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Managing the Interpretive Flexibility of Technology: A Case Study of Celonis and its Partner Ecosystem

Short Paper

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Abstract

IT artifacts as embodiments of digital technologies are perceived differently by different user groups – a characteristic denoted as the technology's interpretive flexibility. As emphasized in prior contributions, social and technological factors shape the different outcomes of the focal technology. What is less clear is how technology firms can manage and exploit the interpretive flexibility of their technology to maximize their value potential while adequately addressing their (potential) customers' needs. This ongoing study aims to investigate the mechanisms technology providers use to strike that balance individually and collectively. Between 2018 and 2021, we conduct an in-depth case study of Celonis the market leader in process mining, and develop a preliminary model for managing the interpretive flexibility of technology. Focusing on Celonis' efforts to create a partner ecosystem around its core technology, we find two basic mechanisms through which partners increase (deployment) or decrease (abstraction) the interpretive flexibility of Celonis' technology.

Keywords: interpretive flexibility; boundary management; process mining; digital platform ecosystem; partner ecosystem

Introduction

Researchers have long discussed the role of technology in organizations and the interplay between social and technological aspects in influencing organizational outcomes (Orlikowski 1992; Sahay and Robey 1996). The *interpretive flexibility* (Pinch and Bijker 1984) of technology follows the academic discourse on the social construction of technology (SCOT), and the characteristic is open to more than one interpretation. The concept helps explain how the implementation of the same technology can lead to different (organizational) outcomes (Doherty et al. 2006). For instance, machine learning (ML) technology exhibits great interpretive flexibility because different groups of users (e.g., experienced vs. inexperienced users) perceive the characteristics, expectations, and limitations of the technology in different ways and, thus,

shape the outcomes of its application (Harandi et al. 2020). The differences in outcomes lie in social and technological factors that influence the shape of the technology (Cadili and Whitley 2005; Orlikowski 1992).

Compared to other (i.e., non-digital) technologies, IT artifacts (as embodiments of digital technologies) are particularly flexible. Machine learning platforms, e-government portals, or basic tools such as Microsoft Excel, for example, are highly adaptable to users' needs and inputs. This emphasizes the influence of technological properties on a technology's interpretive flexibility as perceived by users (Chen et al. 2009; Doherty et al. 2006). This situation yields opportunities and challenges for providers of IT artifacts because they may adapt the artifact to their particular user groups. This results in lower interpretive flexibility and increased value to users (Jensen and Aanestad 2007).

At the same time, by adapting the IT artifact, providers can prevent its usefulness to other user groups, which lowers the potential economic value associated with the technology. For instance, a provider of an ERP (Enterprise Resource Planning) system, may choose to adjust its technology to the needs of large enterprises in the pharmaceutical industry. While this particular customer group will receive great value from the product's specific features, other customer groups like small-and-medium-sized firms in the construction industry will gain less value from this ERP system. Hence, technology providers need to precisely balance the interpretive flexibility of their technology to the needs of their customers (i.e., to increase customer value through low interpretive flexibility), while expanding their potential market (i.e., increase the technology provider's value through high interpretive flexibility).

In recent years, process mining has been one of the most promising digital technologies in the business domain (Kerremans 2019; van der Aalst 2016). Big Data Analysis (BDA) technology builds on the analysis of event logs in information systems to analyze the actual execution of business processes on the system, while being agnostic to the source system (Eggers and Hein 2020; Geyer-Klingenberg et al. 2018). Process mining is used to discover actual process instances, monitor real-time process flows, and improve business process design based on the analysis (van der Aalst 2011). Latest developments in the field have focused not only on the passive analysis of past process data but proactive process execution based on live monitoring, situational context, and decision models (e.g., Kerremans (2019)). Unsurprisingly, the technology has spurred great demand among organizations to improve processes and adapt to steadily changing business requirements (Altinkemer et al. 2011; Kerremans 2019). Users access and use the technology via software firms such as Celonis, the market leader in process mining (Kerremans 2019), which provides the technology as a highly configurable Software as a Service (SaaS). Process mining has been applied in various industries and organizational contexts, for different types of processes, on different IT systems, data types, and for various purposes (Eggers and Hein 2020).

