

AI-Driven Digital Platform Innovation

Sergey A. Yablonsky

“We're rapidly entering a world where everything can be monitored and measured. But the big problem is going to be the ability of humans to use, analyze and make sense of the data.”

Erik Brynjolfsson
Director of the Digital Economy Lab,
Stanford Institute for Human-Centered AI (HAI)

Artificial Intelligence (AI) innovation becomes useful today when it enriches decision-making that is enhanced by applications of big data (BD), advanced analytics (AA), and some element of human interaction using digital platforms. This research aims to investigate the potential combination of AI, BD and AA for digital business platforms. In doing so, it develops a multi-dimensional AI-driven platform innovation framework with AI/BD/AA innovation value chain and related levels of AI maturity improvement. The framework can be used with a focus on the data-driven human-machine relationship and the application of AI at different levels of an AI-driven digital platform technology stack.

1. Introduction

The industry platform is a distinctive organizational form that has become significant over the past decades (Evans & Gawer, 2016). Nowadays, a new digital platform together with its related ecosystem (industrial, data or otherwise), is positioned to create and capture value in digital economies (Yablonsky, 2019a; 2020).

With digital platforms, data has become a kind of raw material and the basis for a new infrastructure used to generate revenue. In digital economies, with billions of consumers and providers connected through mobile online devices and engaging with other users almost continuously, platforms record and analyze enormous amounts of user-generated data, tracked via cookies and other services (Cusumano et al., 2020). Where there is data, there is value. Data and analytics are central to success in the platform business. But successful platform growth and scaling requires more data, more complex data, more variables, and more sophisticated analysis by more business people, beyond what can be done manually.

The vast array of available digital platform data together with the rapid emergence of Artificial Intelligence (AI) insights and services have given rise to a perception of technology abundance. However, while most platforms have enough data processing solutions, products, and vendors, they are typically lacking a single organizational view into 1) what AI transformation services they need to use, on 2) which digital assets, regarding 3) who, when, and why they should be provided, as well as 4) what services they should be integrating with, and 5) why they should be doing it.

Insights from the literature on platform enterprise architecture conceptualization are essential to understanding the relationship between platforms and AI innovation. In the era of Big Data (BD) and the privacy issues it raises, platform enterprises can ill afford to ignore runaway AI technology that may be collecting data outside the lines of industry and government regulations. Indeed, BD and AI present more than just a compliance risk. Understanding – and strategically planning – exactly what AI services are or should be in use across the platform as directed by the official business organization is critical to maintaining a sound BD and AI business platform strategy. It is not only

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about the technology when it comes to AI integration. It is also about what AI technology enables a platform to do. This involves understanding how the data is being collected, passed between technology platforms, stored, processed by AI, and ultimately used (or not used) to add value to business.

This paper addresses the following questions:

- What is AI-driven platform innovation?
- What is the potential value of multilayer business platform AI innovation through a descriptive framework that combines AI with a digital platform stack?

My aim in the paper is to investigate a step further work done already that combines AI and a “digital platform stack” (Yablonsky, 2018ab, 2019b, 2020). The term “digital platform stack” is defined in (Yablonsky, 2018a) and discussed in Section 3 of this paper. The reason I find the term “digital platform stack” important for discussing AI platform innovation is because it helps to combine and describe the main platform layers involved with emergent AI technology (Figure 1).

The remainder of this paper is structured as follows. Section 2 describes the methodology. Section 3 discusses the main definitions and conceptual background of AI and digital platform innovation based on a literature review. Section 4 confers the

place of AI in digital platforms and presents a multidimensional AI-driven innovation framework that combines platform innovation value chains with AI innovation. Section 5 interprets the research results, provides discussion, and suggests implications of this study.

2. Research Methodology

This research aims to explore a multilayered AI-driven platform framework working together with a digital platform stack in order to facilitate understanding, analysis, and more concrete structure of the AI relationship in platform business model design and value creation. This approach proves particularly beneficial for the field due to the current lack of such systematic empirical analysis from management research. Likewise, it holds potential value for platform firms engaging with innovative AI technologies

The development of the AI-driven platform innovation framework used in this research was guided by the approach of Nickerson et al. (2012). It facilitates the iterative combination of conceptual-to-empirical as well as empirical-to-conceptual approaches. At this point, the research process consists of four distinct steps.

