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Beyond AI, blockchain systems, and digital platforms: Digitalization unlocks mass hyper-personalization and mass servitization

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Beyond AI, Blockchain Systems, and Digital Platforms:

ODIGITALIZATION UNLOCKS MASS HYPER-PERSONALIZATION AND MASS SERVITIZATION

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Abstract

The ever-progressing digitalization of the economy and society is unlocking new opportunities for organizations engaging in services. We are in the middle of a transformation of the service sector that can be likened to the advent of mass production in the 1940s. Based on recent advances and developments in artificial intelligence, digital platforms, and blockchain systems, we are witnessing the emergence of new digitalization phenomena of metahuman systems, artificial intelligence platforms, and meta-organizations. Jointly, these forces are shaping now, or will be in the near future, the service activities of organizations around the world. They enable mass hyper-personalized services and mass servitization – new types of high variety and high-volume service processes. Artificial intelligence applications like search and recommendation engines, and artificial intelligence platforms such as Google Maps, Chat GPT, BloombergGPT and Stable Diffusion can be perceived as early manifestations of the ongoing transformation. Already in the present day, applications and platforms such as these can be adopted in a wide range of downstream tasks, thus enabling personalized service experiences for audiences of one. While increasing the value of service offerings, mass hyper-personalization and mass servitization also have the potential to increase the productivity of service operations and the entire service sector, especially in the context of knowledge-intensive work. This working paper reflects and provides an up-to-date synthesis of key emerging concepts on digitalization, services and research directions grounded in our current research.

Tiivistelmä

Mitä tekoälyn, lohkoketjujärjestelmien ja digitaalisten alustojen jälkeen? Digitalisaatio avaa uusia mahdollisuuksia tuottaa yhä yksilöidympiä palvelukokemuksia

Talouden ja yhteiskunnan jatkuvasti etenevä digitalisoituminen avaa uusia mahdollisuuksia erityisesti palveluita tarjoaville organisaatioille. Olemme keskellä palvelusektorin murrosta, jota voidaan verrata jopa massatuotannon syntyyn 1940-luvulla. Tekoälyn, digitaalisten alustojen ja lohkoketjujärjestelmien viimeaikaisten edistysaskeleiden ja kehityksen perusteella olemme todistamassa uusien digitalisaatioilmiöiden, kuten metahenkilöjärjestelmien, tekoälyalustojen ja metaorganisaatioiden syntymistä. Yhdessä nämä digitaaliset ilmiöt muokkaavat nyt tai lähitulevaisuudessa organisaatioiden palvelutoimintaa kaikkialla maailmassa. Ne mahdollistavat massahyperpersonalisoidut palvelut ja massapalvelullistamisen eli uudenlaiset, hyvin monimuotoiset ja suuren volyymin palveluprosessit. Tekoälysovellukset, kuten haku- ja suosittelukoneet, ja tekoälyalustat, kuten Google Maps, Chat GPT, BloombergGPT ja Stable Diffusion, voidaan nähdä meneillään olevan muutoksen varhaisina ilmentyminä. Tällaisia sovelluksia ja alustoja voidaan jo nykyään hyödyntää monissa palveluiden jatkojalostustehtävissä, mitkä mahdollistavat yksilölliset palvelukokemukset yhdelle henkilölle. Samalla kun massahyperpersoonallistaminen ja massapalveluistuminen lisäävät myös palvelutarjonnan arvoa, niillä on myös potentiaalia lisätä palvelutoiminnan ja koko palvelusektorin tuottavuutta erityisesti osana tietointensiivistä työtä. Tämä artikkeli heijastaa ja tarjoaa ajantasaisen yhteenvedon digitalisaation keskeisistä kehittyvistä käsitteistä, palveluiden muutoksesta ja tutkimussuunnista, jotka perustuvat nykyiseen tutkimukseemme.

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Keywords: Artificial intelligence, Artificial intelligence platforms, Blockchain systems, Digital platforms, Hyper-personalized services, Mass hyper-personalization, Mass services, Mass servitization, Metahuman systems, Meta-organizations, Operations, Productivity, Professional services, Service productivity, Service shops

Asiasanat: Tekoäly, Tekoälyalustat, Lohkoketjujärjestelmät, Digitaaliset alustat, Hyper-personoidut palvelut, Massahyperpersonointi, Massapalvelut, Massapalvelullistaminen, Metahenkilöjärjestelmät, Metaorganisaatiot, Operaatiot, Tuottavuus, Asiantuntijapalvelut, Palveluiden tuottavuus, Palveluliikkeet