Siemens was one of Celonis' first customers in 2011 and faced a decision on which processes to start analyzing with process mining. Without an upfront analysis, it was uncertain which of Siemens' many business processes held the most significant automation potential, given that almost any process comprising event logs would be feasible to analyze with Celonis' process mining technology. Finally, both companies decided to apply Celonis' early technology in Siemens' accounting department. This laid the foundation for Celonis' expertise in accounting processes such as accounts payable (Reinkemeyer 2020). This example illustrated that process mining technology exhibits great interpretive flexibility for both Celonis and its customers. Customers need to decide which process to analyze, while firms such as Celonis must decide on the process analysis and related support and the necessary consulting expertise to bring to the market.

Consequently, companies such as Celonis invest considerable resources to manage and exploit their focal technology's interpretive flexibility and provide valuable and readily applicable solutions to its (potential) users and partners. For instance, prior research suggests that during the design of the technology itself and through the creation and continuous adjustment of its functional boundaries, a technology's interpretive flexibility for users can be pre-defined in the technological domain (Doherty et al. 2006; Orlikowski 1992): The fictional ERP provider could shape its technology's functional boundaries by fixating the available fields in its ERP software to suit the pharmaceutical industry. This involves striking the balance between too harsh restrictions (i.e., low interpretive flexibility), that limit its potential market and too wide restrictions (i.e., high interpretive flexibility) that increase ambiguity for customers.

However, how organizations individually and collectively identify, set, and adjust a focal technology's interpretive flexibility remains unexplored. Moreover, how they may manage and exploit the resulting

functionality space to attract new customers while mitigating the ambiguity that results from having too many options available, has been outside the focus of prior work. Thus, our study is guided by the following research question:

RQ: How do organizations manage and exploit the interpretive flexibility of their technology?

To answer this question, we conduct a longitudinal case study of Celonis' journey from a process mining startup towards a unicorn-status software platform company between 2018 and 2021. We do so by building on the theoretical lens of interpretive flexibility and the perspective of digital platform ecosystems as the organizational setup. By witnessing and analyzing the interplay of social and technical dimensions when shaping and managing the interpretive flexibility of process mining technology, this ongoing research effort can be located at the core of IS research belonging to the Type IV category according to Sarker et al. (2019).

As part of an ongoing research effort, we inductively analyze the data and preliminarily find that during the time of our study, Celonis traversed different episodes in which it iteratively established an ecosystem of partners to accelerate the deployment of its process mining technology, resulting in Celonis non-linear growth. Hence, we closely observe the interactions between Celonis, its partners, and customers, which manifest in the continuous adjustments to Celonis organizational design and the underlying interpretive flexibility. Iteratively, Celonis managed to make process mining more accessible to its (potential) customers, thus democratizing the access to the technology through the lens of interpretive flexibility. Based on our insights we present a preliminary model for managing the interpretive flexibility of technology.

For future research work, we plan to conduct further interviews to refine and recalibrate our findings and enrich the insights on the changes of Celonis' partner ecosystem and extend our longitudinal dataset. Particularly, we want to include the latest episode starting in late 2020, when Celonis announced to establish the world's first Execution Management System (EMS), allowing customers to automate and optimize business process execution enabled by its process mining core.

