Digital Transformation and the Impact in Knowledge Management

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Keywords: BizDevOps, Context-awareness, UX Engineering, Decision Support and Data Analytics.

Abstract: Nowadays, digital transformation is forcing companies to reach a new level of productivity and digital evolution. Small and autonomous is winning over large and centralized. Digital transformation requires the adoption of more agile business processes and the development of new customer-facing digital services. It means creating scale through reusable services and enabling self-service consumption of those services. Business processes and transactions can be automated with the composition of microservices. We will see that the principle of composability allows microservices to deliver value to the business in different contexts. The paper also explains how a BizDevOps philosophy with references to microservices allows rapid adaptations of requirements to fast-changing needs in businesses, outlining the importance of business process automation for companies to acquire the know-how to implement a just-in-time diachronic dialogue. It presents the alignment of the proposed framework with a digital strategy. Assembling a multidisciplinary team is foreseen as a key factor in developing innovative capabilities to react to new customer demands, enabling the company to stay competitive and continuously address customer expectations, differentiating tacit from explicit knowledge.

1 INTRODUCTION

In the past ten years, companies felt the need to digitize their business operations and establish a business unit dedicated to building and operating customer-oriented digital services. As companies create and expand their digitally transform, they need to unify data, processes, coordination, and measurement of the moving parts that make up a modern, omnichannel customer experience (Ermine 2013). Hence, many companies foster the automation of internal processes to become more competitive.

It means creating cross-functional teams where the team members share problems, solutions, and tools to (re)think not only how to address customers' needs but also to (re)design existing business processes. The emergent tendency is to build BizDevOps teams for the ideation, creation, development, and operation of new digital services (Chasioti 2019). The concept is being introduced by more and more companies to create smaller empowered teams and to break down the borders between people traditionally associated with Business (Biz), Development (Dev), and Operations (Ops) departments. The lack of communication and cooperation between these people has promoted the creation of knowledge silos, causing the company inefficiencies and business opportunities not well explored because of underexplored synergies between the three teams.

The BizDevOps team has an agile mentality and adopts a small-scale, highly focused team framework to rapidly innovate on defined units of business value. They are responsible for continuously (re)defining the business for certain (micro)services and monitoring customer experience/satisfaction. In the digital economy, the BizDevOps team has a high degree of autonomy in designing the functions and architecture of microservices, and therefore contributes to business-IT-alignment in a new way. The implementation of a BizDevOps philosophy with references to microservices requires the adoption of an effective "digital enterprise architecture".

In this paper, we present a framework named Matryoskas Sequence for Knowledge and Innovation (MATSKI). This framework provides a holistic view

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of supporting the transformation of raw data into knowledge, using it in an e ective manner to generate a sustainable competitive advantage in the knowledge economy. The framework was scientifically funded on an integrated modeling sequence for organizational management and just-in-time transformation for a competitive, efficient, and valuable performance in the market (Rosa and Pestana, 2019).

Consumers continue to raise their expectations for products and services. Therefore, the ability to convert data into embedded knowledge is currently considered a valuable intangible asset. In this field, the possibility of providing decision makers with contextual insights about stakeholders' perceptions and attitudes is a key concept to meet customer expectations and improve business performance and competitiveness at all levels. Knowledge management and innovation seem to be axial paradigm of the development of the digital economy (Malhotra, 2001; Gloet and Berrell, 2003; Nilla and Kemp,2009, Rosa and Pestana, 2019), and the survival of business models that are interested in analyzing and understanding the market's perception of a specific product or brand.

This introduction is followed by section 2, in which we outline why companies felt the need to digitally transform their business operations, establishing fast digital business units dedicated to build and operate digital customer-facing microservices. Section 3 describes the methodological approach we employed by presenting the theoretical framework associated with the MATSKI, including a detailed presentation of two of the business processes within the proposed framework. Finally, in Section 4, conclusions are presented with an outlook for future work.

2 THE IMPACT OF DIGITAL TRANSFORMATION IN BUSINESS COMPETITIVENESS

2.1 Multidisciplinary Teams and Microservices

With digital transformation, two concepts have emerged: microservices and BizDevOps. Both are practices designed to provide greater agility and operational efficiency. Research on business architecture that uses a BizDevOps philosophy and refers to microservices to support product digitization, outlines the formation of multidisciplinary teams to achieve common goals and jointly develop innovative capabilities with a single functional view to respond to the needs of new customers in order to stay competitive (Drews 2017) - digital disruptions. Therefore, meeting customer needs is an ongoing challenge that requires constant innovation to retain and maintain customer loyalty. As shown in Figure 1, we will have a BizDevOps team when the developer team and the operations team work with business personnel throughout the project development cycle. Having such a multi-disciplinary team aligned with the business line it supports, we can use agile thinking to meet the specific needs of customers, save money, make business models more stable, and make people happier and more productive (Forbrig 2017).

