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Industrial digital platform evolution

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By Marin Jovanovic,
David Sjödin & Vinit
Parida

Leading industrial firms are increasingly building ecosystems around digital platforms to support the transition to offer monitoring to optimization and, finally, autonomous platform services. This article unpacks the evolutionary dynamics required to make this transition, from proprietary in-house platform development to open industrial platform ecosystem development. Moreover, we show how platforms evolve to gradually to expand the “value space” or potential value creation from the platform through progressive phases of product platform, supply chain platform, and platform ecosystem.

In an increasingly digitalized world, innovative manufacturers are moving away from selling products and services towards selling advanced platform-based services such as fleet management services, optimization services or autonomous solutions. However, making this significant transition is not an easy undertaking. For example, to develop advanced platform service portfolio requires manufacturers are investing in connecting their industrial assets and equipment to digital platforms that provide aggregation of data and analytical capabilities for greater value creation and capture. Yet, many manufacturers are lacking the vision and roadmap to profit from investments in industrial digital platforms. Moreover, technological capabilities and investments are not enough, manufacturers also need to capitalize on platform approach by governing the ecosystem relationships. Specifically, manufacturers need to collaborate with a wide range of B2B partners (e.g. innovative startups, other OEMs, service firms, etc) and onboard them to their industrial digital platforms – creating and evolving a platform ecosystem. These transformational challenges create uncertainty and complexity for manufacturers and hinder their digital transformation.

To provide guidance to these common challenges this paper presents insights from a recently published and highly cited article by Jovanovic, Sjödin and Parida (2021) in *Technovation*. Our research explored four world-leading equipment manufacturers that developed highly advanced platform ecosystems. The research shows the three-step evolutionary model to develop an effective industrial platform ecosystem, focusing on interdependent investments into developing *platform architecture, platform services, and platform governance*.

Platform architecture: From IoT sensors to AI-driven analytics

Platform architecture represents a shared technological core that supports the ecosystem actors to create and capture value. For manufacturing firms there is no “one-size-fits-all” approach to the industrial platform development. However, the study shows that a key part of the digital transformation journey is about investing in development of the data collection infrastructure technology as a core to the industrial platform evaluation.

During the initial phase, manufacturers tended to invest in the platform architecture progressively and increase the capacity for interconnected product-oriented data collection. This included enabling data gathering for major installed bases ex-ante to the possible use cases. Second, over time manufacturers focused on analytics utilization as advanced sensors provided increased data quality and data variety. It enabled manufacturers to start aggregating data, correlating different data sets, and finding patterns. For example, many firms use analytics of vast data sets to proactively discover anomalies in machine performance so that appropriate maintenance actions can be taken in advance. Finally, investments into artificial intelligence enable leveraging on integrating external data sources that maybe provided by third parties and using advance algorithms to reveal hidden insights. For instance, potholes can contribute to tire aging and deterioration. However, if the algorithm navigates the machine, it will bypass potholes and the tire's lifespan will increase.

Platform services: From monitoring to autonomous platform service development

In parallel, manufacturers progressively developed more advanced platform services building on the platform architecture functionalities. The platform service development closely mirrored three phases of the platform architecture development. Therefore, we delineated three levels of platform services: monitoring service development, optimization service development, and autonomous service development. Manufacturers began with monitoring service development, which initially took a machine-centric view and focused on creating automated reports (e.g., fuel analysis). These initial services are not key revenue generators yet provide an important step to show customers “real value” which can be extracted from data. The second level of platform services refers to optimization service development where the scope was extended from an individual machine to an entire fleet (e.g. fleet management services). For example, such services can help identify patterns in fuel consumption across a fleet of machines and suggest optimization opportunities for a process. The third level of platform services refers to autonomous service development. In the case of autonomous services, advanced platform architecture allowed to leverage AI to further improve flexibility, precision, and productivity automatically. For example, site optimization services provided dynamic adjustments to customer-centric processes to maximize strategic objectives within a specific customer production site (e.g. a quarry).