JEL: L8, L84

Introduction

Mass hyper-personalization and mass servitization are grounded in the underlying megatrend of digitalization of business operations across industries. Digitalization is a multi-faceted and complex phenomenon that is continuously evolving (Calvino et al., 2018). Managers, entrepreneurs, policy makers, and consumers around the world are increasingly engaging with new forms of digitalization – a CEO consults BloombergGPT when preparing for a meeting with investors (Wu et. al., 2023), a shopkeeper in a country experiencing high inflation accepts payments in Bitcoin to hold value, a SaaS startup founder creates a service workflow as a distributed smart contract (Mattila, Hukkinen, Seppälä, 2017), the British Goverment drafts a risk-based framework for regulating the use of artificial intelligence (AI) (McCallum, 2023), a parent leaves their own car in a repair shop and rides Uber to pick up their kids from school. Overall, the new forms of digitalization and their applications are pervasive. They diffuse throughout the economy and society at a rapid pace and have a significant impact (Mucha & Seppala, 2022). As a result, the underlying changes require investigation of novel phenomena driving future productivity in the economy – this is especially true for service productivity.

In terms of contributions towards Gross Domestic Product (GDP) and international trade, the importance of the service sector has increased, both nationally and globally (World Trade Organization, 2019). It is important to recognize, however, that "an economy's prosperity does not depend on the relative size of its manufacturing or services sectors but on the productivity of the economy as a whole – which in turn depends on efficiencies and innovations across all sectors, and the extent to which they are mutually reinforcing" (World Trade Organization, 2019, p. 16). Hence, we need to understand the impact of the emerging digitalization trends on the service sector, servitization of industry, and their broader interconnections. Based on insights from the articles included in this collection, as well as synthesis of the recent digitalization research and our evaluation of the unfolding digitalization around the world we have identified mass hyper-personalization and mass servitization as vital emerging concepts driving future service sector competitiveness and productivity.

To understand the role of mass hyper-personalization and mass servitization, we need to consider them in the context of existing service processes. Three service process types are typically defined in research: professional services (high variety and low volume), service shops (medium variety and medium volume), and mass service (low variety and high volume) (Silvestro, Fitzgerald, Johnston & Voss, 1992; Silvestro, 1999). Confined by these definitions and the technological constraints of the past, relatively little attention has been dedicated to high variety and high-volume service provision. It is this type of service process, however, where we see the greatest untapped opportunity for improving service sector productivity in the future. We characterize **mass hyper-personalization** as an *efficient, dynamic, and high-volume process of targeting, designing, and delivering customized service experiences for an audience of one*, based on a set of unique criteria, e.g., by using foundation models that are prompted or fine-tuned with user-specific data. The path that is leading the service sector in the direction of mass hyper-personalization has been paved by the recent advances in digital technology – AI and blockchain systems – and the associated new ways of organizing economic activity – digital platforms and smart contracts. Servitization is typically depicted as a process of building revenue streams for company operations from services (Vandermerwe & Rada, 1988). Building on established conceptualizations of services, research on the digitalization of services has contributed to our understanding of how segmentation, customization, and servitization can impact firm productivity, and the process of how those changes take place. Digitalization enables the customization of services more productively than before (Marco, Vendrell-Herrero & Bustinza, 2018). However, the existing research on servitization has not sufficiently addressed the wide variety and high-volume aspects of digital services. While servitization has always included technological aspects, digital technologies have recently attracted increasing attention in this stream of literature (Van Ark, De Vries & Erumban, 2021; Linde, Frishammar & Parida, 2021). This has resulted in the recognizing of digital servitization where digital tools are the fundamental drivers in shifting a firm's business model from product-centric to service-centric (Kowalkowski et. al., 2017; Kohtamäki, Parida, Patel & Gebauer, 2020; Paschou, Rapaccini & Adrodegari, 2020). We predict that the next stage in digital servitization is **mass servitization**, which we define as a *universal high-volume transformation process of shifting from a product-centric business model to a service-centric approach*

by embedding learning, autonomy, and human interaction capabilities into emergent product-service bundles.

This collection of articles presents insights on three inter-related themes of digitalization, which we consider essential in our quest to understand mass hyper-personalization and mass servitization as recently emerging aspects of digitalization. These themes are 1) AI, machine learning-based capabilities, and sociotechnical changes leading to the creation of metahuman systems in organizations (Mucha & Seppälä, 2020; Lyytinen, Nickerson & King, 2020; Dwivedi et.al., 2023); 2) blockchain-based systems and other intelligent tools underlying new types of distributed platforms or meta-organizations for collaboration (Lauslahti, Mattila & Seppälä, 2017; Hukkinen, Mattila & Seppälä, 2017; Mattila & Seppälä, 2018; Lumineau, Wang & Schilke, 2021); and 3) policy considerations for competition, innovation, digital technology stack, and platformized modes of operation (Cenamor & Frishammar, 2021, Holmström & Seppälä, 2020; Cutulo & Kenney, 2021).