The process initiated through a conceptual-to-empirical approach by defining the primary platform value chains, their relations with AI and components/dimensions of an established AI-driven platform innovation conceptualization.

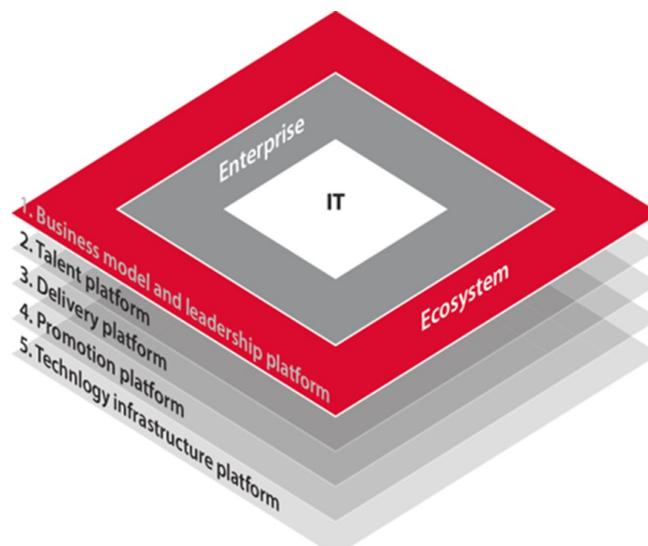


Figure 1. Digital Platform Stack (Yablonsky, 2018 ab)

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Subsequently, we collected qualitative data from secondary data sources and through 10 semi-structured expert interviews. The 15 min interviews were recorded and transcribed. Our interview partners were members of the technology-oriented groups, founders and CTOs of the Russian National Technology Initiative, and international AI-driven platform ventures.

To further improve data reliability and internal validity, the streamlined and codified interview outcomes were triangulated with a range of secondary data, consisting especially of publicly available government AI strategic documents and policies, venture's white papers and annual reports, research papers and cases. To identify the sub-dimensions and instantiations, ventures were screened for differences and commonalities, thus leading to a preliminary version of the BD/AI-driven platform framework presented here.

Finally, a second version of the framework was developed through an online survey consisting of 15 questions about BD/AI-driven digital platform stack enterprise innovation. Invitations were sent to 50 AI-driven platform ventures, specifically to Russian and international startup incubators. The list was chosen from the crunchbase.com database, plus several sites that publish ventures' annual reports. Out of the 50 contacted companies, we received 20 fully filled-out surveys. Based on this feedback, the final minor adjustments to the AI-driven platform framework were made, required modifications identified, and a refined framework proposed.

3. Current Understanding

Despite the growing research interest in AI innovation, most studies on AI innovation look at innovation from a technical, architectural, or information system-level perspective (Lyytinen et al., 2016; Jyoti et al., 2019), rather than from a managerial or business perspective. Let us then have a brief look at what is meant by AI.

Definition (Gartner, 2020)

"Artificial intelligence" applies advanced analysis and logic-based techniques, including machine learning, to interpret events, support and automate decisions, and take actions.

"Artificial Intelligence":

- Emulates human performance, typically by "learning"

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- Comes to its own conclusions
- Understands complex content
- Engages in natural "dialogues" with people
- Helps enhance human cognitive performance
- Replaces people as workers in the execution of non-routine tasks.

The EU (2018) defines "artificial intelligence" as a digital innovation that offers solutions to transform enterprise products, services and businesses using AI, BD, and related AA.

In this article AI-driven platform innovation, data and analytics are approached in terms of platform enterprise digital business platforms and technological platforms. Thus they take on a more active and dynamic role in powering the activities of the entire digital platform and business organization.

Therefore, previous studies took an approach to AI innovation types by choosing BD and AA as its background context (Yablonsky, 2019b). This previous research aimed to investigate the potential value of BD and AA, together with AI within a multidimensional framework that combines AI maturity and AI/BD/AA value chains. In doing so, it developed a data-driven AI innovation taxonomy framework with related levels of AI/BD/AA maturity improvement across innovation value chains. This was done to see how strategy, products, and solutions transform into innovative data-driven AI business strategies, products, or solutions that subsequently impact traditional business operations, and can even lead to the creation of new businesses. Indeed, there is little argument that AI is right at the heart of digital disruption.