Platform governance: From value chains to ecosystems

Succeeding with industrial platforms requires manufacturers to govern the expansion of ecosystems on both supply and demand sides. The industrial business-to-business (B2B) context characterizes need for heavy investments, a low appetite for risk and requires a high level of privacy. Therefore, manufacturers should gradually induce new partners on the supply-side, followed by platform adoption on the demand-side (e.g., customers). The first level included value chain expansion, which implied training, testing, and promoting the digital platform among traditional intermediaries such as dealers. This allows critical partners in value delivery to expand their capabilities in using digital platforms. In the second level, platform governance aimed at value system expansion, which involved stimulating platform use among prospective customers to guide their digital transformation. Finally, the ecosystem expansion was facilitated by opening up the platform interfaces, promoting interoperability between different platform services as well as creating an open marketplace for new partners to deploy their value-added services. For example, a manufacturer of construction equipment described plans toward developing a marketplace similar to Apples app store including both internally developed applications and third-party applications from the ecosystems.

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A framework for industrial digital platform evolution

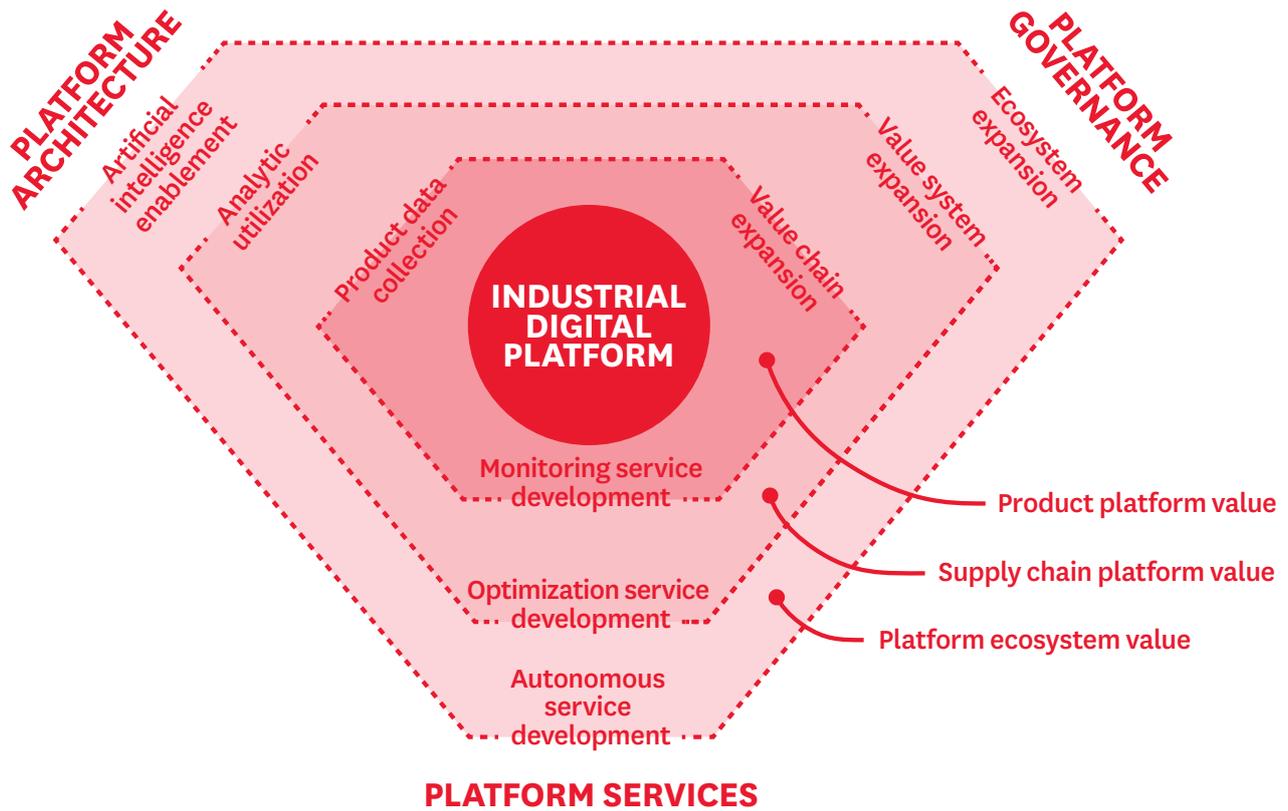
In this section, we propose a framework for the industrial digital platform evolution (see Fig. 1). The framework illustrates how platform architecture, platform services, and platform governance co-evolve. Moreover, we find that all three dimensions mirror each other in three distinct phases of evolutions. Each phase is centered on a distinct platform archetype that we label *product platform*, *supply chain platform*, and *platform ecosystem*. As platforms evolve along these phases gradually expand the “value space” or potential value creation from the platform. Thus, as manufacturing firms evolve over different phases their ability to exploit new opportunities and value through digital platform significantly increases.