To navigate and investigate this conceptually novel, evolving and intertwined terrain, we need to be armed with a vocabulary that allows us to capture and express what we encounter. Therefore, for the benefit of the reader, we collect and recap here some of the key concepts, which we first present as a carefully arranged visual map (Figure 1), and subsequently define in detail (Table 1). The list is not exhaustive and conceptual overlap is inevitable, because many of the definitions originate from distinct scholarly traditions or literatures and have different scope in terms of levels of analysis. We primarily draw these definitions from digital platforms, blockchain, and artificial intelligence literatures and, when needed, we refer to economics, information systems, and other disciplines of research. While this arsenal clearly reflects the complexity and multi-faceted nature of digitalization, it allows us to identify areas of future focus for scholars, business practitioners, and policy makers.

Hierarchy/arrangement of selected concepts/definitions:

- Underlying concepts:
  - Agents
  - Modularity
  - Multi-Agent Systems
  - Sociotechnical Systems
- Key concepts in recent research on digitalization:
  - Digital Platforms
  - Artificial Intelligence
  - Smart Contracts
  - Blockchain Systems

Figure 1 **A mapping of selected key concepts related to digitalization, mass hyper-personalization, and servitization**

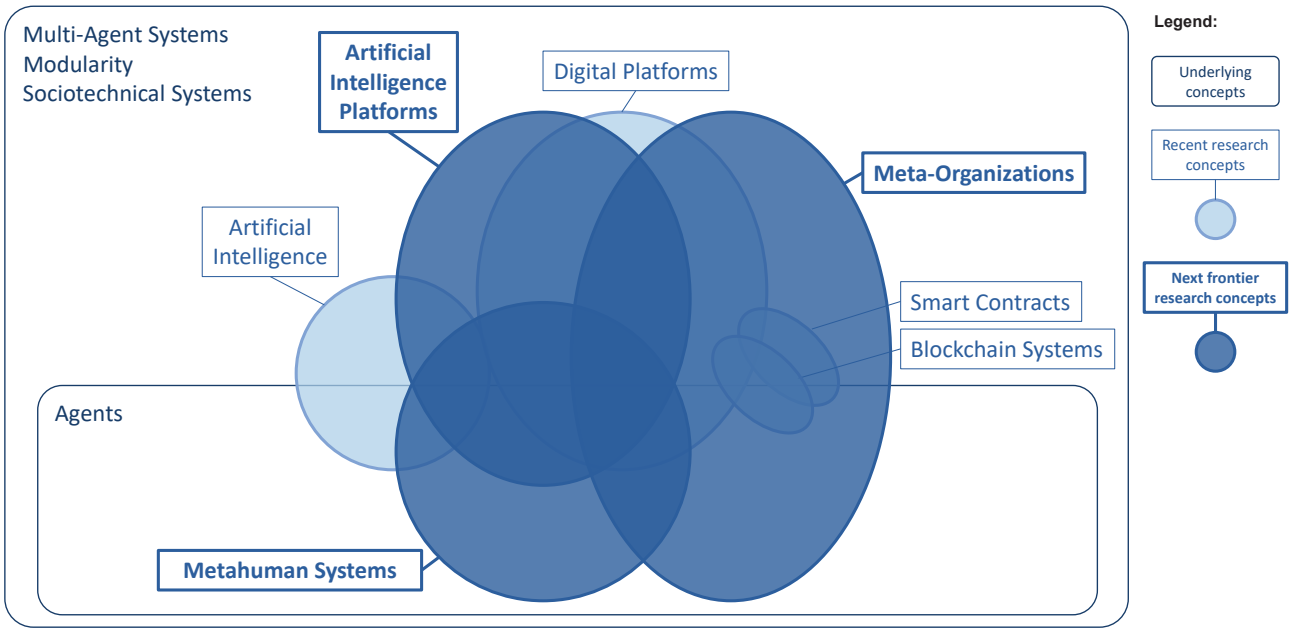


Table 1 Selected definitions of key concepts

	Definition	Source
Underlying concepts:		
Agent	Is an individual human, but also in some settings an information systems artifact or an organization, possessing "the ability to accept rights and responsibilities for ambiguous tasks and outcomes under uncertainty and to decide and act autonomously."	Baird & Maruping, 2021; Lyytinen & Newman, 2008
Modularity	Is an approach where different parts of the product and/or service and/or software are designed and manufactured by separate, specialized working groups working independently of one another. The "modules" could then be connected and (in theory at least) would function seamlessly, if they as they confronted to a predetermined set of design and manufacturing rules. With modularity enforced, it is possible to change pieces of the system without redoing it whole. Designs and manufacturing become flexible and capable of evolving at the module and system levels.	Baldwin & Clark, 2000
Multi-agent systems	Consist of autonomous entities know as agents. Agents collaboratively solve tasks, yet they offer more flexibility due to their inherent ability to learn and make autonomous decisions. Agents use their interactions with neighboring agents or with the environment to learn new context and actions. Subsequently, agents use their knowledge to decide and perform an action on the environment to solve their allocated task.	Dorri, Kanhare, Jurdak, 2018
Sociotechnical systems	Are "any organizational system viewed as a multivariate system consisting of four interacting and aligned components – task, structure, actor, and technology."	Lyytinen & Newman, 2008
Key concepts in recent research on digitalization:		
Digital Platforms	Are an evolving organizations and meta-organizations that: 1) federate and coordinate constitutive agents who can innovate and compete; 2) create value by generating and harnessing economies of scope in supply and/or in demand side of the markets; and 3) entail modular technological architecture composed of the core and periphery.	Gawer, 2014;
Artificial Intelligence	Is the frontier of computational advancements that references human intelligence in addressing ever more complex decision-making problems. It is, furthermore, multidimensional and can be presently viewed from the following perspectives: 1) Data analytics; 2) Sensing and situation awareness; 3) Natural language and cognition; 4) Interaction with humans; 5) Digital skills, interactions in work life; 6) Machine learning; 7) System level and systemic impact; 8) Computing equipment, platforms, services and ecosystems; 9) Robotics and machine automation – the physical dimension of AI; 10) Ethics, moral, regulation and legislation.	Berente et al., 2021; Ailisto et al., 2018
Smart Contracts	Are digital computer programs that: 1) are written in computer code and formulated using programming languages; 2) are stored, executed and enforced by a distributed and replicated blockchain network; 3) can receive, store and transfer digital assets of value; and 4) can execute with varying outcomes according to their specific internal logic.	Lauslahti, Mattila & Hukkinen, Seppälä, 2018