Conceptual Foundation

Interpretive Flexibility of Technology

Interpretive flexibility denotes a focal technology's characteristic of being open to more than one interpretation (Pinch and Bijker 1984). According to Pinch and Bijker (1984), a technology's interpretive flexibility eventually enters the stages of *closure* and *stabilization*, where all actors within a relevant social group converge in their interpretation of the focal technology and its meaning, features, and purpose. However, IS researchers have argued that closure in the context of IT, is unlikely to occur. and that there may be different interpretations of one technology (Doherty et al. 2006; Sahay and Robey 1996). An IT artifact such as Google's Android platform continues to evolve based on the underlying technology and its many different areas of application, which range from smartphones to smart TVs and cars. Hence, we follow the definition of Sahay and Robey (1996, p. 260), stating that interpretive flexibility is *"the capacity of a specific technology to sustain divergent opinions."* Early studies investigated interpretive flexibility in different contexts and with different underlying IT systems that ranged from Geographic Information Systems (GIS) in government agencies (Sahay and Robey 1996), and ERP-systems in a large multinational (Cadili and Whitley 2005) to Electronic Patient Records (EPR) in hospitals (Jensen and Aanestad 2007). These studies focused primarily on the differences in outcomes when the same technology is implemented in different organizations or organizational subunits. Thus, the role of the social dimension and the importance of involving users was emphasized. However, differences in interpretive flexibility are not only influenced by the social dimension (i.e., the actors involved and the context in which the technology is used) but also by the underlying properties of the focal technology. This is the case of IT artifacts as embodiments of digital technologies (Doherty et al. 2006; Orlikowski 1992). According to Orlikowski (1992), the interpretive flexibility of technology is a result of human interaction in the *design mode* and *use mode* of the technology. Hence, designers, such as software engineers of IT firms influence a focal technology's interpretive flexibility as perceived by users. Accordingly, the design mode allows firms to manage interpretive flexibility by design.

Under high interpretive flexibility, potential users of a technology face great uncertainty. They have problems in understanding the purpose and potential of the technology, its use cases, and the actual use (Cadili and Whitley 2005; Orlikowski 1992). This uncertainty manifests in either rejection or unintended

usage of the focal technology. However, it also grants users the freedom to apply the technology more flexibly (Orlikowski 1992). In turn, when interpretive flexibility is low, the application of a certain technology is obvious to its users. This may render explanations and training optional or even obsolete. Yet, the user flexibility to choose the concrete usage of the technology is also restricted. For instance, ML technology embedded in the Google Photos Application allows users to search and filter their pictures according to themes such as ”beach” or “Christmas,” and there is little ambiguity concerning the technology’s features, purpose, and use cases.

Further, a technology’s interpretive flexibility for different stakeholders can be managed to navigate these extremes. Besides the design of the technology itself (Orlikowski 1992), prior work suggests that the *functional boundaries* of the focal technology can be adjusted by *enforcing* or *proscribing* certain applications of the technology (see Figure 1) (Doherty et al. 2006). For instance, the definition of mandatory and optional data input fields represents one way to manage the functional boundaries of a focal IT system for its stakeholders. Apart from top-down design, the collaborative design of boundary objects such as User Interfaces (UIs) or services allows multiple stakeholder groups to access an underlying technology (Steger et al. 2018). That is, the concrete ways users perceive the technology during use mode within its boundaries can, for example, be moderated through user engagement in the design mode of the technology (Doherty et al. 2006; Orlikowski 1992). User engagement may concern the design of general interfaces, but it may also concern feedback or requests on certain functionality and information being processed (Doherty et al. 2006). The technology and its boundaries are not static but are subject to change over time to adjust for the users’ needs, the technology provider’s goals, or changes in the underlying technology (Star 2010; Steger et al. 2018).

Digital Platform Ecosystems

Platform-based ecosystems have emerged as the dominant organizational form during the last decade. All major companies—ranging from Alphabet (i.e., Google) and Microsoft to Alibaba and Tencent—employ ecosystems of autonomous actors (Cusumano et al. 2020). Moreover, these companies build their businesses around an “extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and interfaces through which they interoperate” (Tiwana et al. 2010, p. 675). That is, digital platform ecosystems are organizational setups. They are software-driven, which enables them to engage with and integrate a multitude of autonomous actors (often referred to as *complementors* or *partners*) to create compelling value propositions for customers (Hein et al. 2019). Thereby, partners not only act as third-party developers that provide add-on pieces of software but also consult, sell, and implement the platform for users (Sarker et al. 2012; Wareham et al. 2014).