AI disruption itself has a goal to drive better customer engagement and lead to accelerated rates of innovation, higher competitiveness, higher margins, and more productive employees. AI innovation has been powered by BD and AA. BD involves collecting and active gathering from of a wide variety of inputs, including publicly available data, information, or knowledge, human intelligence, then processing the resulting inputs in a way that helps to better understand and predict competitor strategies and actions (Erickson & Rothberg, 2015; Marr, 2015).

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The AI value chain identifies the following key high-level AI/BD/AA activities, also described as “dimensions” (Yablonsky, 2019b):

- AI Awareness/Big Data Acquisition is the process of gathering, filtering, and cleaning data before it is put in a data warehouse, data lake, or any other storage solution on which data analysis can be carried out based on the availability of BD and access to BD sources. There are a variety of BD types and sources. Value for business purposes is created by acquiring data and combining data from different sources. BD pre-processing, validating, and augmenting, as well as ensuring its integrity and accuracy, adds value to the data.
- Adjusting AI/Big Data Analysis is concerned with making the raw data acquired amenable to use in decision-making, including that which is domain-specific. “Value” here refers to providing access to data with low latency, while ensuring data integrity, and preserving privacy. Evaluation, machine learning, information extraction, and data discovery of intangible AI/BD assets adds further value.
- Measuring AI/Big Data Curation is the active management of data over its life cycle for effective usage based on the measurement of AI/BD assets to ensure it meets the necessary BD quality requirements for its effective usage.
- AI Reporting and Interpreting/Big Data Storage denotes the persistence and management of data in a scalable way that satisfies the needs of applications that require fast access to the data.
- AI Decision Making/Big Data Usage covers data-driven business activities that need access to data, its analysis, and the tools to integrate data analysis as a business activity. It covers the main AI/BD assets usage in business decision-making that can improve competitiveness through reducing costs, increasing added value, or any other parameter that can be measured against existing performance criteria.

This paper uses and integrates into one framework:

- the current AI value chain to model high-level activities that comprise a digital platform enterprise.

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- the five levels of AI maturity (Yablonsky, 2019b), from a completely ad hoc approach with limited awareness, to one in which AI innovation strategy is integrated into the organization's culture at every level, enable defining AI-driven platform innovation dimensions.
- the digital platform stack (Yablonsky, 2018ab, 2020).

AI maturity can be seen as a useful lens for understanding a company's AI-driven platform innovation logic because it explains what value is provided, how the value is created and delivered, and how profits can be generated from it. Thus, the main technological and platform type dimensions can be extended with various levels of AI maturity. This helps to understand how to capture AI-driven value from technological innovations and platforms, by taking into account the boundaries of a firm (Zott et al., 2010), and creating a direct connection between business strategy, business processes, and technological platforms.

Digital platform transformation of enterprises across industries is still an emerging phenomenon. At a high level, digital transformation covers the intense changes taking place in society and industries through using digital technologies (Khin, Ho, 2018; Vial, 2019). At the organizational level, it has been contended that firms must find means to innovate with new technologies by creating “strategies that embrace the implications of digital transformation and drive better operational performance” (Hess et al., 2016).

A “multi-sided business platform” is an enterprise organization that creates value primarily by enabling direct interactions between two (or more) distinct types of affiliated customers (Evans & Gawer, 2016; De Reuver et al., 2018). Researchers (Cusumano et al., 2020) have divided such platforms into three basic types:

- Innovation platforms enable third-party firms to add complementary products and services to a core product or technology (examples: Google Android, Apple iPhone operating systems or Amazon Web Services)
- Transaction platforms enable the exchange of information, goods, or services (examples: Amazon Marketplace, Airbnb, or Uber)
- Hybrid platforms (combination, emerging type).

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The six most valuable firms in the world are built around these three basic types of platforms (Cusumano et al., 2020). In their analysis of data going back 20 years, researchers have identified 43 publicly listed platform companies in the Forbes Global 2000. It has been asserted that “these platforms generated the same level of annual revenues (about \$4.5 billion) as their non-platform counterparts, but used half the number of employees. They also had twice the operating profits and much higher market values and growth rates” (Cusumano et al., 2020). In order to provide managerial guidance for digital platform transformation, research needs to enhance our understanding of how firms can achieve a sustainable competitive advantage by building on specific AI-related platform resources. This includes identifying which strategies they should adopt to succeed digitally, and how a firm’s internal organizational structure must change to support digitalization strategies.