Blockchain systems	Are 1) open source and open access technology compositions; 2) comprising non-hierarchal peer-to-peer networks without any single point of failure or control; 3) which maintain consensus over cryptographically concatenated, shared, replicated append-only data structures; 4) according to deterministic self-contained consensus algorithms, void of external inputs such as validation by central authorities or off-chain signaling.	Mattila, 2021
Emerging concepts shaping future research on digitalization:		
Metahumans systems	Are new, emergent, sociotechnical systems where machines that learn join human learning and create original systemic capabilities.	Lyytinen, Nickerson & King, 2020
Artificial Intelligence Platforms	Are digital platforms which critically rely on AI technologies in at least one of the following areas: 1) federation and coordination of constitutive agents; 2) value creation; or 3) technological architecture.	Mucha & Seppälä, 2020
Meta-organizations	Are cross-organizational systems where multiple agents (human, metahuman system, and legally autonomous organization) interact in a 1) dynamic, 2) interoperable, 3) intelligent, 4) federated, and 5) coordinated manner, thus enabling them to create unique and context specific bundles of product-service design and delivery.	This article

- Emerging concepts shaping future research on digitalization:
  - Metahuman systems
  - Artificial Intelligence Platforms
  - Meta-Organizations

We grouped the key concepts presented here into three sets, which reflect the chronological and conceptual progression of academic research and evolution of digitalization. The underlying concepts are the broadest and most seasoned ones. Apart from connecting our work to long-established research, they also show how our understanding needs to be periodically revised, as technology and society advance. For example, we used to consider only humans or organizations as agents. Now, however, technology artifacts have been endowed with much higher levels of autonomy and capabilities, thus exhibiting agentic properties (Baird & Maruping, 2021). Concepts related to the recent research on digitalization are central to understanding the articles included in this collection, which we will present next. Finally, the emerging concepts reflect our newly informed insights, which are based on our synthesis of findings and contributions from the articles included in this collection, recent literature on digitalization, and active engagement with digitalization taking place in the industry and society.

Contributions in this collection of articles

This collection of articles introduces three sets of themes. The first theme, articles one to three, describe when and how companies have started to adopt AI leading to creation of metahuman systems in organizations. The second theme, articles four to six, explain how blockchain systems have been considered by companies and new distributed collaborative meta-organizations. The third theme, articles seven to eight, consider policy implications for competition, innovation and industries primarily in the context of technology stack and digital platforms.

The first three articles in this collection (Mucha & Seppälä, 2021; Mucha & Seppälä, 2022; Mucha, Seppälä & Gustafsson, 2023) examine the technology diffusion and corporate adaptation of artificial intelligence technologies and the increasing importance of AI platforms. The first article proposes a method for estimating firm-level digital intensity based on industry sector level data, which can be used to understand firm digitalization among its peer group. The proposed method considers firms' participation in multiple industries, uses reference sector-level digital intensity scores, and is replicable and reproducible. The second article proposed a method for monitoring the commercial diffusion of technology which captures the temporal progression of technology adoption by organizations and relies on qualitative content coding. It provides transparent, replicable, updatable, and granular results that are illustrated using the case of AI diffusion among S&P 500 companies. The third article takes a sociotechnical system perspective on the micro foundations of capabilities and develops an integrative conceptual framework to extend understanding of organizational capabilities in the context of machine learning (ML) initiatives. The framework incorporates a temporal dimension, and multiple propositions are developed using anecdotal evidence.