As the “locus of value creation moves from inside the firm to outside” (Parker et al. 2017, p. 263), platform firms employ specialized organizational designs. These designs are enabled by the modularity and complementarity of products and services provided by the platform and its various complementors (Jacobides et al. 2018; Tiwana 2015). To ensure the coherence and fit of multiple actors’ modular and complementary value propositions, the platform owner issues governance rules, which set the rules concerning decision making and gatekeeping, among others (Schreieck et al. 2016; Wareham et al. 2014). Besides the imposed rules and regulations, resources such as platform boundary resources provide partners with the technical and social resources necessary to deliver ever-increasing value to customers and potential customers while controlling their alignment (Ghazawneh and Henfridsson 2013).

Consequently, digital platform firms utilize particular organizational designs that allow them to manage value creation outside—rather than inside-out—and achieve unprecedented economic success. Thus, these designs leverage organizational and technological modularity to extend the production and innovation of their value propositions to realize the full potential of their core technology (Gawer 2014). The underlying process of opening up the platform’s core technology to third parties and managing the resulting third-party relationships can be explained using the theoretical lens of interpretive flexibility of technology.

Research Approach

We follow a single case study (Yin 2018) to focus on the case of Celonis the market leader in process mining (Kerremans 2019). Our longitudinal dataset allows us to investigate the changes implemented by Celonis to make their process mining technology available to a growing number of customers across different IT

systems, business processes, industries, and regions over time. Finally, this period also comprises the extension of Celonis' technology portfolio from pure process mining to data-driven business process execution (termed Celonis Execution Management System (EMS)) based on process mining. Our case study thus provides a suitable and unique setting to investigate how a single organization adjusted and exploited the interpretive flexibility of its technology.

Case Overview and Data Collection

We collect data on the period between 2018 and 2021, with data collection still ongoing, comprising the key events of Celonis' success story and providing us with a rich longitudinal dataset. An overview of the case timeline with selected events is depicted in Figure 1.