Gartner defines “innovation management” as a business discipline that aims to drive a repeatable, sustainable innovation process or culture within an organization. Innovation management initiatives focus on disruptive or step-by-step changes that transform a business ecosystem in some significant way.

According to one definition (Burton & Basiliere, 2016), a “digital platform” is a business-driven framework that allows a community of partners, providers, and customers to share and enhance digital processes and capabilities, or to extend them for mutual benefit.

To design a digital business platform, organizations must lead their business to take a data-driven, outside-in approach (Evans & Gawer, 2016). Digital business platforms empower flexible and dynamic digital business transactions. Disruption through such platforms is a process that impacts multi-sided markets through digital capabilities, channels, and assets. Digital business innovation thus creates disruptive platform network effects or externalities.

Definition (Leiblein, 2018)

“Platform innovation” refers to changes in support structures that increase the effectiveness with which a group of activities may be performed on a platform. Product platform innovation entails changes to a common component or body of knowledge that may be redeployed across products. Industry platform innovation entails changes to infrastructure, standards,

and rules that enable transactions between multiple firms. Digital technology platforms are described through the lens of applications and business capability components of the business platform technology stack they support (Yablonsky, 2018ab, 2020).

The author of this paper previously (Yablonsky 2018ab, 2020) distinguished the following main platform types related with the digital platform stack (Figure 1):

1. Business platforms

- 1.1. Business Model and Leadership platform (B1).
- 1.2. Talent platform (B2).
- 1.3. Delivery platform (B3).
- 1.4. Promotion platform (B4).

2. Technology platforms

- 2.1. Information systems platform (T1): Supports the front and back office and operations, such as ERP and other core systems.
- 2.2. Customer experience platform (T2): Contains the main customer-facing features, such as customer and citizen portals, omni-channel commerce, and customer apps.
- 2.3. Data and analytics platform (T3): Includes information management and analytical capabilities. Data management programs and analytical applications fuel data-driven decision making, and algorithms automate discovery and recommended action.
- 2.4. IoT platform (T4): Connects physical assets and smart machines (smart things) for monitoring, optimization, control, analytics, and monetization. Capabilities include connectivity, analytics, and integration to core and OT systems.
- 2.5. Ecosystems platform (T5): Supports the creation of, and connection to, external ecosystems, marketplaces, and communities. API management, control, and security are its main elements.
- 2.6. Trust platform (T6): Enables a higher sense of trust between participants in the ecosystem. A

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distributed ledger (for example, blockchain) technology used to foster community trust provides one emerging example.

2.7. Integration platform (T7): Supports the integration of all the above platforms, allowing the maximum flexibility to support business transformation demands.

4. AI-driven Platform Innovation

AI-driven platform innovation can be developed through the lens described above involving business capability components and applications of a digital business platform technology stack they support. It is intended to provide a high-level overview of the key capabilities necessary to assemble a AI-driven platform innovation in the digital business platform stack.

Business Platforms

The Business Model and Leadership platform, as well as the Talent platform, are related more with platform capabilities (Teece, 2017). Their goal is to facilitate knowledge exchange in Business Model and Leadership environments and to offer affiliates the opportunity to access large intra-ecosystem or ecosystem communities of actors, with experiential, educational, or professional knowledge in a company's diverse geographical and disciplinary fields (Boudreau, 2010; Boudreau et al., 2011; Colombo et al., 2013; Colombo et al., 2015; Evans & Gawer, 2016). The key roles of a Business Model and a Leadership platform are to collect dispersed sources of knowledge, to recombine the collected knowledge, to empower innovation and management, and to transfer it to new technological and organizational contexts. Delivering a digital platform business requires new capabilities to enable, support, and manage digital business (Burton & Basiliere, 2016).

The variance in a company's digital business performance can be a function of the differences in their platform's resources and capabilities compared with market competitors.

In contrast with the clear inside and outside distinction in traditional business, a digital platform provides a business with a foundation where resources can come together in various combinations to create value. Some resources may be inside, permanently owned by the company, while some may be shared by customers, and others can even come from an outside ecosystem. timreview.ca

The combined value a company uses to scale comes largely from the dynamic connection of resources and actors, and the potential network effects that arise between them.

Platform design facilitates matching among providers ("producers") and consumers ("users") or, in other words, the creation or exchange of goods, services, and social currency, so that all participants in the market can capture value. Digital platforms offer unique opportunities to engage members of a business ecosystem in transactions to exchange value (Blosch & Burton, 2016).