The BizDevOps approach can facilitate collaboration and communication between managers, business analysts, and development teams to build new business models to enhance interaction with customers. However, BizDevOps can only work when the right people, processes, and technology are involved. Thanks to this technology, real-time data analysis (i.e., just-in-time) can also be provided for business processes, enabling collaborative workflows to create continuous delivery pipelines, which puts forward new requirements for maintaining operational excellence. And the realization of enhanced or new (digital) business models with higher quality and lower risk

According to the literature (O'Reilly, 2018; Kotler, 2017), there are a few dominant characteristics for the new business models in the digital economy: (1) companies with separation of the production means (e.g., access instead of possession); (2) use of technological platforms for knowledge management and interaction (24/7 co-creation and dialogue); (3) a variable geometry service and prices (algorithms adjust supply according to demand); and (4) custom work subcontracted to measure.

There are some notorious illustrative examples: Uber revolutionized transportation and food delivery, WhatsApp broke the foundation of messaging and communication, AirBnB revolutionized the accommodation and leisure economy, RedBox changed video and media rentals, and Netflix became a major player in the entertainment industry, Lyft leads the American demand-car company, Farfetched is the top online luxury fashion retail platform; Glovo has become the leading fast door-to-door delivery service for small goods; Amazon is the world's most delivered company; Google, Instagram, Dropbox and Slack are huge world communication platform leaders, etc.
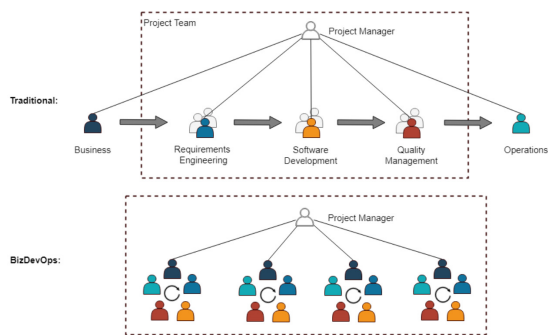
Figure 1: The difference between a traditional and a BizDevOps approach, adapted from (Schrader 2018).

All these examples apply new business models (competing with traditional models), and are supported by a build-to-order or Just-in-time (knowledge sharing and transformation) management model, with "zero" stock and a substantial increase in the operational efficiency and business profitability. In this case, innovation is strongly generated from users in a permanent (24/7) dialogue, and the lead users (i.e., early users, domain experts, opinion leaders and influencers) become the "core engine" of this diachronic flow of co-creation (creative intelligence).

The participation of these users potentializes the discovering of the "golden nuggets" (e.g., best innovative ideas and concepts) to feed new business processes with lower costs, which can be afforded by SMEs and micro-organization. In this area, it is foreseeable that continuous innovation is a sustainable process that can support the response to new requirements and changing market demands, and establish new business models to empower customer interaction.

Since customers are more demanding than ever before and will abandon businesses that are too slow to respond, all businesses strive to provide an ideal customer experience. The microservice-based architecture shapes the delivery of solutions to the business in the form of services, thereby providing a holistic and unified omni-channel customer experience. Companies that adopt microservices, together with a BizDevOps philosophy, share common approaches to the role of the technology in providing decision-makers with the right tools and information they need in their daily business operations (MuleSof 2016). As such, identifying and defining digital assets that are align with core business capabilities is critical.

A microservice that encapsulates core business functions and comply with usability design principles to promote a smart user experience should be

regarded as true digital assets. Positioning microservices as a valuable asset of the enterprise implicitly promotes the adaptability of microservices and enables them to be used in multiple contexts. The same service can be reused in multiple business processes or on different business channels or digital touchpoints as needed. By applying the principle of loose coupling, the dependence between the service and its users can be minimized. Adopting this design method (i.e., microservices encapsulate the functions of a specific business domain) helps other groups/applications to discover these (micro)services.

The principle of composability allows aggregated services to create value for the business in different contexts. The addition of data analytic techniques also helps to bring value to the business, because it enables the service to be used in a variety of situations.

