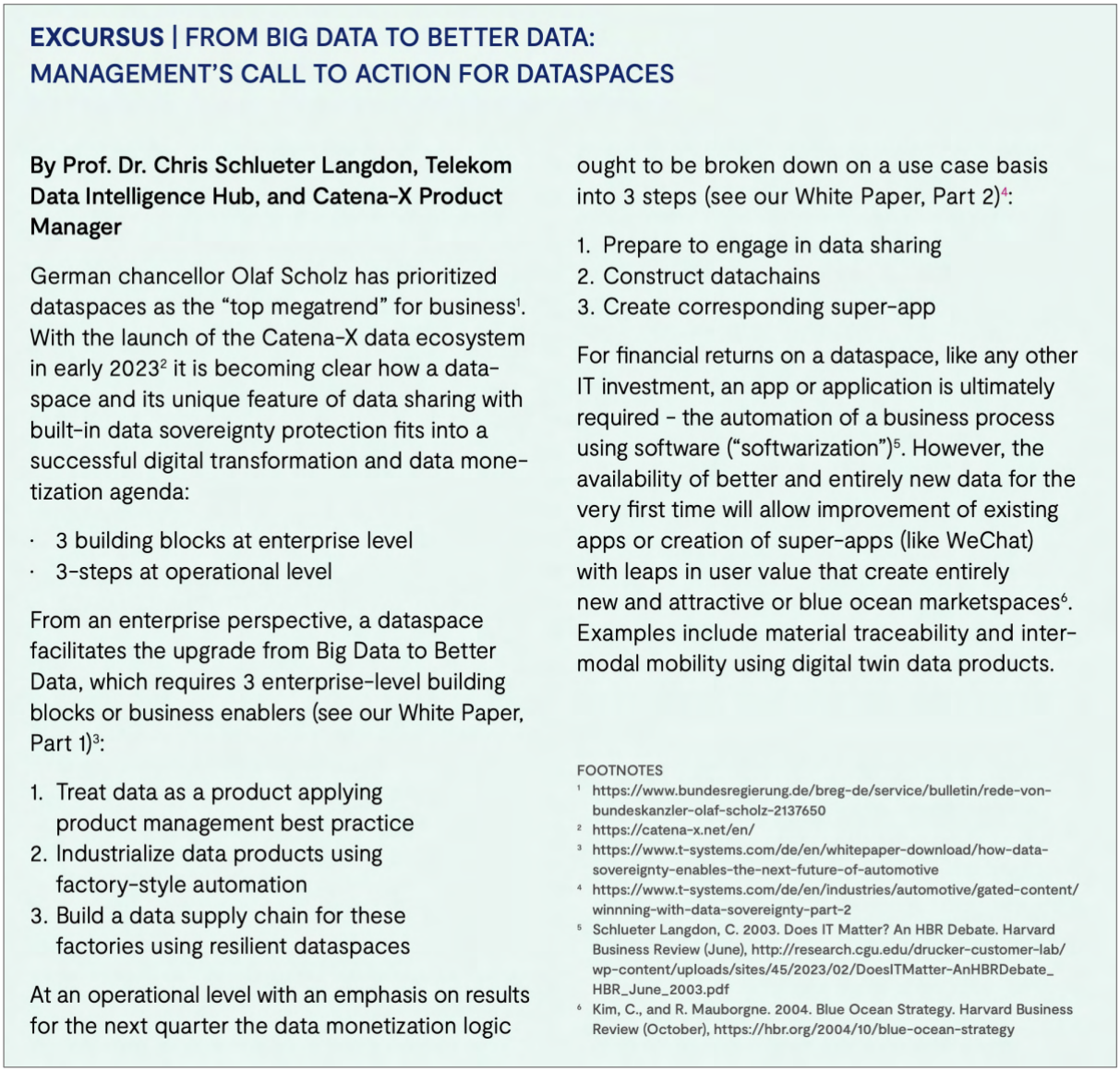
With billions of euros invested in dataspace initiatives and executed in a market-oriented, customer-centric manner (as advocated by Peter Drucker), valuable lessons have been learned. Catena-X alone had a budget of €250 million and was established with an industry consortium of 28 partners, including direct competitors such as Mercedes-Benz, BMW, and Volkswagen, driven by industry use cases. Catena-X has already undergone extensive piloting and live data installations, providing significant insights (see launch of live data chain at CES 2024: Link). A key takeaway is how to 'slice the elephant'—structuring a project to create a successful dataspace-enabled solution. Our involvement in these projects has refined and validated a three-step best practice approach as shown in Figure 4, which aligns with the simplified architectural view illustrated in Figure 3:

1. **Dataspace network**: Prepare to utilize a dataspace with sovereignty protection to exchange supply chain and market channel data
   —> Dataspaces 101 – Compendium (link)
2. **Data products**: Economize on data sharing and reuse by refining raw data into standardized, ready-to-use data assets for broad consumption, such as data products and data chains like digital twins
   —> Data products: dgitial twins – Compendium (link)
3. **Super-app**: Upgrade existing app or create new app with agent capability to take advantage of cross-organizational and -sectoral data product for unified solutions with a seamless user journeys and application experience
   —> Auto 5: Mobility super-app disruption – Case study (link)

[3] The author was Consortium Lead of Gaia-X 4 Advanced Mobility Services (GX4AMS with a budget of approx. €25 million) and lead of dataspace work package of Gaia-X 4 Artificial Intelligence (GX4AI).
[4] The author was agile Product Manager (SAFe certified PM-PO) with responsibility of delivery of the software release together with a colleague from BMW and SAP (—> Linkedin story: link).

Annex: How to balance managing for today and the future?

Peter Drucker long ago quipped about the challenge of achieving short-term results while ensuring long-term success—how do you accomplish this? The annex with the breakout box in Figure 5 builds on experience with our three-step approach in Figure 4 for quick operational success and complements it with a CEO agenda of three strategic initatives or building blocks to sustain, reinforce, and scale short-term gains into a broader **digital transformation**. It has been published by Detecon, Deutsche Telekom's global management and technology consultancy with a focus on digital transformation.



EXCURSUS | FROM BIG DATA TO BETTER DATA: MANAGEMENT'S CALL TO ACTION FOR DATASPACES

By Prof. Dr. Chris Schlueter Langdon, Telekom Data Intelligence Hub, and Catena-X Product Manager

German chancellor Olaf Scholz has prioritized dataspaces as the "top megatrend" for business[1]. With the launch of the Catena-X data ecosystem in early 2023[2] it is becoming clear how a data-space and its unique feature of data sharing with built-in data sovereignty protection fits into a successful digital transformation and data monetization agenda:

- 3 building blocks at enterprise level
- 3-steps at operational level

From an enterprise perspective, a dataspace facilitates the upgrade from Big Data to Better Data, which requires 3 enterprise-level building blocks or business enablers (see our White Paper, Part 1)[3]:

1. Treat data as a product applying product management best practice
2. Industrialize data products using factory-style automation
3. Build a data supply chain for these factories using resilient dataspaces

At an operational level with an emphasis on results for the next quarter the data monetization logic ought to be broken down on a use case basis into 3 steps (see our White Paper, Part 2)[4]:

1. Prepare to engage in data sharing
2. Construct datachains
3. Create corresponding super-app

For financial returns on a dataspace, like any other IT investment, an app or application is ultimately required - the automation of a business process using software ("softwarization")[5]. However, the availability of better and entirely new data for the very first time will allow improvement of existing apps or creation of super-apps (like WeChat) with leaps in user value that create entirely new and attractive or blue ocean marketspaces[6]. Examples include material traceability and inter-modal mobility using digital twin data products.

FOOTNOTES

1 https://www.bundesregierung.de/breg-de/service/bulletin/rede-von-bundeskanzler-olaf-scholz-2137650
2 https://catena-x.net/en/
3 https://www.t-systems.com/de/en/whitepaper-download/how-data-sovereignty-enables-the-next-future-of-automotive
4 https://www.t-systems.com/de/en/industries/automotive/gated-content/winnning-with-data-sovereignty-part-2
5 Schlueter Langdon, C. 2003. Does IT Matter? An HBR Debate. Harvard Business Review (June), http://research.cgu.edu/drucker-customer-lab/wp-content/uploads/sites/45/2023/02/DoesITMatter-AnHBRDebate_HBR_June_2003.pdf
6 Kim, C., and R. Mauborgne. 2004. Blue Ocean Strategy. Harvard Business Review (October), https://hbr.org/2004/10/blue-ocean-strategy

Figure 5: Managment's call to action (Detecon 2023, p. 3)

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