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## How an Incumbent Telecoms Operator Became an IoT Ecosystem Orchestrator

*The journey to become an ecosystem orchestrator for an Internet of Things (IoT) platform poses considerable strategic challenges for industry incumbents, which arise along three dimensions: platform, ecosystem and value co-creation. We describe how “TelcoCorp,” a large European telecoms operator, addressed these challenges as it established its enterprise IoT platform ecosystem. Based on the TelcoCorp case study, we provide recommendations that IT and business executives can use to become orchestrators in the IoT instead of fearing platform competition.<sup>1,2</sup>*

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### Challenges and Opportunities for Industry Incumbents in Enterprise IoT Initiatives

The Internet of Things (IoT), which interconnects the physical and digital worlds, is shifting organizations' value creation from selling traditional products to marketing "smart products" with integrated digital service offerings.<sup>3</sup> Moreover, the digital economy has taught us the power of platform businesses. They connect a plethora of technology providers and users and profit from "network effects,"<sup>4</sup> which result in ever-more users, data, innovation and transactions. In the business-to-business (B2B) context, the combination of IoT and digital platforms has stimulated a race for technology leadership. Native platform providers, such as Amazon's Web Services, Microsoft's Azure and Google's Cloud, all of which can be used as IoT platforms, compete against long-established product and service firms, referred to in this article as "industry incumbents." These incumbents include, for example, AT&T with its IoT Control Center, GE with its Predix platform offering and IBM's Watson IoT platform. According



<sup>1</sup> Varun Grover and Kalle Lyytinen are the accepting senior editor for this article.

<sup>2</sup> The authors thank Varun Grover and the members of the review team for their thoughtful feedback and guidance throughout the review process.

<sup>3</sup> For an article on smart product competition, see Porter, M. E. and Heppelmann, J. E. "How Smart, Connected Products Are Transforming Competition," *Harvard Business Review* (92:11), November 2014, pp. 64-88.

<sup>4</sup> For a classic article on network effects, see Katz, M. L. and Shapiro, C. "Technology Adoption in the Presence of Network Externalities," *Journal of Political Economy* (94:4), August 1986, pp. 822-841. For a more recent practice-oriented article on network effects and platform strategy, see Eisenmann, T., Parker, G. G. and Van Alstyne, M. W. "Platform Envelopment," *Strategic Management Journal* (32:12), April 2011, pp. 1270-1285.

to market researchers, there are now over 600 IoT platform offerings worldwide competing in a market worth \$6.7 billion in 2019.<sup>5</sup>

Industry incumbents have decades of experience improving their businesses and supply chains and now have the opportunity to extend their business models and value creation logic through IoT platforms.<sup>6</sup> As a collection of software resources, IoT platforms create value by exploiting the generic capabilities in devices, connectivity, data, security and application management, connecting physical things with digital entities, and technology adopters with third-party providers. The latter can leverage a platform through hardware- and software-based “complements,”<sup>7</sup> forming an ecosystem of collaborating organizations around the IoT platform. The processes and activities of these collaborating organizations to integrate resources into the IoT platform are referred to as “value co-creation.”<sup>8</sup> In enterprise IoT, this value comes in various forms, including devices (e.g., the EnOcean multisensor), connectivity (e.g., Cisco’s network technologies), analytics tools (e.g., Microsoft’s IoT Edge toolkit) and applications (e.g., GE’s asset performance management software). All of these forms of value improve customers’ business operations.

To benefit from an IoT platform business model, industry incumbents must learn how to establish their IoT ecosystems and orchestrate third-party providers for value co-creation. To date, there has been little investigation of industry incumbents’ experiences of establishing and orchestrating IoT platforms and ecosystems. Prior research, however, hints that they will need to master how to:

5 See Lueth, K. L. “IoT Platform Companies Landscape 2019/2020: 620 IoT Platforms globally,” *IoT Analytics*, December 2019, available at <https://iot-analytics.com/iot-platform-companies-landscape-2020/>.

6 For a good article on how industry incumbents, or “pipeline businesses,” can shift their business models to platforms, see Van Alstyne, M. W., Parker, G. G. and Choudary, P. S. “Pipelines, Platforms, and the New Rules of Strategy,” *Harvard Business Review*, April 2016, pp. 54-60.

7 Complements are products or services that are interoperable with the platform and add functions to it. Examples in IoT platforms include new devices, communication protocols, digital twins or predictive maintenance applications.

8 For an excellent article on IT- or platform-based value co-creation, see Grover, V. and Kohli, R. “Co-creating IT Value: New Capabilities and Metrics for Multifirm Environments,” *MIS Quarterly* (36:1), March 2012, pp. 225-232.

1. Provide a platform with a standalone value proposition
2. Establish an ecosystem of third-party IoT providers
3. Foster value co-creation for IoT customers.<sup>9</sup>

In addition to mastering these three dimensions (i.e., platform, ecosystem and value co-creation), senior executives in industry incumbents must ensure their businesses have the competencies needed to meet the challenges specific to the enterprise IoT context. This context includes industries such as manufacturing, logistics, automotive, energy, construction, and healthcare, and involves facing challenges in three particular areas: technical (e.g., dealing with a variety of different types of devices), organizational (e.g., negotiating lengthy sales processes) and regulatory (e.g., complying with national or industry standards). These challenges reduce the chances of successfully establishing an IoT platform ecosystem that dominates multiple industries with a “horizontal” market approach.<sup>10</sup>

Because of this complexity, companies (even when competing in a different line of business) often join forces to co-create value in the enterprise IoT space. Thus, successful journeys to establish enterprise IoT platforms and ecosystems differ considerably from those in consumer markets and increase the need for platform owners to orchestrate the IoT resources and capabilities of organizations that collaborate in the ecosystem to co-create value.

In this article, we present a case study of a leading European telecoms company, which we refer to anonymously as “TelcoCorp.” We describe the major challenges TelcoCorp faced as it established its IoT platform ecosystem between 2015 and 2020 and the strategies it adopted for dealing with the challenges. (Our case study methodology is described in the Appendix.) From our analysis of the TelcoCorp case, we show how industry incumbents in general that want to establish and foster IoT platform ecosystems

9 For more information on value co-creation in B2B and IoT platforms, see Hein, A., Weking, J., Schreieck, M., Wiesche, M., Böhm, M. and Krcmar, H. “Value co-creation practices in business-to-business platform ecosystems,” *Electronic Markets* (29:3), pp. 503-518.

10 For a description of IoT platforms and complexity-related challenges in the enterprise or industrial context, see Pauli, T., Fielt, E. and Matzner, M. “Digital Industrial Platforms,” *Business & Information Systems Engineering* (63:2), January 2021, pp. 181-190.

can adopt early growth strategies that move beyond merely offering a platform. To thrive and survive alongside established IoT platforms or digital entrants, industry incumbents need to learn how to build on their strengths to become ecosystem orchestrators. As such, they will be able to combine customers' domain and partners' technological knowledge to foster growth both as a horizontal platform provider and as a vertical provider serving specific industries.

As well as describing the challenges that industry incumbents face when establishing enterprise IoT platforms, we also provide actionable recommendations based on how TelcoCorp managed and overcame the challenges. These recommendations can be used by industry incumbents and firms that operate traditional pipeline businesses that want to become IoT orchestrators and capitalize on digital service opportunities. Our insights from the TelcoCorp case provide IT and business decision makers with strategies to co-create, deliver and capture value in enterprise IoT initiatives, and guidance on how to embed these strategies in larger transformation journeys from pipeline businesses to platform businesses.