Three contributions, article four (Mattila, Seppälä, Valkama, Hukkinen, Främling, Holmström, 2021), article five (Hakanen, Eloranta, Marttila & Amadae, 2023) and article six (Mattila, Seppälä & Salakka, 2021) of this collection of articles discuss new blockchain systems and other intelligent tools and their impacts on organizations and markets. The fourth article proposes a blockchain-based approach for product information management, which aims to collect product life-cycle data, maintain an accurate single state of product information, and provide economic incentives for solution deployment. The evaluation identifies challenges in deploying blockchain-based solutions in the current industrial landscape, but the paper lays the foundation for a self-sustained and self-incentivized deployment approach. The fifth article talks about other kinds of blockchain systems i.e., distributed ledger technologies (DLT), primarily designed to facilitate the exchange of unique, scarce items. This paper presents an alternative decentralization protocol based on anti-rival goods. The authors explain the technical approach behind the concept, referred to as shareable non-fungible tokens (sNFTs), and illustrate their argumentation by presenting a decentralized platform for sharing and streaming data.

The sixth article considers the game industry's expertise in building virtual economies that can establish data product markets, potentially challenging digital platform incumbents. To protect the Finnish game industry and economy, policymakers should understand the resources, protocols, and regulative frameworks required to foster new businesses and industrial growth in new digital infrastructures.

Two contributions, article seven and eight of this collection of articles discuss competition, innovation and industry policy implication (Cutulo & Kenney, 2021, Holmström & Seppälä, 2020). The seventh article discusses the significance of digital platforms, especially the power asymmetry between platforms and ecosystem members is intrinsic to their economics and technological architecture. Article seven suggests that entrepreneurs in the platform ecosystem are more usefully termed "platform-dependent entrepreneurs" (PDEs) and explores strategies to mitigate their dependence. Additionally, the article provides a framework for policy makers to consider regulating platform-organized markets. The eight article focuses on the US-China trade conflict and the potential technology separation that could disrupt global value chains of digital technologies, particularly in the lower hardware levels of the technology stack. The article highlights the potential implications for Europe and smaller open economies such as Finland and explores different options for Europe if the technological separation continues.

Jointly, the three themes addressed by articles in this collection indicate the directions in which digitalization of industry and society is inevitably evolving. This direction, in our view, is hyper-personalization of services and mass servitization. These two phenomena are grounded in the emergence of metahuman systems, AI platforms, and meta-organizations. The articles in this collection identified and explored the harbingers of these nascent systems or their building blocks. Based on the early evidence, already at this stage, we recognize the transformative impact of these systems on various industries. In the upcoming section, we take a more in-depth look on these future research areas, and thereafter we develop a research agenda focused on the implications for hyper-personalization and mass servitization. This is an area where we anticipate the impact of these systems will be particularly significant.

The emerging cornerstones of mass hyper-personalization and mass servitization: Metahuman systems, AI platforms, and meta-organizations

Understanding key technologies and their potential impacts is merely a starting point. Ultimately, technologies do not determine outcomes — people, organizations, and institutions interacting with technologies do (Emery, 1993; Leavitt, 1965). In short, technology enables action. It is ours to decide how to apply it, and with what kinds of consequences. Vice versa, technology deployment and its context are influenced by strategies, regulation, and policies. Therefore, we need to better understand the broader sociotechnical aspects of the emerging drivers or cornerstones of operations and service productivity.

By building on the insights from the articles included in this collection and complementing these with our readings of the recent literature on digitalization, as well as our perception of the unfolding digitalization around the world, we identify metahuman systems, AI platforms, and meta-organizations as the emerging concepts shaping future research on digitalization, particularly in relation to mass hyper-personalization and mass servitization (Figure 2).

Metahuman systems are new, emergent, sociotechnical systems where machines that learn join human learning and create original systemic capabilities at the level of teams or, potentially, organizations (Lyytinen et al., 2020; Mucha et al., 2022, Forthcoming). These new capabilities are distinct, because without ML technologies that are learning and adapting it would not be practically or technically feasible to reach the required levels of performance within these systems (Mucha et al., 2023). Metahuman systems will impact operations and service delivery from the perspective of both the organizations providing the service as well as those of customers receiving, co-creating or co-operating within the service.

