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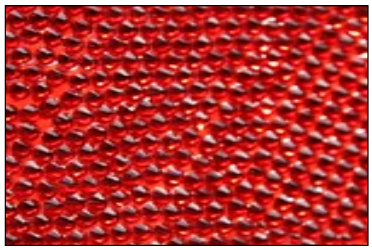

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Celebrating Innovation in Florence

Welcome to the October issue of the Technology Innovation Management Review. We invite your comments on the articles in this issue as well as suggestions for future article topics and issue themes.

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Overview

The Technology Innovation Management Review (TIM Review) provides insights about the issues and emerging trends relevant to launching and growing technology businesses. The TIM Review focuses on the theories, strategies, and tools that help small and large technology companies succeed.

Our readers are looking for practical ideas they can apply within their own organizations. The TIM Review brings together diverse viewpoints —from academics, entrepreneurs, companies of all sizes, the public sector, the community sector, and others —to bridge the gap between theory and practice. In particular, we focus on the topics of technology and global entrepreneurship in small and large companies.

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Editorial: Celebrating Innovation in Florence

Stoyan Tanev, Chief Editor and Gregory Sandstrom, Managing Editor

Welcome to the October issue of the Technology Innovation Management Review. This edition includes articles that were initially presented at a conference of the International Society for Professional Innovation Management (ISPIM), which took place June 16-19, 2019, in Florence, Italy. Florence has a reputation of being one of the most beautiful, creative, and innovative cities in the world, the home of such great innovators as Dante, Giotto, Brunelleschi, Verrocchio, and Da Vinci.

The conference itself was dedicated to Leonardo da Vinci: "Celebrating Innovation: 500 Years since Da Vinci". Given the broadly defined conference theme, articles were presented that focused on diverse themes, some of which related to managing innovation. The articles in this edition raise issues involving profound transformation in how we interact with technology in society during the information era, reflecting the view that a kind of new global digital renaissance is currently upon us. While there is no overarching theme that connects them, we believe they each provide in their own way an example of celebrating innovation.

The lead article by ***Marie-Christin Schmidt, Johannes W. Veile, Julian M. Müller***, and ***Kai-Ingo Voigt***, "Kick-Start for Connectivity: How to Implement Digital Platforms Successfully in Industry 4.0", addresses the research question: "How are digital platforms best implemented in Industry 4.0 contexts?" It uses a qualitative case study design based on 32 semi-structured expert interviews to identify different triggers and initiators, challenges, respective countermeasures, and requirements for digital platforms, as core elements in the implementation process. The research insights contribute to existing literature on Industry 4.0 and digital platforms. In addition, the article discusses practical implications for industrial companies interested in implementing digital platforms in an Industry 4.0 context.

Michael Hartmann, Désirée Laubengaier and ***Kai Foerstl*** in "Live and Let Die: On the Management of Creativity", emphasize the importance of feedback on creative ideas in innovation management processes. They draw on data from a single case study at a German multinational manufacturing firm, and show that there is flip side of managerial attempts to provide feedback and foster employees' creative output. The authors identify distinct organizational practices focusing on idea generation, elaboration, championing, and implementation, and find that various practices can turn organized innovation management efforts into a political process. They present a virtuous and a vicious circle of managerial attempts to manage creativity in innovation processes. In doing so, the authors highlight the value of taking a practice lens to better understand the challenges in organized innovation management efforts. According to them, managers should flexibly design organized innovation management processes to account for radical ideas, and pay close attention to coherency in communication when providing feedback and encouraging employees to come up with creative ideas.

Lotta Haukipuro and ***Satu Väinämö***'s article "Digital User Involvement in a Multi-Context Living Lab Environment", provides new insights on the long-term use and value of having a digital user involvement tool as part of a living lab, in this case one focusing on ICT, health, and public service development. The study was carried out within an authentic living lab environment between 2011 and 2018. The primary source of information was 70 in-depth interviews with customer companies, public organizations, and other relevant stakeholders. The results focus on the the tool's value for the digital user community in terms of the potential of users to develop new products and services. The key benefits for the community are the speed, ease, and efficiency of user involvement, regardless of time and location, and the richness and quality of the end-user feedback. The specific value categories are identified as Cost-efficiency, Timing & flexibility, Ease of use, Quality of results, User involvement, Open & closed participation, Multi-method approach, and Sustainability. A key finding is that online user participation methods should be utilized for solutions that are mature enough to guarantee high quality feedback.