## Dimensions of Orchestrating IoT Platform Ecosystems for Value Co-Creation

To successfully establish IoT platform ecosystems, industry incumbents must develop the orchestration capabilities<sup>11</sup> that will enable them to benefit from value co-creation. In the context of enterprise IoT, the term "orchestration" denotes an organization's ability to enable and organize a platform's digital resources, the customers and third-party providers in the ecosystem, and their collaborative co-creation activities. In line with state-of-the-art information systems research, organizations that seek to become successful orchestrators need to consider the three dimensions mentioned above and

depicted in Figure 1: platform, ecosystem and value co-creation.<sup>12</sup>

First, the IoT platform dimension<sup>13</sup> provides the technological foundation to co-create value through using openly designed application programming interfaces (APIs) that must be generic enough to communicate with heterogeneous hardware and software complements, but specific enough to benefit a single industry. The IoT platform is owned and controlled by the platform owner, which takes on the role of the ecosystem orchestrator. The platform owner's challenge is to manage the diversity of hardware and software on the IoT platform to ensure these elements can connect with heterogeneous industrial assets, on the one hand, and to provide applications for different industries and types of customers, on the other.

Second, on the ecosystem dimension, customers and third-party providers form a non-hierarchical network of collaborating individuals and businesses, including OEMs, systems integrators, device manufacturers and software developers.<sup>14</sup> Ecosystem challenges arise from transforming existing business relationships into partnerships and onboarding new partners that create value-adding complements, as well as managing the customers that consume the solutions provided by complements. This classic problem of simultaneously growing the supply and demand sides of a platform is known as the chicken-and-egg problem.<sup>15</sup>

Third, the value co-creation dimension refers to the collaborative activities between ecosystem partners to generate customer value, such as enterprise IoT solutions that are integrated, reliable and secure. Complexity emerges from the

12 Our view on successful journeys for establishing and orchestrating IoT platforms and ecosystems is based on the tripartite framework proposed by Lusch and Nambisan when explaining value co-creation for service innovation. For more information, see Lusch, R. F. and Nambisan, S. "Service Innovation: A Service-Dominant Logic Perspective," *MIS Quarterly* (39:1), March 2015, pp. 155-175.

13 There are two dominant types of platforms: innovation and transaction platforms. In this article, an IoT platform refers to an innovation platform that acts as a base technology to facilitate value co-creation and innovation. See Cusumano, M. A., Gawer, A. and Yoffie, D. B. *The Business of Platforms: Strategy in the Age of Digital Competition, Innovation, and Power*, Harper Business, 2019.

14 For a detailed description of ecosystems, see Jacobides, M. G., Cenno, C. and Gawer, A. "Towards a Theory of Ecosystems," *Strategic Management Journal* (39:8), May 2018, pp. 2255-2276.

15 The chicken-and-egg problem refers to the question of which market side to attract first to grow the platform—the demand or supply side—to reach a critical user mass that generates network effects.

11 For more information on value co-creation and orchestration capabilities in enterprise software platforms, see Schreieck, M., Wiesche, M. and Krcmar, H. "Capabilities for value co-creation and value capture in emergent platform ecosystems: A longitudinal case study of SAP's cloud platform," *Journal of Information Technology* (13:4), August 2021, pp. 365-390

need to bring together customers and third-party providers to develop value-adding applications. Hence, the orchestrator must bridge knowledge gaps between customers' domains and third-party providers' technologies to enable the creation of usable, value-adding IoT applications. Moreover, platform owners or orchestrators must establish a governance regime for defining the IoT development and commercialization opportunities of third-party providers.<sup>16</sup>

Overall, an IoT platform ecosystem thus forms a sociotechnical system that comprises an extendable software base that can be complemented by an ecosystem of third-party providers. The successful establishment of an IoT platform ecosystem requires an organization to launch an IoT platform, nurture an ecosystem of collaborating organizations and foster value co-creation activities among ecosystem partners to develop and market value-adding IoT complements. Industry incumbents require orchestration capabilities to trigger and manage the value co-creation process effectively and to leverage growth and innovation. However, acquiring the necessary orchestration capabilities to compete as an IoT platform owner poses a significant challenge to industry incumbents. Despite recent work on the dynamics of ecosystem orchestration<sup>17</sup> and evolving technologies,<sup>18</sup> research in this area is still very limited. To address this gap, in this article we report on the rich empirical findings from our study of TelcoCorp and provide insights into the orchestration capabilities needed to address the novel managerial issues associated with enterprise IoT initiatives.

## TelcoCorp's Recognition of the IoT Business Opportunity

TelcoCorp is a large European provider of information and communication technology (ICT) services, serving consumer and business markets with mobile and broadband connectivity, media entertainment and cloud services. As the national market leader in mobile communications with a market share of about 60% and 19,000 employees, TelcoCorp generated total revenue of \$12.3 billion in 2020—40% of which came from business customers. However, since the early 2010s, TelcoCorp had been facing significant challenges with stagnating revenues and, more recently, declining revenues. Like many other European telecoms companies, TelcoCorp has suffered from decreasing price levels in saturated markets<sup>19</sup> and competition from over-the-top (OTT) services provided by non-telecoms companies. Examples include WhatsApp, Microsoft Teams and Disney+, which have entered the market with rich content, heavy advertising and direct-to-consumer offerings via the internet, partially disrupting TelcoCorp's traditional value chains. TelcoCorp's strategic response to these challenges was to radically improve its operations and extend its business by offering novel data-based services.

As industry incumbents, telecoms operators like TelcoCorp are in a good position to extend their value proposition from just providing connectivity to offering IoT platforms and associated digital services—i.e., providing an “IoT technology stack.”<sup>20</sup> Given that IoT applications provide connectivity between a physical device and scalable back-end IT systems, telecoms operators have a strong competitive edge. Nick Earle, chief executive of Eseye (an IoT solutions provider), has emphasized the need for reliable and secure connectivity in IoT applications:

16 For an excellent paper on platform evolution and platform governance, see Tiwana, A., Konsynski, B. and Bush, A. A. “Research Commentary—Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics,” *Information Systems Research* (21:4), December 2010, pp. 675-687.

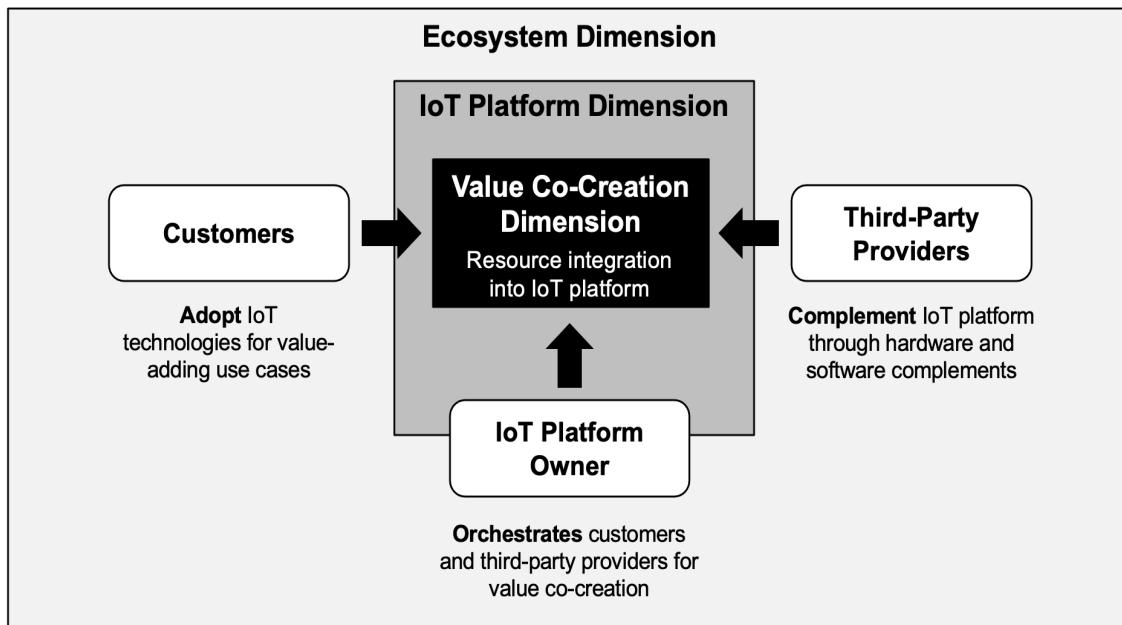
17 For more information on capabilities needed to orchestrate ecosystems for innovation, see Linde, L., Sjödin, D., Parida, V. and Wincent, J. “Dynamic capabilities for ecosystem orchestration A capability-based framework for smart city innovation initiatives,” *Technological Forecasting and Social Change* (166), February 2021, Article 120614.