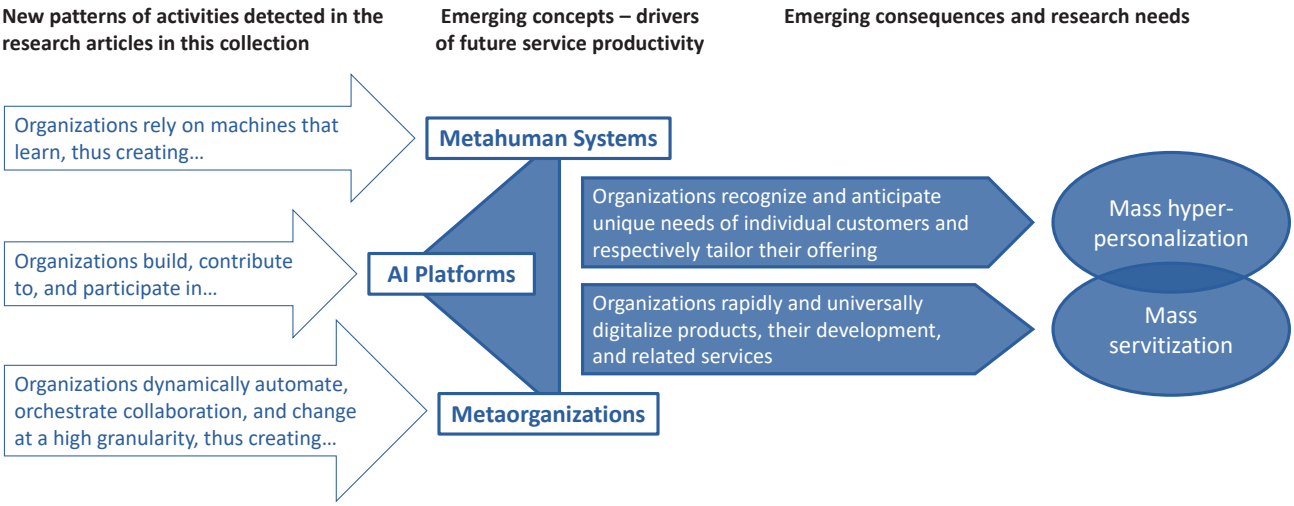
The distinction between internal and external impact of metahuman systems on organizations is important because it highlights the sweeping impact of metahuman systems on operations and service productivity. First, many organizations internally consider knowledge workers as providers of internal services to other units, functions, or roles (Davis, 1996). Machines that learn already now can or soon will be able to keep track of sets of actions of individual employees and in conjunction with that start modifying own behavior to increase the level of personalization for the need of these employees. If successfully executed and developed into hyper-personalization, these metahuman systems will potentially improve the baseline performance by, for example, lowering variance, increasing throughput, or improving output quality (Mucha et al., 2023). Clearly, some metahuman systems will also be re-imagined and novel, rather than incrementally developed versions of the preceding sociotechnical systems (Mucha et al., 2021, Forthcoming). However, even more impactful productivity gains can be reaped by organizations leveraging metahuman systems to render services that are more valuable than the status quo and serve external customers. By creating offering that is better tailored to external customer needs, especially those "jobs to be done" that are unique, important, and insufficiently catered to. Thus, metahuman systems will, in many cases, form the fundamental building blocks underlying hyper-personalization.

This line of reasoning is also salient to understanding the role of metahuman systems in enabling and fostering mass servitization. One of the stumbling blocks on the transformation path from product to service logic is the scalability of human resources and the ability to respond to unique customer needs (Zhang & Banerji, 2017). These challenges in our view have prevented, thus far, servitization from happening on a mass scale. Metahuman systems, however, will help organizations to scale human knowledge and capacities better by encapsulating some of these into technology that is essentially freely scalable (Mucha et al., 2021).

Another cornerstone of future operations and service productivity is the increasingly critical role of AI in the functioning of digital platforms, thus the emergence of AI platforms (Mucha & Seppala, 2020). While the platformization of the economy is already a well-established trend, we have seen only very preliminary impacts of AI in this domain compared to what is already now feasible from a technology viewpoint. AI platforms provide a backbone to many individual organizations actively leveraging or constructing metahuman systems (Mucha & Seppala, 2020). Consequently, understanding the role of AI platforms in this capacity will be pivotal.

We, furthermore, need to consider both innovation platforms and transaction platforms having both important

Figure 2 **The emerging patterns of activities and concepts shaping future research on digitalization**



and unique own contribution to this evolution (Cusumano et al., 2020). Innovation platforms will be both fostering and constraining some organizational uses of AI. This will have an important impact on the competitive dynamics of service sector, because uneven access, maturity of, or ability to leverage AI will partially determine the outcomes of mass hyperpersonalization efforts of organizations (Mucha & Seppala, 2020). Transaction platforms, on the other hand, will play a crucial role in distributing and disseminating services or information about these services. Furthermore, transaction platforms might constitute some of the marketplaces where critical enablers of hyper-personalization will be exchanged. This logic extends to mass servitization, because of the constant pressure and efforts towards platformization of industrial sector. Here, it is important to recognize the role of newly emerging AI platforms (start-ups), which are distinct from hyperscalers (Mucha & Seppala, 2020). These AI platforms will likely play an important role in mass servitization because their offering might be centered around specific servitization use cases.