First, the product platform represents a cornerstone phase for platform owner, where they create the platform core with a machine-centric data, basic data analysis, and ensured value chain partnership to effectively deliver monitoring services. Second, the *supply chain platform* increased platform architecture functionalities with a fleet data, advanced use of data analysis, and strengthened partnership with both partners and customers that resulted in higher value optimization services. Finally, the *platform ecosystem* additionally increased platform architecture functionalities that included AI-driven data analysis and opened interfaces to diverse partners that collectively enabled autonomous services. At this phase, data and applications are more openly shared and recombined leveraging on the potential of ecosystem partnerships leading to a significantly expanded value space.

Managerial implications and conclusions

This article provides several important recommendations for senior managers aiming to build ecosystem around industrial digital platforms. We also want to highlight that our recommendation are aimed towards B2B context which makes them unique. First, we identify and conceptualize critical dimension in the evolution of platform ecosystems in the B2B context. We highlight that prospective platform owner are required to simultaneously manage *platform architecture*, *platform*

Figure 1: The evolution of industrial digital platform



services, and platform governance. Second, the study highlights the investments and managerial steps in platform evolution required to transition from monitoring platform services to autonomous platform services. Thus, we discourage senior managers to take an aggressive approach to industrial platform evolution as B2B context tends to be much different than B2C. Third, we underline the importance of actively managing and governing strategic interactions between different actors in the B2B context and responsibilities of a platform owner role. Final, we emphasize that access to well organized and integrated data is a critical pre-condition for the development of industrial digital platforms, without it investing in platform ecosystem development may be a fruitless endeavor. Thus, developing a well thought out data-oriented strategy for industrial digital platform is a critical success factor in B2B context.

RECOMMENDED READING:

> Jovanovic, M., Sjödin, D., & Parida, V. (2021). Co-evolution of platform architecture, platform services, and platform governance: Expanding the platform value of industrial digital platforms. *Technovation*, 102218.



MARIN JOVANOVIC

mjo.om@cbs.dk

Assistant professor at the department of operations management at Copenhagen Business School and a visiting scholar at Luleå University of Technology. His research interests include the digital transformation of manufacturing, maritime, and healthcare sectors, platform ecosystems in the business-to-business context, and artificial intelligence.



DAVID SJÖDIN

david.sjodin@ltu.se

Associate professor in Entrepreneurship and Innovation at Luleå University of Technology, Sweden. He conducts research on the topics of servitization, advanced services, digitalization, artificial intelligence, and business model innovation.



VINIT PARIDA

vinit.parida@ltu.se

Professor of Entrepreneurship and Innovation at Luleå University of Technology, Sweden. He researches on organizational capabilities, servitization, business model innovation, digitalization of industrial ecosystems, and circular economy.