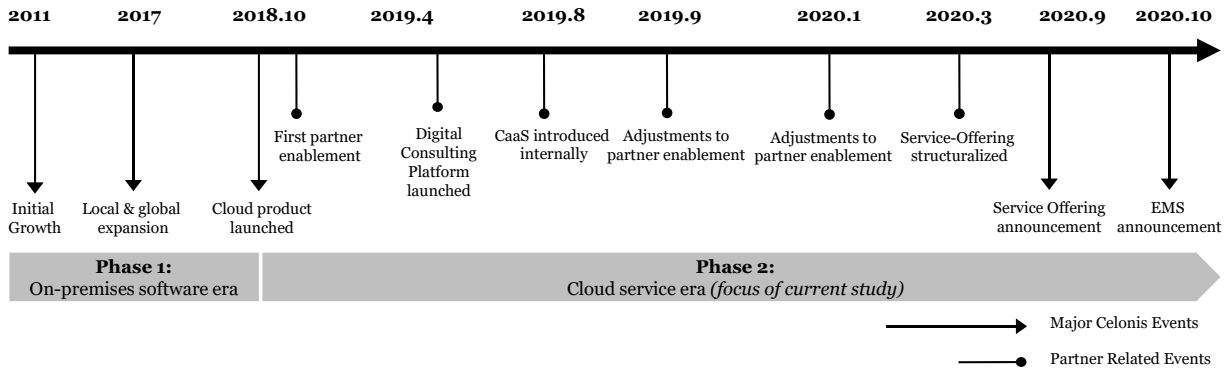


Figure 1 Overview of Selected Events on the Case Timeline

Between 2018 and 2021, Celonis not only gained unicorn status with a valuation of 2.5 billion $US in late 2019 but also built and scaled up its partner business. Also, Celonis grew the number of its employees from about 400 to more than 1200 during the focal period of our study. Our current dataset comprises 14 semi-structured interviews with representatives from Celonis as well as its partners. Eight interviews were conducted with Celonis representatives in general partner management and managers and engineers for consulting partners with an average length of 37 minutes. Six interviews with five different partner organizations were conducted with an average length of 46 minutes. Additionally, one of the authors has been an employee of Celonis since mid-2019 and tasked with managing consulting partners, co-developing different go-to-market strategies and services with them. Hence, the dataset also includes a multitude of meeting protocols, internal documents, communication, and memos. Regarding the period between mid-2018 and mid-2019, we collected additional internal documents and conducted informal interviews to gather relevant insights from experienced colleagues. Lastly, we augmented our primary data with publicly accessible secondary data from the company website, blog entries, and external communications.

Preliminary Data Analysis

After transcribing the interviews, we coded the interviews using open, axial, and selective coding. Applying these procedures, we conducted a qualitative content analysis (Miles and Huberman 1994). During our preliminary analysis, we first focused on the themes of partner enablement and governance as emphasized in the literature on digital platform ecosystems. From our data, we generate concrete insights into the mechanisms of bringing a broadly applicable technology, namely process mining to the market. For instance, to increase the access to the use of the technology Celonis created a broad ecosystem of various actors, including over 15.000 trained professionals, more than 250 partners, and over 300 universities. Together with its partners, Celonis co-developed different products and services iteratively addressing customer needs in various markets and segments. To enable its partners to leverage Celonis' technology, Celonis created and adjusted various enablement mechanisms over time reflecting the dynamic nature of ecosystem governance. As such, the interpretive flexibility and its management emerged as the unifying theme, facilitating data analysis in later stages and leading to the conceptualization of the proposed framework.

Preliminary Findings, Contributions, and Next Steps

Toward a Model for Managing Interpretive Flexibility

Based on the results of our in-depth case study, we derive a preliminary model that allowed us to identify and explore different mechanisms and strategies for managing a technology's interpretive flexibility. The model depicted in Figure 2 illustrates a continuum that allows the distinction between two extremes concerning the specificity of a technological solution.