Silje Svadberg, Andrea Holand and ***Karl Joachim Breunig*** provide a helpful (heuristic) framework both for theory and practise with their "Beyond the Hype: A Bibliometric Analysis Deconstructing Research on Digitalization", by adopting a bibliometric analysis to explore extant published research within the field of digitalization. The authors identify key articles and present them in a way that allows distinguishing between interrelated digitalization concepts. They propose a taxonomy with characteristics corresponding to different levels of digitalization. The taxonomy suggests dimensions that create different commercial and organizational opportunities and challenges. It

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offers an opportunity for future research that focuses on innovation and strategy decisions that involve scalability, automation, channel selection, and connectivity. The authors offer a suggestion to companies that managerial teams can benefit from using the taxonomy for implementing digital technologies in their business model innovation, as a way of adopting Industry 4.0 practices.

The article by ***Kirsty de Jong, Urs Daellenbach, Sally Davenport, Jarrod Haar*** and ***Shirley Leitch***, "Giving Science Innovation Systems a Nudge", examines the role that contextual factors play in science innovation systems, as well as how stakeholders' choices influence the orientations and outcomes of publicly-funded research. More specifically, the authors examine how policymakers and funding administrators can affect the decision-making behavior of researchers. The authors argue that there is a need for closer examination of the choice architecture for publicly funded research. Their aim is to understand how the potentially conflicting objectives of the different stakeholders can be pursued most productively through interventions that could form the basis of a novel, behaviorally-based toolkit for science innovation policy.

Martin D. Mileros, Nicolette Lakemond and ***Robert Forchheimer*** complete this issue with "Towards a Taxonomy of E-commerce: Characterizing Content Creator-Based Business Models", that focuses on emerging business models within e-commerce. The authors characterize content creator-based business models by formulating a taxonomy of e-commerce based on a structured literature review that explores the application of concepts such as "social commerce", "platforms', and "user-generated content". The study identifies eight types of content creator-based business models. It outlines theoretical and practical implications for the emerging phenomenon of digital content creator-based businesses, which are referred to as "intellectual commerce". One of the most interesting findings indicates that digital business-oriented content creators or professional amateurs intend to get reimbursed for their efforts, in contrast with traditional content creators. The study demonstrates a need for more research in this area.

This is the first of two issues with papers from the ISPIM Florence event, to be followed by a special edition on Artificial Intelligence set for December. For future issues, we invite general submissions of articles on technology entrepreneurship, innovation management, and other topics relevant to launching and scaling technology companies, and solving practical problems in emerging domains. Please contact us with potential article topics and submissions, or proposals for future special issues.

Stoyan Tanev
Chief Editor &
Gregory Sandstrom
Managing Editor

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Kick-Start for Connectivity - How to Implement Digital Platforms Successfully in Industry 4.0

Marie-Christin Schmidt, Johannes W. Veile, Julian M. Müller & Kai-Ingo Voigt

> *"Be brave, be curious, be determined, overcome the odds. It can be done."*
>
> Stephen Hawking

Based on digitalization and interconnectedness, Industry 4.0 causes a structural change in the value creation processes, and thus reinforces the transformation of business processes and business models. One way for companies to cope with this development and its associated challenges is to apply digital platforms in the value creation process. As the potential of digital platforms for industrial value creation can only be leveraged to its full extent with adequate implementation, this paper addresses the research question: "How are digital platforms best implemented in Industry 4.0 contexts?" Using a qualitative case study design, based on 32 semi-structured expert interviews, the study identifies different triggers and initiators, challenges, and respective countermeasures, as thematic core elements of implementation, and requirements for platforms. The research insights contribute to existing literature on Industryfl 4.0 and digital platforms. In addition, the paper discusses practical implications for industrial companies.