18 For an excellent case study on the dynamics of evolving (platform) technologies, see Sandberg, J., Holmström, J. and Lytynen, K. “Digitization and Phase Transitions in Platform Organizing Logics: Evidence from the Process Automation Industry,” *MIS Quarterly* (44:1), March 2020, pp. 129-153.

19 On average, European telecoms operators' revenues declined by 24% between 2008 and 2018. For more information, see *Telecom Operators: Surviving and Thriving through the Next Downturn*, McKinsey & Company, August 2019, available at <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/telecom-operators-surviving-and-thriving-through-the-next-downturn/>.

20 The four key technology layers in IoT that need to be considered for a value proposition are hardware, connectivity, platform and applications. For an in-depth discussion, see Wortmann, F. and Flüchter, K. “Internet of Things: Technology and Value Added,” *Business and Information Systems Engineering* (57:3), June 2015, pp. 221-224.

Figure 1: Three Dimensions of Value Co-Creation in IoT Platform Ecosystems



"[The] major reason why 80% of IoT projects fail, is the fact that organizations cannot actually connect their devices in order to extract the data they need to support their expected business outcome."<sup>21</sup> By providing IoT platforms, telecoms operators can not only operate and manage the data running through their networks, but can also harness it to alleviate many of their current challenges, such as stagnating revenues, structural inflexibility and the large capital investments needed for network rollouts and cloud installations.<sup>22</sup>

Despite the great potential offered by new network technologies such as 5G mobile networks, telecoms operators must learn how to expand their pipeline business of buying, installing and maintaining connectivity infrastructure into a platform business. This expansion causes new management challenges in each of the three orchestration dimensions—

platform, ecosystem and value co-creation—as industry incumbents' IT and business executives steer their companies on the transformational journey from a technology enabler to an ecosystem orchestrator role that coordinates resources and fosters value co-creation on top of an IoT platform.

Industry analysts were predicting that the emerging IoT market would provide a big growth opportunity for telecoms operators. Telco Corp was eager to exploit this opportunity, as indicated by the Head of Business Customers:

*"With enterprise IoT, we try to shift margins by diving deeper into our customers' businesses and learning more about their industries. So, we do not just equip them with mobile connectivity services, but also connect their assets. Hence, we decided to become a data-as-a-service company that, by leveraging innovation, can achieve greater lock-in effects."* Head of Business Customers, TelcoCorp

Before deciding to enter the IoT market, as a leading telecoms player, TelcoCorp had built up three significant competitive advantages that would help it in the future to become an

21 "Avoid IoT Project Failure with Device Design, Data Handling and Connectivity That Enable the Business Outcome." *IoT Now Magazine*, April 2020, available at <https://www.iot-now.com/2020/04/07/102149-avoid-iot-project-failure-with-device-design-data-handling-and-connectivity-that-enable-the-business-outcome/>.

22 For more information on how telecoms operators can overcome challenges in the future, see *Organizing a New Telco*, Detecon Consulting, January 2021, available at <https://www.detecon.com/en/journal/organizing-new-telco>.

IoT orchestrator. First, it operated the nation's largest mobile broadband network and thus enjoyed a reputation of trust and security. Leveraging its core value proposition as a connectivity service provider to build closer ties with business customers would help TelcoCorp to create and capture value in the enterprise IoT market. Second, the company had over 15 years' experience as an IT systems integrator, with a focus on SAP and Microsoft applications. In the words of TelcoCorp's Head of IoT, "We have a unit of 400+ employees who do this professionally every day, not for IoT but very much for the ERP business domain in general." Third, TelcoCorp provided many auxiliary services, such as 24/7 support, billing and maintenance, which facilitated its business network—and future IoT partners—to implement service-based business offerings on top of network-enabled devices.

Thus, before launching the IoT initiative, TelcoCorp had already been recognized as an IoT enabler with various connectivity-related solutions (e.g., 2G, 3G and 4G). However, driven by a belief in the future business potential of IoT, TelcoCorp's management decided to more actively shape the market as an IoT ecosystem orchestrator.

## TelcoCorp's Journey from IoT Enabler to Orchestrator

In line with its strategy of exploiting digital growth opportunities, TelcoCorp launched its IoT platform initiative in late 2014. The initiative was led by a new department that has steadily grown from less than five employees in 2015 to over 50 in 2020. From the beginning, TelcoCorp knew that realizing its IoT strategy would require key resources (a connectivity-based IoT platform) that enable customers and partners to innovate both IoT devices and applications (an IoT ecosystem) in joint activities (value co-creation). Thus, to implement the strategy, TelcoCorp needed to develop orchestration capabilities. We describe and organize the challenges TelcoCorp experienced and managed on its journey to establish its enterprise IoT platform ecosystem along the three dimensions of platform, ecosystem and value co-creation.

### Dimension 1: From Connectivity to IoT Platform

As of early 2015, TelcoCorp's role as an IoT enabler was to help the emerging IoT market to flourish. It faced several challenges as it set about building an enabling IoT technology, particularly in the areas of establishing a new IoT network and a platform-based modular architecture that would enable the integration of digital and physical resources. The latter involved TelcoCorp considering whether to make or buy the IoT platform.

**IoT Network Challenges.** The first challenge was to build an *ICT infrastructure that lowered the entry barriers for realizing IoT use cases*. Prior to 2015, the growth of the national IoT market had been constrained by the expensive SIM card-based licenses that customers had to buy to connect their devices, using TelcoCorp's 3G and 4G mobile networks. In April 2015, however, senior executives at TelcoCorp decided to deploy a new wireless IoT network—called the Low Power Network (LPN)—that facilitated long-distance communication at low data rates. By using a license-free radio frequency spectrum, the LPN significantly reduced the cost of IoT use cases with low energy consumption. For example, the LPN enabled the use of sensor devices with a battery life of over ten years. In addition, the LPN was powerful and secure, and provided extensive geographical coverage. Because the LPN operates via unique IDs, not SIM cards, TelcoCorp was able to significantly reduce hardware-integration and operational costs:

*"We built the LPN network ... so that certain use cases could be built on it. A few years ago, LPN was totally new and there was little hardware available. That is why we created device catalogs to ensure that hardware could get qualified for this network and would function smoothly in it."*

Sales Manager, TelcoCorp

Another challenge arose from the need to *accelerate LPN expansion to drive IoT innovation*. To speed up the roll-out of the LPN, TelcoCorp drove the development of new communication standards by becoming a founding member of the LoRa Alliance—a non-profit association that fosters low-power network technology. Strategic

partnerships with two major government organizations—the national railway and the postal company—helped to co-finance the cost of expanding the LPN, which particularly benefited rural areas. By the end of 2016, the LPN covered 95% of the country. Overall, its roll-out lowered connection costs and strongly stimulated IoT demand and thus laid the foundation for the market to create new IoT devices and digital services:

*"The transition to higher layers of the IoT technology stack requires trusted, secure and scalable networks that enable specific IoT use cases, such as [using the] LPN for networking over long distances and for worldwide use."* IoT Project Manager, TelcoCorp

Later, in 2018, TelcoCorp complemented the LPN by deploying commercial communication technologies, such as Narrowband (NB) IoT or 5G, thus increasing its IoT momentum. By the end of 2018, TelcoCorp not only provided a scalable IoT network, but also offered connectivity for IoT applications at different levels of scope—from battery-powered devices that sent little data (e.g., NB-IoT) to real-time applications that regularly transmitted large volumes of data (e.g., 5G). TelcoCorp was now perceived as an IoT connectivity “enabler”—but its ambitions were much wider than this.