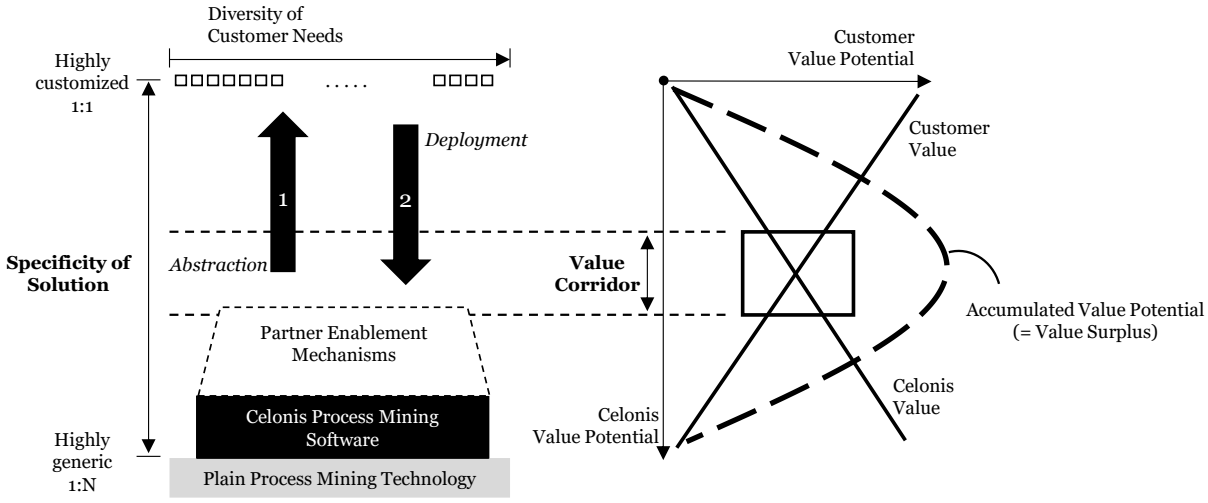


Figure 2 A preliminary model for managing interpretive flexibility of technology

On the top side of the continuum (1:1), the technological solution is highly customized to a single customer's needs (i.e., it has low interpretive flexibility) and cannot be transferred to other customers due to its degree of specificity. On the bottom side of the continuum (1:N), process mining as the plain process mining technology is highly generic and—while theoretically and potentially adjustable to any customer need, cannot readily solve any immediate customer need (i.e., it has high interpretive flexibility). Before describing the resulting framework depicted in Figure 2, it is important to emphasize that this is a highly stylized and relative conceptualization and serves as the basis for deriving generic instructions. Moreover, it reflects our preliminary findings and will be developed further according to our ongoing study.

From a value perspective, we can see that the value of the focal technology, namely process mining, depends on the focal actor. For instance, the value potential from the technology for Celonis is highest when the technology is more generic. That means, the technology can be applied to an almost infinite number of customer needs. This essentially describes Celonis' overall market potential concerning their process mining technology. Yet, to realize this potential, the technology needs to be adjusted and implemented for each use case separately, requiring dedicated resources like consultants that lower the overall, theoretical value potential. At the same time, the value potential for Celonis is lowest when process mining is in its highly customized form. This would allow Celonis to address only one single customer problem. This situation is reflected in the C*elonis Value* graph depicted on the right of Figure 2. Conversely, from a customer perspective, the value of process mining is the highest when the technology is configured to address their concrete use case, solving the customer problem immediately without further adjustments. On the opposite side of the continuum, the technology is too generic to be of high use-value to the customer as it does not readily solve the customer's problem. Again, this situation is depicted in the *Customer Value* graph on the right of Figure 2.

By integrating both value graphs concerning the *accumulated value potential of the technology* for Celonis and its (potential) customers, an inverted U-shape graph can be derived. The dashed line in Figure 2 describes the accumulated value potential of the technology through the lens of interpretive flexibility. The accumulated value is highest when the technology's interpretive flexibility is balanced and Celonis can offer

its technology to many (but perhaps not all) customers, while many customers (but perhaps not all) can derive certain value from the technology's application.

From the graph, we derive a *Value Corridor* that allows us to balance the interests of Celonis and its potential customers around the peak of the accumulated value potential curve. Hence, Celonis is challenged with managing the interpretive flexibility of its process mining technology in a way that allows an increase in its value potential while addressing customer needs with concrete implementations. Naturally, Celonis needed to find ways to manage these diverging interests effectively and efficiently and stay *inside* the value corridor while doing so. Thus, the proposed model for managing interpretive flexibility allows us to investigate the strategies and mechanisms Celonis employed to manage and exploit the interpretive flexibility of their process mining technology while balancing diverse interests.

The Role of Celonis' Partner Ecosystem in Managing Interpretive Flexibility

Based on our data, we find, that at the core of Celonis' strategy is the collaboration with partners and the building up of a partner ecosystem around its technological core consisting of its process mining technology. Importantly, Celonis' technological core remained largely stable over time, while the products and services wrapped around the technology and the go-to-market strategies together with partners were subject to constant change along the company's nonlinear growth trajectory. The (re-)design and use of these products and services as vehicles of process mining technology are at the center of our analysis. To that end, our preliminary analysis focuses on two aspects: First, Celonis' efforts to enable its partners through *partner enablement mechanisms,* and second, the collaboration with partners in bringing Celonis' process mining to customers via deployment and abstraction (shown as arrows 1 and 2 in Figure 2).