1. Introduction

The intention of Industry 4.0, internationally known as the Industrial Internet of Things (IIoT), is to transform industrial value creation into the digital age. Among several other instruments, Industry 4.0 intends to implement digital platforms in the value creation process (Kagermann, Wahlster & Helbig, 2013; Voigt et al., 2018). Platforms have the potential to create ecosystems in which companies interact with partners, customers, and suppliers alike, paving the way for new forms of value creation. In doing so, digital platforms enable a central characteristic of Industry 4.0, which is required to realize horizontal and vertical interconnection across the supply chain (Kagermann, Wahlster & Helbig, 2013; Lasi et al., 2014; Voigt et al., 2018).

Digital platforms act as catalysts for the digital transformation of a company (Hossain & Heidemann Lassen, 2017), which can significantly profit from their great adaptability across industry sectors and value chain stages. Therefore, not only the choice of a product or a technology is crucial, but also the choice of the best platform strategy in combination with the best ecosystem, in order to gain a competitive advantage (Cusumano, 2010). However, little is known about specific changes implied by digital platforms in industrial value creation, regarding the potentials that arise through their application, and especially involving adequate implementation strategies for companies (Parker, Van Alstyne, & Choudary, 2016; Veile et al., 2019; Wiegand et al., 2015).

Given the lack of research on interconnections between Industry 4.0 and digital platforms, alongside of a great interest in research and corporate practice alike, in this paper we address the following research question: *"How are digital platforms best implemented in Industry 4.0 contexts?"* Further, we give special attention to implementation triggers, requirements concerning platform design, main obstacles that arise, as well as strategies to overcome them.

2. Theoretical Background

Industry 4.0

Industry 4.0 describes a paradigm shift towards a digital and interconnected future of industrial value creation (Lasi et al., 2014; Voigt et al., 2018). It is based on the ex-ante expectation of industrial value creation undergoing a fourth industrial revolution (Kagermann, Wahlster, & Helbig, 2013). Cyber-physical systems form the technological basis of Industry 4.0 and enable real-time interconnectivity in the physical and virtual world along

the entire supply chain. This provides the basis for smart data analyses, which entail far-reaching potential. Industry 4.0 is based on the concept of the Internet of Things (IoT), which is why it is also known as the Industrial Internet of Things (Kagermann, Wahlster, & Helbig, 2013; Lasi et al., 2014).

Industry 4.0 addresses current technological developments, such as further automation, digitization, and interconnection of and between machines, people, and products along the entire value chain. This relates to its three main foundations: horizontal interconnection (across the supply chain), vertical interconnection (across company functions), and end-to-end engineering (from production to recycling) (Kagermann, Wahlster, & Helbig, 2013; Lasi et al., 2014). In addition to securing the competitiveness and future viability of the industrial sector, Industry 4.0's potentials include flexibility and productivity increases, development of new business models, ecological potential, such as reducing energy consumption, and social potential like smoothly integrating people into adaptive working environments (Kagermann, Wahlster, & Helbig, 2013; Müller et al., 2018). However, the concept is also expected to bring several challenges to existing companies, for example, high costs, endangered existing business models, and fear of employees being replaced (Birkel et al., 2019; Müller & Voigt, 2018).

Digital platforms

A digital platform represents a digital technology-based system infrastructure, business model, and intermediary acting market place that interlinks multiple actors, both internal and external to the company, like customers and suppliers. Based on the quality and quantity of interlinkages, a platform enables communication, interactions, and transaction processes between all connected actors. Digital platforms provide manifold value and advantages, including the ability to reach a wide user base, thereby profiting from high scalability, realizing low transaction costs, and achieving network effects (Gawer & Cosumano, 2014; Hagiu & Wright, 2015).

In general, digital platforms are expected to foster innovation and collaboration between partners, suppliers, and customers by easing communication and coordination among stakeholders (Esposito De Falco, 2017; Xie et al., 2016). Besides this benefit, platforms imply the transformation of existing value chains into digital value creation networks (Kenney & Zysman, 2016). By collecting, analyzing, and using data, these value creation platforms provide the basis for new business models that unite partners, customers, and suppliers on one platform (so-called multi-sided platforms), and thereby serve the goals of several target groups. A change in the value proposition following digital platforms, and involving new products and services, may better serve customer needs and generate additional revenues (Hagiu & Wright, 2015; Müller, Buliga & Voigt, 2018).