**Digital and Physical Resources Challenges.** TelcoCorp recognized that “connectivity will eventually make [up] about 5% of the overall IoT revenue” (IoT Project Manager, TelcoCorp), so saw the urgency to extend its service portfolio to the upper layers of the IoT value chain. The firm needed capabilities to professionally manage its IoT network and connected IoT devices and thus faced the challenge of deciding whether to *make or buy an interoperable IT infrastructure to connect devices, manage data and operate applications*. However, because TelcoCorp lacked the internal capabilities needed to develop digital platforms, and to avoid large upfront investments, it licensed an existing IoT platform from a German technology provider that specialized in device, connectivity, analytics and application management. This cloud-based IoT platform was installed in TelcoCorp’s data center, which ensured the security of the platform and

compliance with national regulations and thus emphasized the importance of data security and privacy. TelcoCorp was now in a position to oversee the efficient management of the connected devices. In addition to centralized connectivity management, the IoT platform provided device management capabilities for full control over device status and costs:

*"Imagine you have to update the firmware of your IoT devices, for example, SSL certificates expire at some point. ... You cannot put 1,000 maintenance technicians in airplanes, who visit the devices all over the world to make manual cable-based updates. This way, a single device update would kill the whole business case. ... You need functions that address devices from your back end to upload and download data, to push a firmware update or certificate for example."* Head of IoT, TelcoCorp

Another integration challenge arose from the need to *gather, store, process and maintain IoT data pipelines at scale*. This issue was linked to device and data management and required TelcoCorp to flexibly scale its cloud storage up or down. It adopted a hybrid approach, based on its own infrastructure and the cloud-based platform services provided by the German technology firm and Microsoft Azure. This approach enabled TelcoCorp to overcome big data-related management challenges when handling the volume, velocity and variety of IoT-based data pipelines. As a consequence, TelcoCorp was able to offer its customers flexible data- or analytics-as-a-service models on a utility or subscription basis.<sup>23</sup>

In summary, licensing an IoT platform with ready-to-use functions helped TelcoCorp shorten time-to-market and focus on interoperability between its network infrastructure and the cloud-based IT systems. This interoperability ensured data security and enabled TelcoCorp to develop additional analytics capabilities. Together, the network and platform created a strong IoT market offering that prioritized scale through

<sup>23</sup> For more information on how industry incumbents can achieve big data analytics capabilities, see Dremel, C., Herterich, M. M., Wulf, J., Waizmann, J. C. and Brenner, W. “How AUDI AG Established Big Data Analytics in Its Digital Transformation,” *MIS Quarterly Executive* (16:2), June 2017, pp. 81-100.

growing the numbers of devices and platform licenses.

## Dimension 2: From Supply Hierarchies to an IoT Ecosystem

After successfully establishing the LPN and the IoT platform in late 2016, TelcoCorp's IoT department decided to leverage its existing business partners to develop an IoT ecosystem. This required TelcoCorp to change its organization and business relationships, shifting from traditional buyer-supplier relationships to relationships with third-party providers. This change, however, raised challenges in the areas of customer centricity and partner management.

**Customer Centricity Challenges.** To leverage the platform-based ecosystem and deliver customer value, TelcoCorp had to *address the chicken-and-egg problem*. Should it first seek to build the demand or supply side? Though focusing first on the demand side would yield direct revenue opportunities, a lack of internal capabilities could lead to IoT projects ending prematurely. Despite this risk, in mid-2016, the IoT department decided to leverage its existing mobile telecoms customer base first. It focused on signing up those customers with a lot of industrial assets that could achieve IoT-based efficiency gains. This approach enabled TelcoCorp to deepen existing relationships and expand its business from mobile device connectivity to asset connectivity. It also meant that TelcoCorp could then incorporate data- and analytics-based services in its existing business model. As a consequence, some customers started building ecosystems around its IoT technology:

*"Everything we do [including enterprise IoT] is customer-driven. Our rather single-sided ecosystem approach to learning about our customer domains and their pain points helped to grow interest in the platform ecosystem and created much market attention. Our partners then grew naturally in the ecosystem, as partners see us not just as a network and platform provider but also as a sales channel."* Head of Business Customers, TelcoCorp

Another challenge was to *reduce customers' anxiety of dependence*. Business customers face risks when joining IoT platforms, such as the

high cost of retrofitting assets with sensors and connectivity, potential lock-in and loss of intellectual property. TelcoCorp, a highly regulated and trusted company, addressed this challenge by operating open technologies: the IoT network (providing license-free LoRa connectivity solutions) and the IoT platform (providing open data access via APIs). In addition, TelcoCorp supported standard methods for integrating Microsoft and SAP applications into cloud solutions and on-premises IT systems, which gave customers control over their devices, data and systems. By offering these high-quality solutions with long-term support at low costs, TelcoCorp could reduce its business customers' level of perceived risks. This openness was well received by partners and customers:

*"TelcoCorp has a solid brand that stands for trust, quality and reliability, and we had a great experience with them as a telecoms provider. We thus saw great benefits in partnering [with TelcoCorp for IoT]. In addition, other telcos did not invest in the IoT market. Smaller connectivity providers only offer closed network systems, [but] TelcoCorp provides an open network system, open IoT platform and open ecosystem, with partners to support projects, which made our choice easy."* Head of Digital and IoT, Customer 2<sup>24</sup>

## Partner Management Challenges.

TelcoCorp's success in attracting customers to the demand side of the platform ecosystem generated much interest among providers of IoT complements, with many of them deciding to join the platform ecosystem. However, the growth in the supply side meant that TelcoCorp faced the challenge of *extending its traditional buyer-supplier relationships with an IoT-focused partner model*. TelcoCorp's IoT department responded to this challenge by launching an official partner program in early 2017.

TelcoCorp distinguished its traditional supplier relationships (e.g., with Ericsson), which were defined by deterministic outcomes regarding volume, time and price, from its IoT partnerships, which were governed by flexible partner contracts. In the words of TelcoCorp's

<sup>24</sup> The partner and customer interviewees are listed anonymously in the Appendix.

Partner Ecosystem Manager, these contracts were based on “mutual agreement that joint business opportunities are not quantifiable and risks are not mitigatable [when co-creating IoT solutions].” Thus, ecosystem partners, including IoT device providers, systems integrators, consulting firms and software vendors, agreed when they decided to collaborate in the ecosystem that business opportunities and risks could not be clearly quantified or prevented because of the uncertainty in IoT business outcomes. This contractual arrangement requires more trust than conventional supplier relationships, where contracts definitively cover all business aspects.