Microservices are interoperable in nature. Because their interfaces are defined according to existing standards at the industry level, they facilitate the exchange of information regardless of how they are implemented. If microservices use standard protocols (such as RESTful API) to expose their interfaces, they can be used and reused by other services and applications without direct coupling through language binding or shared libraries.

2.2 Total Quality Management Theoretical Framework

The design method can also benefit from a Total Quality Management (TQM) ideology to build potentially shippable product increments, which speeds the deployment pipeline, achieving a result that culminates in bringing changes to production as quickly as possible and in line with customers´ expectations. Organizational development and transformations should be applied under a TQM framework (Yusuf, 2007; Talib, 2013; Rosa 2014), aiming to meet full customer satisfaction and recommendation and higher business performance and competitiveness at all levels.

Furthermore, it can be observed that (...) *the high competitive level of the market ... implies the development of technical quality management systems – also designated TQM (Total Quality Management) - in which technological systems of the dynamic type of collection can be integrated by information modules with feedback and/or dialogue (...)*, (Rosa, 2014).

TQM has been extensively discussed in the literature ... as a management philosophy characterized by its principles, practices, and strategies that emphasizes upon continuous improvement in quality, increased involvement of employees, the commitment of top management, employee empowerment, teamwork, benchmarking, leadership, rewards and recognition, feedback and relationship with suppliers (Talib, 2013).

The implementation of the TQM framework should thus consider three fundamental operational aspects: (1) commitment, (2) involvement, and (3) continuous improvement. Commitment as a never-ending (e.g., diachronic) improvement process for quality and services delivery to the customer; involvement of all the team members in achieving a common goal; and of continuous improvement by monitoring and correcting any error and defects on the spot (i.e., just-in-time).

3 THE KNOWLEDGE MANAGEMENT VALUE CHAIN

3.1 The MATSKI Landscape with Digital Strategy

In this section, we present the MATSKI[3] framework (Rosa e Pestana, 2019), a holistic framework that supports the transformation of raw data into embedded knowledge. The simultaneous management of tacit knowledge and explicit knowledge helps to transform the organizational knowledge in the diachronic knowledge flow, in which learning, sharing and interaction are the basic functions, which can continuously acquire new knowledge and consolidate existing knowledge, thereby bringing a strong competitive advantage to the organization. In this knowledge flow process, it is important to distinguish between tacit form explicit knowledge. Generally, tacit knowledge is defined as embedded in individuals (i.e., not documented possessed by an expert), and explicit knowledge is defined as existing in documents, books of rules, databases and other record formats (i.e., well-documented).

This holistic, integrated framework empirically confirms the parsimony of a collaborative multichannel communication flow (e.g., a just-in-time diachronic dialogue) with customers and the stakeholders (e.g., suppliers, distributors, and employees), encapsulated within the basic operational aspects of the TQM framework and controlled by performance metrics (e.g., just-in-time KPIs), synchronized with the gathering of new knowledge obtained by data semantics, context awareness analysis, and visual data analytics, originated by the co-creative interactions that reveal the most valued insights – designated as the Gold Nuggets.

From a high-level perspective, the MATSKI landscape consists in three conceptual pillars: Processes, Technology, and People's skills operationalized by (1) an ontological model for the Processes pillar; (2) an operational model for the Technology pillar; and (3) an applied model for the People's Skills pillar. The knowledge value chain presented in Figure 2 provides a knowledge management (KM) framework to analyze the value added by each KM process. In this chain, information is the result of data processing, knowledge is the result of information processing, and wisdom is the result of knowledge processing. The objective is to provide an analysis and action framework that will make it possible to act on the value chain and improve the company's performance, gradually steering the company toward greater cognitive capacities.

The digital strategy endorses digital governance, which is fundamental to define a clear responsibility of aligning the role of the BizDevOps team with the company policies, business (digital) services, and customers' expectations. This alignment is essential to create competitive advantages and future value-added for the stakeholders. Digital governance, when effectively defined and implemented, will for sure, help the development of digital and agile business and sustainable company (Welchman, 2015; Almarabeh, 2009). Figure 2 represents the fit of these overall strategies. The InovaFlow (an ontological meta-system) maps how tacit knowledge is captured to diachronically feed the creation of (new) explicit knowledge and transform it into (new) embedded know-how.