Platform business model management is an important managerial function (Osterwalder and Pigneur, 2010; Hagi, 2014). It involves the ongoing monitoring of activities that encompass the company's business model, as well as of incentives for stakeholders participating in the business model. Business model management thus considered could be viewed as part of a firm's ordinary capabilities (in terms of the day-to-day performance of activities), but it also requires dynamic adaptation and transformation in light of market conditions, and thus links to the dynamic capabilities framework. Identifying sustainable business models and ecosystems in and across sectors and platforms is an important challenge. Many SMEs that are now involved in highly specific or niche roles will need support to help align and adapt to new AI-driven value chain opportunities in the future.

New concepts for digital platform AI-driven BD collection, processing, storing, analyzing, handling, visualization and, most importantly, usage are emerging, and new AI-driven platform strategies and business models are being created around them. With AI-driven digital platform business models, platform assets may be added or combined in new and different ways to support the platform's strategy.

In platform business models, AI is good for scale acceleration to:

Automate sorting processes and actions.

- Automate predictions in detail.
- Address historical desires first.
- Address data with clear parameters.

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- Identify credible, good-quality data with sufficient scope to fully engage the problem.
- Pursue reasonable and possible goals.

AI provides the potential for generating the following economic benefits from platform data:

- Indirect data monetization
- Using data to improve platform efficiencies.
- Using data to develop new platform products and markets.
- Using data to build and solidify platform partner relationships.
- Branded indices.
- Direct data monetization
- Bartering/trading with platform data.
- Data-enhanced platform products or services.
- Selling platform raw data through brokers.
- Offering platform data/report subscriptions.

A Delivery business platform creates value primarily by enabling direct interactions between two (or more) distinct types of affiliated delivery consumers. Here AI-driven innovations can influence smart transport delivery business processes related with driverless transport, AA/BD predictive analytics, and supply chain management.

A Talent business platform creates value primarily by enabling direct interactions between two (or more) distinct types of affiliated talent consumers. The talent platform is at the center of the enterprise's relationship with talent. How can an enterprise acquire and keep its top talent in the age of digital business? In its relationships with top talent, enterprises can use marketing tools and analyses. Seeing talent through the eyes of a customer, based on an employment-by-talent platform as a kind of company brand promise fulfilled, can improve talent acquisition and retention. Persistent shortfalls in key talent areas show that enterprises have to act now to adapt their talent approaches in the digital world.

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A Talent platform serves the need of multiple customer segments, including enterprise executives, managers, HR professionals and recruiters, potential or current employees, to create and maintain engagement and dynamic relationships between the enterprise and its contributors, internal and external (Hunter and Coleman, 2016). A key function of the talent platform is data capture and analysis related to talented individuals and talent pools; before, during and after their employment by the enterprise. Treating talent through the eyes of a customer whose relationship with the enterprise includes a mix of exploration, evaluation, and engagement over time is more realistic and fruitful for all involved than has been the former tradition of treating the acquisition of talent as a transaction.

AI influences and provides platform data literacy: the ability to read, write, and communicate data in context, including an understanding of data sources and constructs, analytical methods and techniques applied, and the ability to describe use-case applications and their resulting value.

A Promotion business platform creates value primarily by enabling direct promotional interactions between two (or more) distinct types of affiliated platform participants, including consumers, producers, and providers. It enables internally managed outbound messages and external inbound messages by platform participants themselves. A Promotion platform influences platform participants to submit multimedia messages, provide footage, documentation, or reports about different types of activities and share them on social media and other platform ecosystems.

Technology Platforms

Each area of a platform can deliver insight that is descriptive, diagnostic, predictive, and/or prescriptive. BD, analytics, and algorithms are essential to digital business platforms and should be integrated with platform services to permit other platforms to use external and internal data and analytics. To democratize data processing and visualization, a Technology platform should include self-service features for increasingly wider enterprise constituencies. AI may infuse digital platforms in all mentioned above business and technology versions (Table 1).

Key stakeholders of AI-driven platform innovation include executives, IT leadership, line-of-business managers, employees, partners, and suppliers.