The **partner enablement mechanisms** provided by Celonis comprise the rules and tools that help partners apply Celonis' solutions to customer problems or develop their applications. We find, that over time Celonis deployed a variety of different resources to support their partners and continuously develop the process mining market and increase their market share. These resources comprise online training and partner representative certification, workshops, webinars, and personal technical support. Celonis intensively engaged in co-developing different products and go-to-market strategies with its partners. These range from providing partners the software to equipping them with development resources and technical support to enable them in building applications based on their respective domain expertise.

Our data suggests there are two underlying mechanisms for delivering the Celonis technology to potential customers by **collaborating with partners**. First, these partners –usually consulting firms - use Celonis' software and apply it directly to a concrete customer problem within the scope of a consulting project. Leveraging the consultant's expertise in business processes, the merits of process mining can be delivered to various market segments, scaling Celonis' market potential while accommodating user needs. We term that mechanism to decrease interpretive flexibility *deployment* (arrow 1). To enable its partners to use Celonis technology in their consulting projects, Celonis in 2019 introduced a product called Celonis as a Service (CaaS), incorporating their technology in a software bundle that consultants could use in their consulting projects. In April 2021, Celonis initiated the Celonis for Consulting (C4C) Plus initiative, which aims at providing its technology to one million professionals worldwide, further lowering the barriers for consulting firms to use its software and simultaneously broadening its application space. Second, in 2020 Celonis and its partners co-developed a product called Service-Offering, which allowed partners to build a productized service from single customer projects and make their expertise available to other customers, too. We term that mechanism to increase interpretive flexibility *abstraction* (arrow 2). For instance, between late 2020 and early 2021, partners created 80 applications for Celonis EMS. To enable the co-creation of Service-Offering, Celonis and its partners collaborated intensely on technical and business model configurations, organizing multiple workshops and hackathons for selected partners to pilot the new product.

Contributions and Next Steps

Our study makes several initial contributions that can be generalized to other information technologies that exhibit ambiguity for users and a high degree of interpretive flexibility. The present work, therefore, informs the ongoing discussion on Artificial Intelligence (AI) or distributed ledger technologies that face similar challenges in their application and exploitation as process mining.

First, this study advances research on the interpretive flexibility of technology by taking the perspective of the designer of the focal technology as opposed to the prevailing user perspective (e.g., Orlikowski (1992), Sahay and Robey (1996), and Harandi et al. (2020)). Adding this view to extant research broadens our understanding of the origins of interpretive flexibility that results from purposeful design to address multiple users' needs. To that end, our preliminary model on the management of a technology's interpretive flexibility yields the great potential to advance the practical and scholarly debates around technology-related strategies and decision-making.

Second, we integrate the technical and organizational perspectives on digital platform ecosystems by showing that a platform ecosystem as an organizational design facilitates the delivery of an underlying technology platform to users (De Reuver et al. 2018; Gawer 2014). Through their organizational design based on partner enablement mechanisms and partner engagement, platforms mitigate the ambiguity caused through the interpretive flexibility of the underlying technology for users (Hein et al. 2019).

This study presents preliminary results and is part of a larger research endeavor, thus several limitations will be addressed while advancing this study. We are currently working with Celonis to expand data collection on the latest changes to its partner network and technology and build a longitudinal perspective. Further, our preliminary results only describe the most salient mechanisms in place. This is why the research team is planning to investigate all the different strategies and co-developed products and services between Celonis and its partners and answer the question of "how" Celonis managed interpretive flexibility of process mining in greater detail. Moreover, the impact of strategic partnerships and situations of conflicting interests are relevant aspects to be included as important environmental factors. Overall, we aim to develop and adjust the presented preliminary framework into a powerful model that helps technology companies assess and derive different go-to-market strategies and diverse models for collaboration with potential partners. The current short paper marks an early, but important milestone toward that goal.

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