Nevertheless, TelcoCorp still had to govern the ecosystem by defining and enforcing new rules that prescribed partners’ development and commercialization opportunities, to mitigate competitive tensions among partners providing similar service offerings:

*“Trust and corresponding partner contracts in the ecosystem help to prevent competition, but often only until an order worth millions is received, at which point one party will try to capture the biggest slice of the cake and also accept any legal consequences.”* Consulting Manager, Partner 3

As TelcoCorp recognized the market need for retrofitting customers’ assets (i.e., connecting devices to the Internet and IoT platform), it formed strategic alliances with hardware firms. Each device that was certified for TelcoCorp’s networks was guaranteed to be interoperable with the cloud, and its data model was guaranteed to be compatible with TelcoCorp’s platform. Moreover, as each type of certified device was rolled out at scale, traffic on its network and IoT platform increased, creating a win-win-win situation. The ability to retrofit customers’ machines, buildings or plants with average lifecycles of more than 30 years with IoT technology provides a competitive advantage because it allows today’s assets to function with tomorrow’s IoT technologies.

By the end of 2018, TelcoCorp had established about 30 IoT partnerships. While these partners allowed TelcoCorp to scale its connectivity and platform business, differences in firm size and culture were impeding joint actions for value

co-creation. To streamline the onboarding and business operations of third-party providers, TelcoCorp faced the challenge of *setting up clear governance with roles, responsibilities and shared activities* that prescribed the value co-creation opportunities of third parties. TelcoCorp addressed this challenge by introducing the “ecosystem manager” role to establish rules and mechanisms that defined these governance-based structural arrangements. For example, TelcoCorp’s partner ecosystem could extend the cloud-based IoT platform by using open APIs to create new complements. Partners either charged customers directly for these complementary products and services or indirectly through TelcoCorp. Each new IoT complement helped to extend the platform, resulting in a wide variety of generalizable and reusable digital services.

In addition to organizing joint marketing events, ecosystem managers established new performance-based ecosystem goals, such as shared customer lifetime value. However, as mentioned by the CEO of a partner, some partners still missed “a shared strategy … to set up a concrete plan on how to create value together.”

Co-CEO, Partner 4

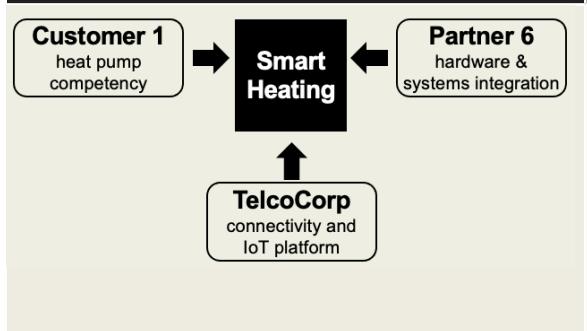
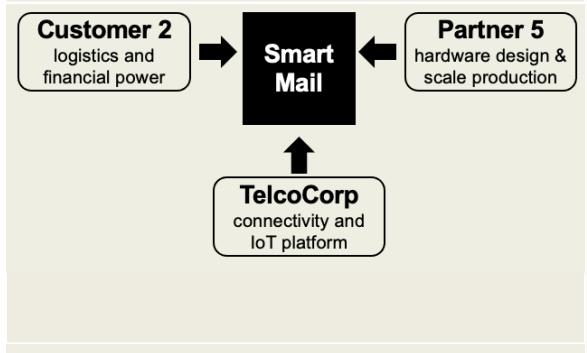
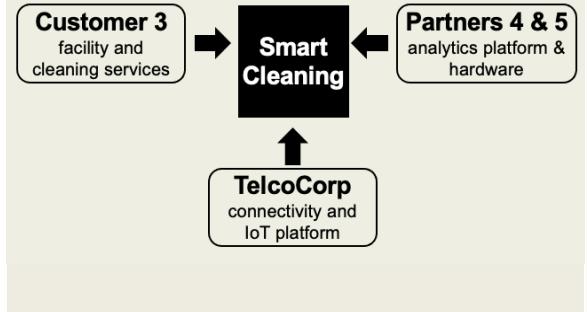
In summary, TelcoCorp had to provide mechanisms to ensure ecosystem partners could co-create value. As well as a deep focus on customers, these mechanisms involved establishing new roles, such as ecosystem managers, that defined community goals and encouraged partners to collaborate in a value-oriented manner while also holding them accountable.

### Dimension 3: From Value Delivery to Value Co-Creation

Between 2015 and 2020, TelcoCorp had enabled many IoT use cases through delivering connectivity. But to move forward from just providing value through connectivity, TelcoCorp had to overcome challenges as it reconfigured its role in the IoT ecosystem from enabler to orchestrator of ecosystem partners co-creating business value. We illustrate how TelcoCorp addressed these value co-creator and business challenges by referring to three IoT use cases of co-creating IoT value (see Table 1).

**Value Co-Creator Challenges.** Before TelcoCorp and its ecosystem partners could start

Table 1: IoT Use Cases of Value Co-Creation

Value Co-Creation Illustration	Use Case Description
	<p>Customer 1 (a leading building equipment supplier) uses an IoT-based smart heating application for predictive maintenance service of heat pumps. Its aim was to reduce field maintenance costs (about 700 field workers) by creating a service business with two new professions: remote diagnosticians and computer scientists. Together with Partner 6 (a hardware and systems integrator), it developed a successful regional pilot in 2016, which was rolled out nationwide in early 2017 with 3,000 connected heat pumps.</p>
	<p>Together with Partner 5 (a hardware designer and manufacturer, Customer 2 (a postal delivery service) created an IoT-based smart mail device that enables households to place simple delivery orders (such as stamps) by pressing a button on the device. Additional customer value was created by establishing an ecosystem of value-added services around the service button, such as food delivery. After a successful pilot in 2018, involving 1,000 households, Customer 2 has now deployed over 20,000 smart mail devices, which use TelcoCorp's LPN.</p>
	<p>Customer 3 (which provides facility and cleaning services) co-created with Partners 4 and 5 an IoT-based smart cleaning device, initially as an internal service that allowed employees to place simple cleaning orders, e.g., cleaning coffee machines. Using this service-on-demand solution enabled Customer 3 to increase its operational efficiency by reducing the number of scheduled cleaning services. After a successful pilot in early 2019, the service button was extended with additional sensing functionality (e.g., temperature, CO2) in another co-creation project.</p>

to co-create IoT-based value, TelcoCorp faced the challenge of *understanding its customers' industries, use cases and technological needs*. This challenge was compounded because many use cases, even when appearing similar at first sight, required different solutions. For example, in the smart heating use case that required sensors monitoring the operating status of heat pumps, which are located underground in cellars, the connectivity solution and technology differed significantly from above-ground applications. Physical location, and other requirements, determine which technologies can be effectively used, with the result that superficially simple aspects can become a major challenge as use cases progress.

To address this challenge, TelcoCorp cultivated a “fail fast, learn fast” mindset. Its IoT department trained project managers to bridge customers’ knowledge gaps related to technical aspects and the case’s value-generating potential. To kick-start possible innovative IoT use cases, the IoT project managers ran co-innovation workshops with various partners, which followed agile principles and practices. More recently, TelcoCorp has started to share technical knowledge through free online training using webinars and other channels, such as podcasts or innovation contests, to drive IoT-based innovation.

Another value co-creator challenge was how to *coordinate both customers and partners to co-develop IoT use cases*. When developing an

IoT use case, it was vitally important that every partner focused on its role and the fundamental value proposition for the customer. The misalignment of roles had previously resulted in competition between TelcoCorp and partners as well as among partners.