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Table 1. AI-driven digital platform technology stack innovations

Platform type	AI-Driven Innovation
Business Platforms	
Business Model and Leadership platform (B1)	B1 facilitates knowledge exchange in Business Model and Leadership environments and offers affiliated actors the opportunity to access large intra-ecosystem or ecosystem communities of actors with experiential, educational, or professional knowledge in company's diverse geographical and disciplinary fields.
Talent platform (B2)	B2 creates value primarily by enabling direct interactions between two (or more) distinct types of affiliated talent consumers.
	AI impacts and provides platform data literacy: the ability to read, write and communicate data in context, including an understanding of data sources and constructs, analytical methods and techniques applied, and the ability to describe the use-case application and resulting value.
Delivery platform (B3)	B3 creates value primarily by enabling direct interactions between two (or more) distinct types of affiliated delivery consumers.
	AI impacts smart transport delivery business processes related with driverless transport and AA/BD predictive analytics and supply chain management.
Promotion platform (B4)	B4 creates value primarily by enabling direct promotion interactions between two (or more) distinct types of affiliated platform participants: consumers, producers, and providers.
	AI influences <ul style="list-style-type: none"> – Creation of internally managed outbound messages and externally inbound messages by platform participants themselves. – Exchange/sharing among platform participants - consumers, producers, and providers - multimedia messages. – Provision and promotion on social media and platform ecosystems different activity types.

AI-driven digital platform innovation incorporates multiple activities that are sometimes difficult to unravel, analyze, and predict. Such innovations on digital platforms are often rapidly changed. To maximize complementarity across the platform technology stack, it is important to identify the relationship between different business platforms (capabilities), technological platforms, performance, and innovation for enterprise-level digital platforms.

This paper uses a simple method of matrix mapping (Yablonsky, 2018ab, 2020) for the business model platform layer and platform's technology stack. As a synthesis of various views commonly held by technology

analysts, researchers, and practitioners today, the paper analyses and designs AI-driven platform innovation dimensions through a minimalistic, object-oriented, and functional representation. This is based on seven key technology platforms and five levels of AI maturity (Table 2).

For example, the following sequence for companies to use in their self-assessment based on five key levels of AI platform maturity might be implemented as follows:

- (1) List key five levels of AI-driven platform maturity.
- (2) Use needed or assessed level of platform maturity

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Table 1. AI-driven digital platform technology stack innovations (cont'd)

Technological Platforms	
Information systems platform (T1)	T1 supports the front and back office and operations, such as ERP and other core systems (Employees & Suppliers).
	AI transforms <ul style="list-style-type: none"> – Business and Operational Analytics. – Core IT Systems. – Back-Office Systems. – Supplier Portal. – Supplier Apps.
Customer experience platform (T2)	T2 contains the main customer-facing counterparts, such as customer and citizen portals, omni-channel commerce, and customer apps.
	AI transforms <ul style="list-style-type: none"> – Customer Analytics. – Multichannel Commerce. – Social Networks. – Customer Portal. – Customer Apps. – Customer Facing and Public APIs.
Data and analytics platform (T3)	T3 includes information management and analytical capabilities. Data management programs and analytical applications fuel data-driven decision making, and algorithms automate discovery and action.
	AI transforms <ul style="list-style-type: none"> – Decision Models. – Algorithm and AI Engines.
IoT platform (T4)	T4 connects physical assets and smart machines (smart things) for monitoring, optimization, control, analytics, and monetization. Capabilities include connectivity, analytics and integration to core and OT systems.
	AI transforms <ul style="list-style-type: none"> – IoT Analytics. – Connected Things (Enterprise). – Connected Things (Partner). – Connected Things (Customer). – Endpoint Computing.
Ecosystems platform (T5)	T5 supports the creation of, and connection to, external ecosystems, marketplaces and communities. API management, control and security are its main elements.
	AI transforms <ul style="list-style-type: none"> – Partner and Supplier Analytics. – Partner Facing Public APIs. – API Marketplaces. – Enterprise Run Ecosystems. – Industry & Partner-Run Ecosystems.
Trust platform (T6)	T6 is used to foster trust.
	AI enhances blockchain security, risk, and compliance strategies.
Integration platform (T7)	AI influences integration of all above platforms that allows the maximum flexibility, security and trust to support business transformation demands.

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as a starting point for coming up with some initial ideas for AI-driven platform transformation analysis.