Information technology companies have been developing such platforms for years (Gawer & Cusumano, 2002), while the traditional industrial sector, which will be foundationally affected by Industry 4.0, undertakes less efforts in this respect (Parker, Van Alstyne, & Choudary, 2016). It remains that there are hardly any scientific studies examining the effects and implications of digital platforms in industrial application contexts. They refer either to a specific understanding, or to partial aspects of platforms and do not analyze and generate a holistic picture (Boudreau, 2010; de Reuver et al., 2017; Fatorachian & Kazemi, 2018; Parker, Van Alstyne, & Choudary, 2016).

Questions of data ownership, platform control, and power relations between actors within a digital platform, remain unresolved (Boudreau, 2010). Further, digital platforms call for adequate IT competencies, especially for traditional industrial manufacturers (Ravichandran, 2017). It remains a challenge for established enterprises to find partners to develop and set up digital platforms, and thereupon develop new business models (Tiwana & Bush, 2014; Wiegand et al., 2015).

3. Research Design

Method and data collection

Our research approach adopts a multiple case study based on inductively analysed expert interviews (Edmondson & McManus, 2007; Eisenhardt & Graebner, 2007). It is well-suited to examine contemporary and complex phenomena within their real-life contexts (Yin, 2009), along with relatively novel developments at initial stages (Eisenhardt & Graebner, 2007, Yin, 2009). Both aspects are true for platforms in the context of Industry 4.0. Relying on multiple cases increases the robustness and generalizability of the findings as compared to single cases (Eisenhardt & Graebner, 2007).

Following common research practice, the study conducted qualitative research, using semi-structured expert interviews with qualified and experienced managers as the main source of empirical material. This facilitated structured data collection, while still providing the required level of openness in order to

allow unexpected and novel knowledge to emerge (Yin, 2009).

Between October 2018 and January 2019, our team interviewed 32 German managers within varying firm sizes and industry sectors. These include information and communication technology (n=14), electronic and electrical engineering (n=8), mechanical engineering (n=4), automotive (n=4), aerospace (n=1), and commercial trade (n=1). The diversity of companies and the heterogeneity of the empirical material counteracts potential negative effects of sample biases on our findings, and follows Yin's (2009) recommendation for multiple case study sampling.

Data analysis and reliability of the study
After transcribing the 32 audio-recorded interviews, a qualitative content analysis was applied to identify and interpret common patterns, themes, and categories. The developed categories were mainly defined inductively, but were also informed by extant literature (Gioia, Corley, & Hamilton, 2013). Initially, first-order (informant-centric) concepts were developed. These concepts were then synthesized into second-order themes, followed by creating final categories. The entire coding process was conducted as a team in order to achieve as rich interpretations and profound understanding as possible.

Given the research objective, after that, we proceeded to evaluate and re-evaluate the results to uncover key findings from the study. To this end, we identified topics with the highest weighted relevance for the study's interview partners, and examined them against the background of the current state of literature. Finally, we evaluated the results of this procedure as a team to determine our final set of key findings.

4. Results

The table in the appendix depicts the study's main results according to the categorization system presented as follows.

Triggers and Initiators
Both of the main roles, triggers and initiators, can be divided into external and internal categories. While triggers are mainly external sources (named by 29 of 32 experts), initiators are prevailingly internal to a company (n=26). We therefore conclude that internal decision-makers generally perceive major external triggers and therefore undertake to initiate implementing a platform.

Among the internal initiators are management (n=15) and functional departments (n=14). Herein, a great variance of departments is notable, as initiators are not only found in engineering or IT, but also in various other departments. A strong interplay between management and operating units concerning initiation is visible as well.

The central external trigger leading to platform initiation is digitalization (n=14), as it provides the technical basis, and prospectively leads to an optimization of processes and data, with increased value added. As well, market factors (n=12) exhibit incentives for digital platforms, which include favourable market conditions for platforms, and competitive pressure. Finally, improved external and internal collaboration and connectivity (n=6) motivates companies to implement platforms.

Internal motivations for companies include prospective improvements in competitive factors (n=14), for example, efficiency gains through digital platforms. Also, internal strategic developments (n=9), as for instance possible new business models, incentivize companies to make a decision in favour of a platform.