Over time, TelcoCorp addressed the coordination challenge by evolving from a technology enabler to an ecosystem orchestrator. Successful IoT projects required it to orchestrate individual and standard IoT solutions, which meant it had to develop relationship-oriented capabilities that involve personal exchanges. For instance, the smart heating use case was orchestrated by TelcoCorp's IoT project managers, who subcontracted the creation of gateway and antenna devices as well as the associated software needed to connect the cellar-based heat pumps with the IoT platform to hardware and systems integration partners:

*"With TelcoCorp as a partner, we could already select large building blocks of their solution portfolio to realize our use case. As the business case was really tight, we decided that TelcoCorp should coordinate all aspects that were not heat-pump-specific. When decisions had to be made, for example, with regards to external competencies, they came up with different variants that all had a price tag, so we had the final say."* CIO, Customer 1

**Business Value Challenges.** To ensure it could capture maximum business value from IoT use cases, TelcoCorp needed to overcome the challenge of *scaling and scoping IoT use cases from prototype to full production*. Similar to customers who needed convincing use cases and evidence of concrete business value to justify their IoT investments, TelcoCorp, and its third-party partners, needed to capture value from IoT use cases through continuous revenue streams and growth of their customers' digital transformations:

*"The challenge in IoT is actually rarely a technological one, but rather where exactly to generate value, how to develop the business case and how to transition your customers and partners into the pay-per-use model."* Consulting Manager, Partner 3

The scale of IoT use cases depends on the number of connected devices, the volume of data transmitted and the degree of standardized communication, whereas the scope is determined by deploying hardware and software complements across different industries. To increase both the scale and scope of IoT use cases, TelcoCorp used an agile approach to orchestrate the ecosystem—starting with co-innovation workshops, then early proofs of concept and finally moving to prototype testing. Moreover, the firm used its financing power to make IoT use cases with weak business cases profitable early on, for example, by ordering higher quantities of devices to reduce unit costs and to lower the overall service offering costs. Although co-financing use cases with partners was risky, there were several examples of this approach boosting ecosystem growth. Though new roles, such as IoT project and ecosystem managers, signaled a commitment to the ecosystem value capture approach, TelcoCorp's internal bonus-oriented incentive schemes still favored its traditional cash-cow business, with those selling large connectivity packages receiving bigger bonuses.

TelcoCorp's final business value challenge was to *balance the development of standard vs. individual IoT solutions*. This key trade-off arose from the firm's go-to-market strategy. TelcoCorp's traditional business model was based on scale—a horizontal market approach—but the IoT department saw that there was much value capture potential in providing vertical industry-specific solutions. To address this challenge, TelcoCorp pursued a hybrid approach: co-developing vertical end-to-end solutions in the short term and scaling generic solutions across industries in the long term—as reported by one of TelcoCorp's partners: “In [TelcoCorp's] IoT platform ecosystem, we try to achieve economies of scale with the projects we co-develop and thus place certain components as standard modules for other joint customers to reuse” (CTO, Partner 2). For example, the hardware design and software modules from the smart mail use case were reused in the smart cleaning use case to develop a multisensor device. Today, that device supports various smart building applications with services like ordering food and drinks, making it scalable across other industries, such as banking, retail and insurance. To summarize, TelcoCorp

**Table 2: Summary of TelcoCorp's IoT-Related Challenges and Actions to Address Them**

Dimension	Area	Challenges for TelcoCorp	Actions Taken
Platform	IoT Network	Building an ICT infrastructure to lower the entry barriers for third parties' and customers' IoT use cases	Deployed a network designed to facilitate various IoT use cases, even those with weak business cases, at different levels of scale and scope (e.g., local vs. regional vs. global)
		Accelerating infrastructure expansion to drive IoT innovation	Co-financed the network roll-out with strategic partners
	Digital and Physical Resources	Making or buying an interoperable IT infrastructure to connect devices, manage data and run applications	Licensed an existing IoT platform with device, connectivity, data and application management capabilities to shorten time-to-market and focus on integration with its own systems
		Gathering, storing, processing and maintaining IoT data pipelines at scale	Adopted a hybrid approach with own data center and cloud-based offering (e.g., Microsoft) to offer customers a flexible data-as-a-service model (e.g., utility or subscription-based)
	Customer Centricity	Addressing the chicken-and-egg problem to grow the platform-based ecosystem	Focused first on existing customer base by deepening relationships (e.g., from mobile device connectivity to asset connectivity)
		Reducing customers' anxiety of dependence (e.g., lock-in effects)	Supported (partly) open and interoperable technologies and standards (e.g., APIs) and integration services (e.g., with third-party platforms or legacy systems), giving customers control over devices and data
Ecosystem	Partner Management	Extending traditional buyer-supplier relationships to an IoT-focused partner model with new contracts	Balanced hierarchical and flat partner-management structures to cope with IoT-related uncertainty (e.g., less deterministic IoT partner contracts) and built alliances with hardware partners (e.g., for sensors)
		Setting up clear governance with partner roles, responsibilities and shared activities with IoT focus	Established governance capabilities (e.g., ecosystem managers) that prescribe development and commercialization opportunities with return-based community goals (e.g., shared customer lifetime value)
	Co-Creator Role	Understanding customer industries, use cases and technological needs	Trained staff to bridge IoT-related technical and business knowledge gaps (e.g., co-innovation workshops, online training)
		Coordinating both customers and partners to co-develop IoT use cases	Orchestrated IoT projects through architectural means (e.g., APIs) and relational mechanisms (e.g., IoT project managers)
Value Co-creation	Business Value	Scaling and scoping IoT use cases from prototype to production	Made upfront bulk investments and co-financed the hardware design and development for feasible IoT use cases
		Balancing the development of standard vs. individual IoT solutions	Co-developed end-to-end IoT solutions when seeing an opportunity to grow with customers and scale generic functions across industries

took on the orchestrator role and co-developed end-to-end vertical solutions whenever it saw an opportunity to leverage its customers or scale generic downstream functionality across industries.

### **Summary of Challenges Faced by TelcoCorp in all Three Dimensions**

Table 2 summarizes the key challenges in all three dimensions (platform, ecosystem and value co-creation) that TelcoCorp faced on its journey to establishing an IoT platform ecosystem and the actions taken to address them. Other telecoms operators seeking to extend their own IoT service offerings can use these actions as a source of guidance or inspiration.

### **Recommendations for Orchestrating Enterprise IoT Platform Ecosystems**

Other industry incumbents, such as Bosch, Siemens, Hitachi and Toyota, face similar challenges to those of TelcoCorp as they embark on their journeys from IoT enablers to IoT ecosystem orchestrators. Even though they operate in different industries, there are many similarities in their business mixes that make the insights from the TelcoCorp case relevant for industrial firms with traditional product and service businesses. These similarities include deep customer relationships, streamlined supply chains, traditional products or service businesses, and data access to assets and customers. Hence, our recommendations, which have been derived from our analysis of TelcoCorp's IoT journey, are applicable to all industry incumbents—including IoT customers and third-party providers—that seek to become orchestrators of their IoT platform ecosystems. For example, Siemens orchestrates its MindSphere ecosystem, has adopted Microsoft Azure technology and complements Amazon Web Services with its applications, demonstrating the dynamics of taking on different roles in IoT ecosystems. We believe that the following four recommendations will help IT and business leaders in industry incumbents to position their organizations for competitive roles in the enterprise IoT landscape.

### **1. Augment Key Resources with a White-Label Approach to Shorten Time-to-Market**

Once an industry incumbent has decided to embark on a digital journey, and thus extend its traditional pipeline business with a platform-based offering, it immediately faces a make-or-buy decision. There are many commercially available IoT platforms that come with preconfigured modules for connectivity, devices, data, analytics and application management. So, why reinvent the wheel if you can find an off-the-shelf solution? In fact, many leading IoT platform providers, such as Siemens MindSphere and GE Predix, started their journeys by licensing existing platforms, and then customized and branded them to their needs—i.e., they adopted a “white-label approach.”<sup>25</sup> Access to standard modules not only facilitates the development of IoT applications and collaboration, but also ensures “plug-and-play” integration with heterogeneous devices through communication protocols that are continuously being updated as new standards are agreed.