- (3) Use a proposed framework (map of the digital platform technology stack), reflect on strategic intent, analyse business platform layers in the stack (Business model and Leadership platform, Talent platform, Delivery platform, etc.) using an idea design process, while streamlining the analysis with an eye for possible Technology platform synergies.
- (4) Use value drivers for specific dimensions of platform innovation to clarify how technology is employed in implementing AI-driven digital platform innovation ideas. Value drivers related to specific digital dimensions of platform performance and innovation generation may be a consideration.

The framework proposed in this paper could be run through several iterations until all platform layers (Table 1) are analysed/classified, and all table cells are filled. This approach keeps the focus on the AI-driven digital platform transformation throughout the platform BM portfolio design/analysis process, while providing leeway to explore opportunities beyond digitalization. The level of granularity depends on the needed level of detailing.

Another example is to do a “checklist” exercise to determine what platform parts are missing, in need of

improvement, or updating in an enterprise. The results of such a checklist can be foundational.

5. Conclusion

Organizations worldwide must evaluate their vision and transform their people, processes, technology, and data readiness to unleash the power of AI and thrive in the digital era (Jyoti et al., 2019). To help with strategic innovation planning and investment decisions related to AI-based automation, this paper developed a multi-dimensional data-driven AI platform innovation framework. The framework allows for evaluating the support by platforms in the human-machine relationship regarding applications at different levels of automation across any industry and functional use case.

The paper adds the following results to current understanding:

- 1. An AI-driven platform innovation framework is now available for the first time to use with related AI-driven platform innovation value chains. The new dimensions of AI-driven platform innovation maturity and value chains allow for repeating this analysis with different types of business components (technology, leadership, talent and skills, ecosystem, and new data-driven business models). The emergence of a new wave of platform data from innovative sources, such as the Internet of Things (IoT), sensor networks, open data on the Web, data from mobile applications, and social network data, together with the growth of datasets inside platform organizations, creates new

Table 2. Multi-dimensional AI-driven platform innovation framework, $A_j, j \in \{0,1\}$ or other scale. Matrix integration of the AI maturity stages (Yablonsky, 2019b) and the business platform stack (Yablonsky, 2018a).

Stage of AI maturity	Business platforms				Technological platforms						
	B1	B2	B3	B4	T1	T2	T3	T4	T5	T6	T7
D1: Human Led	A_{D1} B1	A_{D1} B2	A_{D1} B3	A_{D1} B4	A_{D1} T1	A_{D1} T2	A_{D1} T3	A_{D1} T4	A_{D1} T5	A_{D1} T6	A_{D1} T7
D2: Human Led, Machine Supported	A_{D2} B1	A_{D2} B2	A_{D2} B3	A_{D2} B4	A_{D2} T1	A_{D2} T2	A_{D2} T3	A_{D2} T4	A_{D2} T5	A_{D2} T6	A_{D2} T7
D3: Machine Led, Human Supported	A_{D3} B1	A_{D3} B2	A_{D3} B3	A_{D3} B4	A_{D3} T1	A_{D3} T2	A_{D3} T3	A_{D3} T4	A_{D3} T5	A_{D3} T6	A_{D3} T7
D4: Machine Led, Human Governed	A_{D4} B1	A_{D4} B2	A_{D4} B3	A_{D4} B4	A_{D4} T1	A_{D4} T2	A_{D4} T3	A_{D4} T4	A_{D4} T5	A_{D4} T6	A_{D4} T7
D5: Machine (Machine Led & Machine Governed)	A_{D5} B1	A_{D5} B2	A_{D5} B3	A_{D5} B4	A_{D5} T1	A_{D5} T2	A_{D5} T3	A_{D5} T4	A_{D5} T5	A_{D5} T6	A_{D5} T7

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ways to reuse and extract value from BD assets through AI-driven platform innovation.

2. The AI-driven platform innovation framework outlined here can be used for better communicating the value of AI capabilities to clients through the lens of changing human-machine interactions, as well as in the context of legal, ethical, and societal norms. While business, IT, and analytics leaders need to recognize how AI is different from previous cycles of IT-based innovation, this paper shows that today's leaders also need to more openly embrace AI and become involved in contributing to the discussion of AI ethics. With the broad participation of a diverse, global population in conversations about the future of AI, we are more likely to advance safely through different levels of AI-driven platform automation, while accumulating benefits for the largest possible population of human beings. A clear and precise description and structuring of information in the AI-driven platform enterprise maturity framework are thus considered as prerequisites for developing a

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