Finally, we recognize that meta-organizations emerge as the third novel cornerstone of future productivity growth in the service sector. While past research has already identified the concept of meta-organizations seen as organizations comprising multiple legally autonomous entities (Gawer, 2014; Gulati et al., 2012), our conceptualization updates that definition to reflect multi-level interactions of various agents constituting meta-organizations. We propose to include within the scope of meta-organizations other types of agents as well – individual humans and metahuman systems emerging within organizations. Furthermore, these agents must be able to interact in a 1) dynamic, 2) interoperable, 3) intelligent, 4) federated, and 5) coordinated manner, which enables them to create unique and context specific bundles of product-service design and delivery. Thus, the interactions constituting the fabric of meta-organizations are present not only within a single organization, but also might frequently cross the organizational boundaries.

AI platforms represent one type of meta-organization, but the scope of meta-organization as a concept is nevertheless much broader than that. For example, the interactions between the actors might be governed by a smart contract and not necessarily rely on a digital platform logic. To add to that, multi-level aspect of meta-organizations reveals important contributions of individual humans and metahuman systems to render product-service bundles. For example, human annotators who label training data for ML models play an important role from the perspective of the system as a whole. Equally, ML-based digital artifacts might drive and constrain actions of human actors or even entire organizations. Thus, meta-organizations constitute a distinct and complementary determinant of mass hyper-personalization and mass servitization.

A tentative research agenda

We believe that with the increasing computing power, the proliferation of AI to firms and digital platforms, and the related emergence of new organizing logics, we are amid a service sector transformation resembling the advent of mass production in the 1940s. The resulting service sector productivity dynamics will be driven by mass hyper-personalization and mass servitization. Our collection of articles points to several fruitful areas for future research inquiry in services, servitization and productivity in the context of AI platforms, metahuman systems, and meta-organizations.

The tentative nature of the proposed agenda reflects the nascent stage of the phenomena we urge scholars to study. Furthermore, in outlining questions for future research, we primarily concentrate on aspects that drive nuanced understanding and contextually rich micro-level perspective. This reflects the complex sociotechnical dimension that we need to understand to better appreciate often nuanced differences between traditional information technology and AI. Therefore, the proposed research directions concentrate on in-depth (case) studies that provide understanding of novel phenomena. However, we expect that macro-perspective approach will soon become viable as well, given the rapidity and pervasiveness of changes that take place in, at least, some of the relevant areas. For instance, in January 2023 ChatGPT became the fastest growing consumer application ever, beating even digital platforms such as TikTok or Instagram (Hu, 2023). Thus, research utilizing quantitative data will need to be developed as well.

1 Metahuman systems – Foundation models, operations, and service automation

By harnessing modern computing resources, abundant data, and continuously advancing algorithms in operations and services, we have greatly improved state-of-the-art computer performance on many tasks such as speech recognition, image recognition, and generation of text, audio, and images. Some of these capabilities have been packaged in the form of foundation models, which have been trained on broad data, can be further fine-tuned to specific tasks and recombined to create new intelligent tools such as ChatGPT and GPT-4.

These novel technologies have the potential to change the ways modern organizations work – the roles of people, the routines they enact, the products and services they deliver, and productivity they achieve. This transformation, however, is not merely about technological progress. Productively integrating these intelligent tools into mass hyper-personalization and servitization of industry requires that we explore and understand the new opportunities and limits of digital automation. Particularly, the understanding of digital automation limits remains downplayed and overlooked.

The nai¨ve view is that simply with more data and computing resources the performance of these new forms of digital automation increases. However, for private sector companies to leverage these tools and drive productivity improvement, as well as for innovation and growth policy actions to foster that development, we need a more in-depth understanding and paradigmatic case examples of the newly redefined constraints of digital automation.

Thus, we propose the following research questions to drive research along this dimension.

Research question 1.1: What is the foundation model application landscape within and outside of generative AI applications for product and service companies?
Research question 1.2: What do mass hyper-personalized service and mass servitized engagements and experiences mean for knowledge work and worker?
Research question 1.3: What are the limits to mass hyper-personalization and mass servitization in metahuman systems? How companies drive productivity within these boundaries?
Research question 1.4: What are the limits to productivity improvement in organizations relying on foundation models, other types of machine learning, or metahuman systems? How do companies drive productivity within these boundaries?