By choosing an off-the-shelf IoT platform, industry incumbents can continue to strengthen their core resources, integrate them with the licensed platform and focus on co-creating customer value. Moreover, this approach enables incumbents to shorten time-to-market and test IoT business opportunities without the need for large upfront investments in infrastructure, such as data centers, or building new software development capabilities. Incumbents should also ensure that the licensed IoT platform complies with their governance or business rules and directly creates internal or external value, such as a “freemium”<sup>26</sup> dashboard to monitor connected field devices.

Industry incumbents that have already committed to developing their own IoT platform should focus on tightly integrating it with the organization's overall digital strategy and

<sup>25</sup> For an article about the make-or-buy decision and the white-label platform strategy for incumbents, see Hermes, S., Guhl, R., Schreieck, M., Weking, J. and Krcmar, H. “Moving beyond the Build-or-Join Decision: A Multiple Case Study on Multi-Platform Strategies of Incumbent Firms,” in *Proceedings of the 54th Hawaii International Conference on System Sciences*, January 2021, pp. 6143-6152.

<sup>26</sup> Freemium, a combination of “free” and “premium,” is a pricing strategy where a basic product or service is provided free of charge, but a charge is made for additional features, services, or virtual or physical goods that expand the functionality of the free version.

tailoring it to their customers' and markets' needs to differentiate their IoT offering from the competition. This will ensure they are not creating two corporate identities or cultures that later cannot be unified.

TelcoCorp licensed its IoT platform from a technology provider. This decision not only shortened time-to-market (because of the pre-installed device, connectivity and application enablement modules), but also allowed TelcoCorp to capture value directly by overseeing its own network devices, including gateways and antennas, which reduced routine maintenance costs significantly, especially in rural areas.

## 2. Leverage the Existing Customer Base for Ecosystem Growth through Bundling or Upselling

Any investment in establishing an IoT platform—whether developed in-house or licensed—will require a clear adoption strategy to create returns. Growing an IoT platform requires the platform owner to address the chicken-and-egg problem. Should the initial focus be on growing the supply side (third-party providers) or demand side (customers)? We recommend that industry incumbents intending to establish an enterprise IoT platform ecosystem should first focus on the customer side. To foster growth, they can encourage existing customers to migrate to the platform. For instance, they can offer their customers a preconfigured self-service analytics dashboard to monitor, control and maintain connected IoT devices.

More generally, there are two strategies that incumbents can use to encourage IoT adoption. The first, more aggressive, strategy is to bundle key resources (e.g., device, connectivity) with the IoT platform, for example, by ensuring plug-and-play connectivity for certified devices. The second, less aggressive strategy is to upsell by persuading customers to move from basic services (e.g., data as a service) to advanced ones (e.g., analytics as a service) that require industry-specific domain knowledge to function.

At TelcoCorp, the IoT sales department adopted the upsell strategy by leveraging its relationships with existing mobile telephony business customers—moving from sales of mobile and broadband connectivity to commercial asset connectivity. It targeted

customers that had immense potential for gaining value from IoT, such as those in the three use cases. Building on its existing customer relationships and reputation for trust, TelcoCorp was able to deepen its insights into customers' business models and operations and to help them along their digital transformation journeys by providing data-based services that extend their business models.

Once a substantial number of existing customers have committed to the IoT platform, potential supply-side partners have a greater motivation to join the ecosystem because of the opportunities to capture value. Incumbents must be prepared to manage and cultivate partners synergistically. Though trust and alignment are helpful for encouraging partners to collaborate, incumbents should put governance mechanisms in place through clearly defined roles (e.g., ecosystem managers) and responsibilities. The governance rules should specify the types of value-adding complements third-party partners are allowed to develop (e.g., open vs. closed APIs) and how they can monetize their offerings (e.g., licensing via the platform provider or directly to customers). The rules will differ depending on the type of third-party provider (e.g., hardware or software) and should be transparent within the ecosystem so that each partner is equally accountable. Governance is an essential component of the IoT platform ecosystem orchestration role.

## 3. Follow a Hybrid Growth Strategy of Co-Creating Individual IoT Solutions but Striving for Scale

To achieve deeply integrated, context-specific and high-value IoT solutions for customers while also allowing for scalability, industry incumbents will need to balance the trade-off between horizontal and vertical market approaches. Horizontal IoT solutions scale across different industries—for example, reusing an asset-monitoring dashboard originally developed to track the status of tractors in farming for tracking garbage trucks in a city context. Vertical IoT solutions, on the other hand, are end-to-end solutions for a particular industry segment.

Even though vertical solutions run counter to what industry incumbents are ultimately trying to achieve with their platform businesses, we

found that it is crucial to emphasize customer value over technology if the platform provider wants to be a long-term partner in a customer's digital transformation journey. From a value co-creation perspective, vertical solutions benefit the entire ecosystem by maximizing shared customer lifetime value. Vertical solutions require collaboration beyond the platform's resources, involving, for example, arm's length relationships in the form of co-innovation workshops to understand the problem and co-create a solution. Once an individual solution is in place, platform owners can abstract functionality from it to create standard platform modules, fostering a virtuous growth cycle. And, as the platform owner creates more dedicated industry solutions, new areas for value co-creation are opened up.

However, increased specialization in vertical solutions will shrink the target group of potential platform customers, and thus reduce the incentive for third-party providers to contribute further applications and the potential to benefit from network effects. Achieving the right balance between horizontal and vertical solutions is not straightforward and should be considered at a strategic decision-making level.

One of TelcoCorp's partners described the trade-off balance as follows: "In [TelcoCorp's] IoT platform ecosystem, we try to achieve economies of scale with the projects we co-develop and thus place certain components as standard modules for other joint customers to reuse." (CTO, Partner 2). For instance, TelcoCorp's customers could reuse hardware and software modules from the smart mail use case to create a multisensor device solution. Thus, TelcoCorp's ecosystem had created an industry-agnostic smart product that could be applied in many smart building contexts across different industries.

#### 4. Consider the Options for New Revenue Streams from IoT Data

When adopting or providing IoT solutions, industry incumbents need to strategically plan how to capitalize on IoT data. We recommend they consider three options: 1) bundling traditional product or service revenues with IoT services, 2) selling IoT-based data, and 3) offering the IoT platform, analytics or software

as a service.<sup>27</sup> The best option depends on an incumbent's business mix and the role it seeks to play in the IoT platform ecosystem in the long run.

First, incumbents could connect or retrofit their assets to securely access data and monitor and control the devices' functions remotely. For example, Honeywell bundled its vast installed base of process control equipment with a digital service suite in 2015 to monitor and control process outcomes in industries such as oil and gas. TelcoCorp offered similar data-based services to its heat pump customer, which profited from moving its business model from physical, technician-based maintenance to predictive, software-based maintenance scheduling.

Second, incumbents could monetize IoT data either by anonymizing and selling it via a marketplace or by offering it to third-party providers for a fee to develop new analytics-based models. For instance, Schindler created a smart elevator platform that allows third parties to display content or advertisements to people using its elevators. TelcoCorp had not sold the IoT data acquired from its customers but allowed its partners to access the data via open APIs (with the consent of its customers) to develop business applications.

Third, incumbents can license their IoT platforms to customers or partners providing data or development resources. For example, Siemens MindSphere charges royalties for access to its Mendix platform, which provides pre-built visual drag-and-drop functions that allow engineering domain experts to develop IoT applications. At TelcoCorp, the licenses for the LPN and the IoT platform enabled, for example, the smart mail and cleaning use cases. However, its partners added different software-based functions that increased both the scale and scope of the use cases. Each new connected device amplified the traffic on the network or platform, and thus increased the usage-based licensing fees.

#### Concluding Comments

In this article, we have described how an incumbent telecoms operator (referred to as

<sup>27</sup> For more information, see Russo, M. and Wang, G. *The Incumbent's Advantage in the Internet of Things*, BCG Henderson Institute, August 21, 2019, available at <https://www.bcg.com/publications/2019/ incumbent-advantage-internet-of-things-iot>.