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[3] Inspired by the Matryoskas concept - or Russian dolls metaphor. Also referred in the literature as the "matryoshka scientific principle". This is a technique to adapt, enhance or create new processes when needed. The principle was originally used in the computing industry, where systems

and processes can be built inside one another, but it can also be adapted to modelling an organizational or business model.
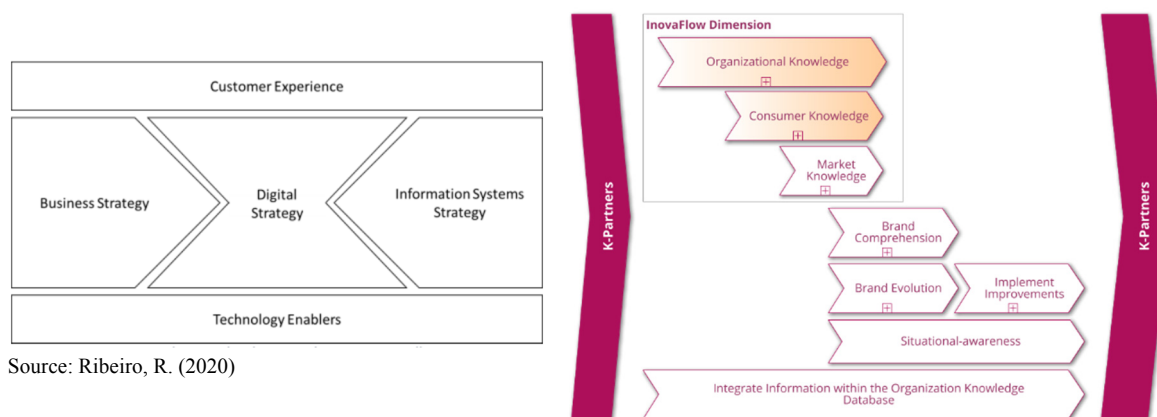
Figure 2: The alignment of the MATSKI landscape with digital strategy.

The Organizational Knowledge process deals with aspects for processing explicit and implicit knowledge integration, and for embedded knowledge updating. The Consumer Knowledge process is relevant for capturing life stories and narratives, for stakeholders learning, sharing, and interacting, and for the development of Community of Practice and living labs for ideation, development, and testing of new products/services. The Market Knowledge deals with the environmental and benchmark of competitors. It is focused on serving customers in ways that are differentiated from competitors, creating a unique user experience. In section 3.2, a detailed collaboration diagram is presented for the two (first) process of the InovaFlow.

A digital strategy aligned with business process automation enables companies to acquire the know-how to convert digital value propositions of their businesses into revenue-generating digital offers (Ross, 2018). One way to achieve this goal is by promoting cooperation and dynamic interactions between business units. As outlined in section 2.1, microservices are intrinsically interoperable. They facilitate an exchange of information independent of how they have been implemented. If microservices expose their interfaces with a standard protocol, such a RESTful APIs, they can be consumed and reused by other services and applications in a simple and automated way. That means they will optimize their internal operation functions, to engage new experiences to customers. These experiences are able to create unique emotional relations and new views of loyalty between the customer and the company in a continuous operation referred to as optimum market value function.

3.2 Business Process Management Automation

Mastering business processes for new products or services development, and how they must be adapted for end-users and just-in-time management, have become key elements in achieving competitiveness in modern companies. In this domain, the automation of business processes is emerging to a semantic paradigm, modeling, and implementation approach. It is considered to be one of the most valuable assets for organizations since its management appropriation helps companies to quickly adapt their business goals and structures to environmental changes while maintaining or improving their competitiveness (Ross, 2018).

These are the many reasons why business process management (BPM) is becoming so important. BPM represents a disciplined approach to "working" with automated and non-automated business processes in order to achieve consistent and targeted results that are aligned with an organization's strategic goals (Ribeiro, 2020). As such, BPM roles are usually related to business roles, such as domain experts and data analysts. But, it is also important that technical roles, like developers, should be involved in managing activities within business processes, as process models provide a good point of communication between all the participants in the process workflow.

In order to be understood by a BizDevOps team and become interoperable between IT tools, BPM must be based on standardized notations that are usually symbol-based or graphical. A well-designed business process diagram, which is based on a standardized notation, such as Business Process Model and Notation (BPMN), can positively affect most BPM activities and improve both intra- and inter-organizational communication as well as fostering collaboration.