Accordingly, in our study, interview partner 16 summarized: "*Above all, it's about strategically realigning and meeting the future or the requirements of the future. … It results that it is necessary to support the current business processes, but also to reorganize technologically towards digitalization*". Interview partner 32 amended: "*Actually there is not one reason, but a bundle of reasons that lead to the implementation of the platform*".

Platform requirements
Our data shows that expectations towards digital platforms can be of integrative (n=13), economic (n=10), or mainly of a technical nature (n=32). Concerning technical requirements, the salient aspect is functionality (n=13), which comprises a great scattering of concepts like scalability, optimization of different processes and services, various analysis possibilities, and standardization measures. We thus conclude that in corporate practice, companies plan to use platforms for diverse purposes. Therefore, the need for a strong individualization of digital platforms addressing actual practical needs is apparent.

Interview partner 21 confirmed: "*And because these are completely different products, the requirements … were of course extremely different. The challenge with this standardization was that we had to combine these extremely heterogeneous requirements from a business*

point of view in such a way that we could distil a common core. And that was a huge issue."

In contrast, there is a consensus concerning performance (n=13) and security aspects (n=7). Experts agree that availability, reliability, topicality, data access, and system security are indispensable features. Additionally, platforms are expected to be easily usable (n=6) in terms of operability, personalization, and standardization, to provide comprehensive data processing (n=6), independent of applied software or hardware, and to increase transparency for all participants (n=4).

From an economic point of view, platforms should fulfil expected increase of added value (n=5) by contributing to business models, value creation, and efficiency gains. Eventually, the ratio between platform implementing efforts and benefits should become favourable. In financial terms (n=7), experts want platforms to reveal company cost optimizations through price cuts or staff savings.

Conforming to inherent platform characteristics, integrative requirements include collaboration (n=9) with customers, partners and internally, along with interconnection (n=11) through openness and connectivity over different devices and applications.

Implementation process

The implementation of a digital platform is a complex process, in which manifold approaches, depending on company-specific individual framework conditions, may lead to success. Therefore, abstracting and generalizing the different possible methods to one ideal-typical sequential implementation process is not expedient, and thus not intended in our study. Nevertheless, we find recurring themes in the various approaches and categorize them as core elements of an implementation process. These aspects are customer and partner management (n=6), building up expertise (n=16), management of requirements (n=21), and platform launch (n=28).

Customer and partner management represents an aspect that companies apply throughout the entire implementation processes. It includes supporting partners (n=3) by different collaboration possibilities or trainings, and raising partners' awareness level concerning the platform (n=3). Another aspect is building up sufficient and adequate expertise. Before implementing a platform, initial knowledge can be gained (n=2) by acquiring market competencies and choosing the right platform developer (n=12). An essential choice to be made in this context is the degree of externalization of development. One factor that potentially influences the implementation success and also the degree of know-how development is previous experience a developer has gained in industrial contexts.

Before the actual launch of a platform, companies generally analyse their specific requirements. They study the technological status quo (n=2) by identifying software standards as well as their own technological strengths and weaknesses. Additionally, customer needs are identified (n=8), for example, through surveys, and the involvement of users in the development process. Hereafter, platform requirements are defined (n=9), and subsequently the platform's scope and architecture are determined, just as the decision concerning the degree of platform customization. Development steps are then pre-defined. Finally, project requirements are determined (n=8), including among others, financing, organization, and strategy development.

Finally, the actual launch of the platform represents an integral aspect of the platform implementation process. Within this phase, eleven companies first internally prepare to use the platform. This includes preparing the infrastructure, replacing previous models, and undertaking preliminary development of the platform, which is expanded internally to the entire company. In a test phase (n=11), the prototyped platform is internally used, tested, and adapted thoroughly in pilot projects, followed by a pre-launch (n=9). In this phase, companies communicate the upcoming launch to partners, open the platform, and subsequently integrate their partners. During the time of the initial launch (n=3), the exchange of data starts, while possible technical problems are communicated and solved.

Challenges

The main challenges industrial companies perceive when implementing digital platforms are collaborative (n=28), technological (n=27), company-internal (n=19), and economic (n=7) in nature.