TelcoCorp) transitioned from an IoT enabler to become an orchestrator of an IoT platform ecosystem. We believe that incumbents in other industries, especially those with deep customer relationships, also have the opportunity of becoming orchestrators and thus gain financial benefits through co-creating value with ecosystem partners. They wouldn't even need to develop a bespoke IoT platform, but could license a platform such as Microsoft Azure. Such a strategy would enable them to collaborate early and compete later in an adjacent, or even in the same market, with a platform or software offering.<sup>28</sup>

TelcoCorp's journey shows that industry incumbents should not be concerned about using platforms from major vendors such as Microsoft. Instead, they should exploit the opportunities to collaboratively establish and lead their industry IoT ecosystems as orchestrators. In fact, even though the IoT platform market share of firms such as Microsoft or Amazon is growing, the number of platform providers keeps increasing.<sup>29</sup> This indicates that the enterprise IoT market leaves much room for industry incumbents to compete through IoT platform ecosystems, given

that they continuously realign their offerings with their customers' needs.

From our analysis of TelcoCorp's journey, we have provided insights into how industry incumbents can leverage their strengths to overcome the challenges of establishing an IoT platform and the associated ecosystem. IT and business leaders of industry incumbents can learn from and be encouraged by TelcoCorp's journey to become an IoT platform ecosystem orchestrator. They too have an opportunity to leverage an IoT platform ecosystem and orchestrate customer IoT use cases for joint value co-creation.

## Appendix: Case Study Methodology

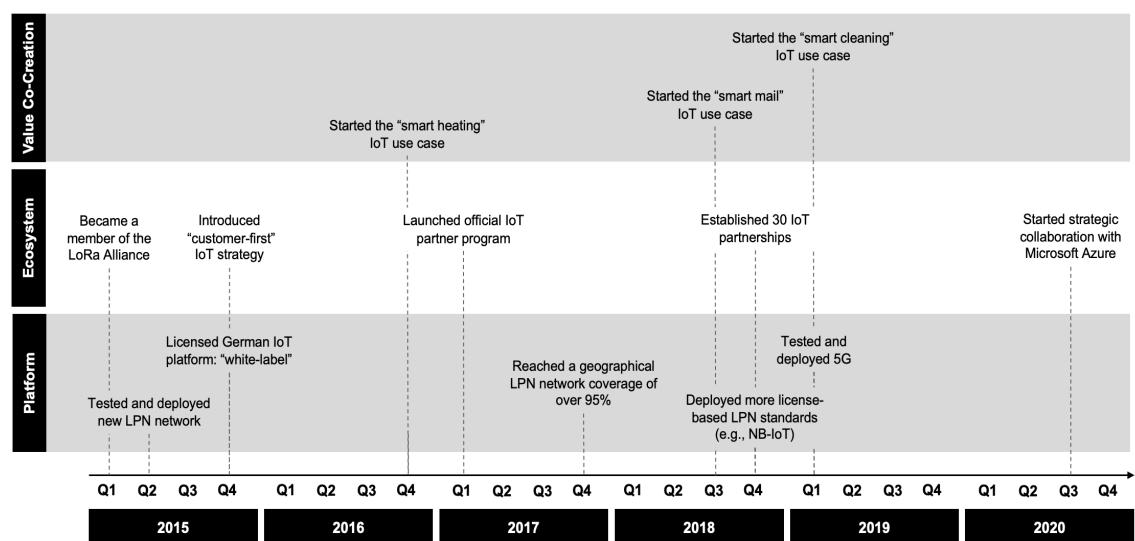
We conducted a single, in-depth case study<sup>30</sup> of TelcoCorp to investigate its journey from IoT enabler IoT platform ecosystem orchestrator and how it overcame the challenges in three dimensions—platform, ecosystem and value co-creation. We believe this case study is “revelatory,” because it provides early but unique insights into orchestration capabilities in the enterprise IoT context. TelcoCorp's journey began in 2015. The figure above summarizes the key

28 For more information, see Karhu, K. and Ritala, P. “Slicing the Cake without Baking it: Opportunistic Platform Entry Strategies in Digital Markets,” *Long Range Planning* (54:5), October 2021, Article 101988.

29 For more information, see Lueth, K. L., op. cit., December 2019.

30 Yin, R. K. *Case Study Research, Design and Methods* (5th ed.), Sage Publications, 2014.

## Case Timeline Along the Three Dimensions



## Overview of Interviewees

Position	Position	Firm Acronyms	Firm Size	Date	Duration [Minutes]
1	Head of IoT	TelcoCorp	Large	April 2020	118
2	Head of Analytics	TelcoCorp	Large	April 2020	60
3	Sales Manager	TelcoCorp	Large	May 2020	56
4	Partner Ecosystem Manager	TelcoCorp	Large	June 2020	90
5	Head of Sales	TelcoCorp	Large	June 2020	55
6	IoT Project Manager	TelcoCorp	Large	December 2020	80
7	Head of Business Customers	TelcoCorp	Large	January 2021	36
8	CEO	Partner 1	Small	November 2020	37
9	CTO	Partner 2	Medium	November 2020	57
10	Consulting Manager	Partner 3	Large	November 2020	40
11	Co-CEO	Partner 4	Small	November 2020	54
12	Head of IoT	Partner 5	Large	November 2020	67
13	CEO	Partner 6	Large	December 2020	28
14	CEO	Partner 7	Small	December 2020	48
15	Head of IoT	Partner 8	Medium	December 2020	68
16	CEO/Founder	Partner 9	Small	December 2020	62
17	Technology Manager	Partner 10	Small	December 2020	49
18	CIO	Customer 1	Large	December 2020	114
19	Head of Digital and IoT	Customer 2	Large	December 2020	36
20	Head of Digital	Customer 3	Large	December 2020	32

**Note:** Partner roles ranged from hardware manufacturers to software developers. Firm size was determined by number of employees (small<50, medium<250, otherwise large).

events referred to in the case study for each of the three dimensions.

### Data Collection

We used two main sources for data collection. First, we conducted semistructured interviews with TelcoCorp (seven interviews), ten of its IoT partners and three IoT customers. Data collection began in April 2020, first by interviewing TelcoCorp's Head of IoT, who described the enterprise IoT strategy and some of the key challenges the firm had faced since beginning its journey in 2015. Subsequently, we conducted a further 19 interviews (see the table above).

The second source of data included TelcoCorp's annual reports (2015-2020), public information and internal documents.

Given our interest in the concept of value co-creation, which requires two or more firms to jointly realize an IoT use case, we triangulated the statements made by interviewees representing the three main ecosystem roles. To complement this triangulation, we selected three IoT use cases that highlight how TelcoCorp orchestrated value co-creation initiatives. We purposefully selected the cases to provide a mix of customer types, industry contexts and involved third parties, so we could assess the different

ways in which value is created. However, common factors in the cases were that they were all B2B examples and TelcoCorp was involved as the orchestrator. These common factors meant that we could make comparisons between the use cases.

### Data Analysis

Before analyzing the empirical data, we read through all the interview transcripts and various other documents and accessed TelcoCorp's website, so we could capture the most important information and build a common understanding. Then, we undertook a systematic coding process that included open, axial and selective coding. The open coding resulted in over 100 codes related to different aspects of TelcoCorp's challenges and actions taken to address them. During the axial coding stage, we aggregated the open codes into second-order codes. Because of our focus on value co-creation, two authors then conducted the selective coding iteration against the backdrop of the three dimensions—platform, ecosystem and value co-creation. After each coding iteration, the results were validated in research discussions between the first and second authors.

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