BPMN 2.0 is a notation that uses standardized symbols to denote events, activities, tasks, connections, etc. Once a process is specified by articulating 'who' does 'what' including the interaction with others – the BPMN is able to explicate the dynamic structure of an organization based on existing functional components and facilitates specifying novel organizational behavior patterns. This notation must be learned by the creators of the workflow in order to enter it into a system. Figure 3 presents how the Organizational Knowledge and the Consumer Knowledge processes from the MATSKI modelization were implemented using BPMN 2.0 to model the information workflow and interaction between the team elements participating in each process.

The MATSKI provides a practical framework for managing the company's knowledge, providing a dynamic Just-in-Time flow for continuous improvement and innovation of the business model. As outlined in Figure 3, it is central to any digital strategy the deployment of a Knowledge database (K-Vault) where the reported information is saved as a Knowledge Object. Each Object is searchable and reusable in a multitude of ways. Once in place, Knowledge Objects can be shared with other members, or with other teams - embedded knowledge sharing. In this case, microservices facilitate an exchange of information. They have a key role in the workflow for situational-awareness, keeping the BizDevOps team informed about any "golden nuggets" the system might identify (resulting from the cognitive analysis and the data analytic tasks).
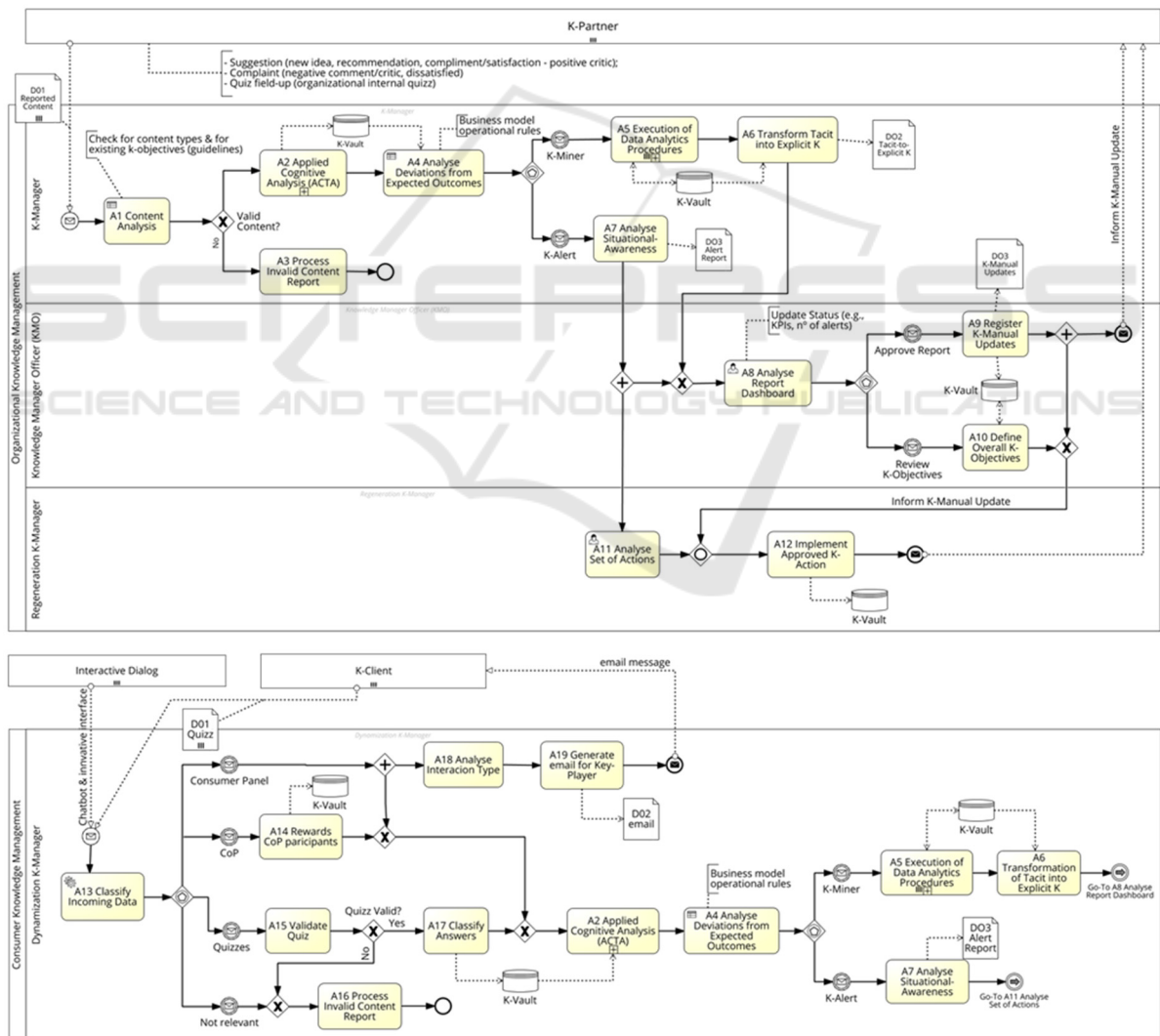

Figure 3: Collaboration diagram for A) Organizational Knowledge process and B) Customer Knowledge process.