2 Artificial intelligence platforms and service firm productivity

The scale of artificial intelligence (AI) platforms, their workloads, and range of offering have been increasing continuously. In the early days of AI use by digital platforms, these technologies were just one of their tools in the toolbox and were utilized predominantly in internal processes. It is important to recognize that subsequently many digital platform companies have not only invested in research and development of AI for improving their own operations but have also looked for the ways to productize AI applications and create own AI ecosystems. The resulting universe of AI platforms has been further enriched by rapid proliferation of various AI services and emerging AI platforms targeting specific services, industries, or market segments.

This growth creates numerous opportunities for service firms, but it is also full of challenges. The barriers to accessing state-of-the-art AI in the form of the latest machine learning models and particularly foundation models are disappearing. This is illustrated by Microsoft making its search engine become more conversational and Amazon partnering with Hugging Face to enable easy fine-tuning and deployment of latest models. This deceptive ease is coupled with many open issues regarding explainability, ownership, and legal basis to name just a few. To further complement the picture, various organizations including government agencies and non-profits are also experimenting with and leveraging these new AI tools. The resulting dynamics and the pivotal role of AI platforms is neither explored by scholars nor well-recognized by practitioners concerned with improving productivity of service firms.

Thus, we propose the following research questions to trace the development of the AI platform as a central feature of the contemporary digital economy and consider the consequences from the perspective of productivity and innovation policy.

Research question 2.1: What are the implications of artificial intelligence platforms integration and interoperability to company product and service portfolio management?
Research question 2.2: How are mass hyper-personalization and mass servitization designed, delivered, and organized by firms participating in AI platforms?
Research question 2.3: How is the productivity of service firms impacted by their participation in artificial intelligence platforms?
Research question 2.4: How is the productivity of service firms impacted by government and non-profit participation in artificial intelligence platforms?

3 Meta-Organizations – The new system architectures for productivity in operations, services, mass hyper-personalization and mass servitization

As various IT systems are becoming increasingly integrated to one another because of digitalization, entirely new modes of mass hyper-personalization and mass servitization are enabled through product, service, and process automation. As manufacturing transitions from a product-model-centric philosophy to a more object-oriented paradigm, product individuals become actors that can be tracked, mass customized and hyper-personalized dynamically over their entire life cycles in unprecedented ways. As product individuals are transformed into personalized service actors with individuality and embedded intelligence, new types of meta-organizations emerge where humans and product systems dynamically interact in mass-servitized and hyper-personalized manner uniquely according to every specific situation.

Simultaneously, in a similar trend of development, new types of platform innovations are enabling more individual user-oriented service logics in digital platforms. For example, through blockchain-based smart contracting platforms, digital workflow processes can be individually tailored, mass servitized, and hyper-personalized in entirely novel and democratized ways. Due to the decentralized nature of such systems, genuine switch-role markets can be generated in a new manner that enables much more dynamic modes of interaction between actors in meta-organizational structures.

Scholarly work falling under this topic should output paradigmatic case examples based on research engaged with practice. This will likely require concentrating on individual sectors, industries, or businesses to surface high-granularity data. Overall, developing insights into the new systems architectures and their impact on productivity will be one of the key objectives of this future research. Therefore, we propose the following research questions.

Research question 3.1: What are the new micro-modular e.g., foundation model based and other, system architectures of service and servitized product firms successfully employing digital automation?
Research question 3.2: What are the implications of these new service system architectures to global value chains?
Research question 3.3: What are the implications of these new service systems architectures to productivity and what role do mass-personalization and mass servitization play in that?
Research question 3.4: What are the innovation, industry and competition policy implications of these new service systems architectures?

Concluding remarks

Metahuman systems, artificial intelligence platforms, and meta-organizations are likely to continue affecting how work, especially knowledge work, is done. These digitalization phenomena converge to enable design and delivery of mass hyper-personalization of services and mass servitization, thus impacting how value is created and captured by companies representing the majority of the economy. The difficulty of predicting how these will affect different industries is due in part to their pervasive impacts. As mentioned in multiple articles in this collection, the application of these novel technologies is often characterized by their ubiquitous, persistent, and deep integration with other forms of economic activity. The initial applications are often generative, thus sparking further innovation which makes predicting the future difficult.

We believe that metahuman systems, artificial intelligence platforms, and meta-organizations are likely to be powerful organizing principles for companies and other organizations, for industries, the economy, and society

over the coming years. Scholars interested in contemporary organizations and industries, or innovation and competition must consider how metahuman systems, artificial intelligence platforms and meta-organizations facilitate, constrain, channel, and change economic or social activity.

We anticipate a rising new "TIDE" of further studies related to metahuman systems, artificial intelligence platforms, and meta-organizations towards mass hyper-personalized operations and service design, delivery and experiences.

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