It is also understood that knowledge partners can increase understanding and may contribute to embedded knowledge updating. Therefore, multiple knowledge partners (K-Partner) continuously feed the system with additional information (DO1); this information needs to be classified and analyzed based on an existing business rule or inferred know-how derived from new knowledge objectives (K-objectives) which may retroactively update the company embedded knowledge, and consequently triggering new actions. This dynamic, just-in-time management of the company K-Vault operates on the promise of empowering companies to capture and repurpose their unique (tribal) knowledge that is so often and easily lost. The K-Vault is different from previous works on automatic knowledge base construction as it combines noisy extractions from K-Partners with prior knowledge, which is derived from existing knowledge bases. A knowledge base combines extraction from Web content (obtained via analysis of text, tabular data, page structure, and human annotations). With MATSKI it is employed supervised machine learning methods for fusing these distinct information sources. The Consumer Knowledge process enables an approach to specific Communities of Practice (CoP) and use of technology (e.g., Chatbot and innovative graphical voice-based interfaces; interactive dashboards and omnichannel awareness mechanisms) to promote interactive dialogs with knowledge customers (K-Client) to capture the market perception and/or to perceive/anticipate customers preferences, interests, and needs. The process is focused on interactions, structuring communication between the parties defining in which sequence messages are received or sent, and how internal actions are executed.

However, according to the MATSKI ontological meta system, knowledge about subjects and their interactions needs to be elicited in the course of future research. The goal is to gain a knowledge-driven view of the business processes that need to be in place to support the MATSKI workflow both within and outside the organization. We need to focus both, on streamlining organizational and technology development in order to coherently address the mental, conceptual, and technological layer. The mental layer embodies the shift of mindsets towards concurrent interactions. The conceptual layer is required to establish corresponding models (i.e., implementation-independent representations), while the technical layer captures infrastructure to be set up for acquisition, representation, processing, and distribution of the embedded knowledge.

4 CONCLUSIONS

Digital transformation requires the adoption of more agile business processes and the development of new customer-facing digital services. For many companies, the digital modeling of their own processes still ranks as a major challenge that takes much time and involves in-depth coordination between subject-specific departments and the IT unit. This paper outlines the need for companies to adopt a digital strategy and how organizations can help their stakeholders becoming more engaged in driving competitive advantage framed by or based on, adopting a BizDevOps approach (i.e., the integration of domain experts with development and operational teams), with a convergent vision on establishing new business models to empower customer interaction. A BizDevOps approach can facilitate collaboration and communication between management, business analysts, and development teams for establishing new business models to empower customer interactions and knowledge sharing and learning.

As companies create and expand their digital presence, they need to unify data and processes, coordinate and measure all moving parts that make up the modern, omnichannel customer experience. Hence, many companies foster the automation of internal processes to become more competitive. A microservices architecture shapes the delivery of solutions to the business in the form of services, providing a holistic and uniform experience to the customer across all the business channels

In digital business, customers are more willing to try new options than ever before. New competitors may bypass established companies in a short time with little or no indication they were a threat until they show up on the customer's doorstep. This means that the digitalization of the business, as well as shorter innovation cycles and changing customer demand, resulting in new requirements for maintaining operational excellence as well as to enable enhanced or new (digital) business models.

The paper presented the MATSKI framework as a holistic framework that supports the transformation of raw data into knowledge in an effective just-in-time manner. The corresponding knowledge value chain was introduced to examine and analyze the activities of knowledge management that are seen as a key factor in realizing and sustaining organizational success for improved efficiency, innovation, and competition in the digital economy. In such a knowledge-based approach, it is important the distinction between explicit and tacit knowledge. The Organizational Knowledge process and the Customer Knowledge process were both described in detail using a BPMN collaboration diagram. They define in

which sequence messages are received or sent, and internal actions are executed. The introduction of advanced modeling features reflects the capability of BPMN to capture complex business cases while ensuring operational coherence, promoting interoperability for business process automation.

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