As far as collaboration is concerned, almost all companies are worried about the inclusion of partners (n=26). Especially partner attitudes, for example, insecurity and diverging expectations, but also support and communication, timing, and country-specific aspects, threaten collaboration. Legal aspects (n=4), such as issues of property and rights of use, as well as distrust and scepticism (n=6), mainly caused by competitive thinking, complement the challenges to collaboration.

Internally, in contrast, experts perceive challenges mainly in terms of new approaches to working processes, that are caused by changing procedures, and which platforms reinforce (n=11). Additionally, new expertize (n=10) is needed that results from stakeholder and technical requirements. Likewise, the employee mind-set has to be changed toward a more open organizational culture (n=3).

Among the main technological challenges are aspects concerning functionality and usability (n=14). As already depicted in the platform requirements, platforms entail a high degree of individualization. Therefore, functional challenges differ notably, including performance, data accuracy, and data exchange. Additionally, security issues (n=11) pose major challenges to smooth implementation. Among them are safeguarding data, along with maintaining internal and external safety standards. Likewise, software (n=7) and hardware challenges (n=4) have to be overcome. In this regard, divergent partners' software and hardware specifications and architectures, and consequent development needs and connections play a crucial role.

Finally, seven experts shared with us what economic challenges need to be tackled. These include profitability (n=6) and sales aspects (n=4), wherein financing, scalability, and business model alignment have to be guaranteed. In addition, a company's offer should be transformed to fit the new digital platform model.

Above all, interview partner 24 emphasised the complexity that arises in platform development: "*When I develop specifics for individual customers, I know exactly what is necessary. If I increase the number of customers … then the requests automatically increase.*"

Coping with challenges

In order to cope with the discussed challenges, experts propose change management measures (n=29), adjustments of framework conditions (n=6), and partner management (n=5).

Human Resource management (n=13) methods entail elaborating training concepts, and performing transparent and honest communication. Also, contracting new employees as well as initiating and expanding innovator and project teams as driving forces, helps to tackle internal company challenges. Management should be very supportive (n=4), by implementing concepts, for example, to acquire and distribute information and knowledge holistically. Eventually, the platform must be included in all employees' mind-sets, which requires a change in the overall corporate culture (n=5).

Further, project management measures (n=12) provide support in overcoming execution problems. Requirements and objectives should be clearly defined, and project partners included closely throughout the entire process.

This also affects the framework conditions, which require further adjustment and refinement. For instance, business models should be aligned with the new digital platform strategy. Measures to tackle technological challenges (n=5) include the development of applications in, for example, software and cloud technology.

Finally, partner management helps to cope with integrative challenges. In this way, customer acquisition (n=4) via different communication channels supports the identification of 'customer visionaries'. Customer development (n=5) enhances customer integration into processes. In this context, customer training and pilot customers are beneficial to gather feedback worth considering for further developments.

Summary of key findings

Our study reveals several insights about how to implement digital platforms successfully. The most important findings include:

- Mainly internal, but also external actors drive the implementation of digital platforms.
- In contrast, mainly external triggers force companies to apply digital platforms.
- Technical requirements are the most prominent platform requirements. Further requirements are economic and integrative in nature.
- Implementation processes differ significantly given a company's specific characteristics and particular environments. Yet, several similarities can be observed, for example, regarding a platform's launch.
- Challenges to implementing digital platforms are mostly caused by collaboration and technological issues, which companies can address by applying change management measures.

5 Discussion and Conclusion

Theoretical implications

This paper adds to the sparse literature that has investigated digital platforms and their implementation, linking it with Industry 4.0 (Müller, Buliga & Voigt, 2018; Voigt et al., 2019). In this context, the development of new business models not only poses a challenge toward companies (Tiwana & Bush, 2014; Wiegand et al., 2015), but also offers essential incentives for companies to implement digital platforms (Inoue & Tsujimoto, 2018).

Challenges of digital platforms are in line with general Industry 4.0 risks like endangered existing business models and unclear amortization, given the relatively high costs of implementation (Birkel et al., 2019; Müller & Voigt, 2018). Also, traditional challenges associated with platforms, like questions of data ownership, issues of control, and the power relation between actors within the platform still remain unsolved (Boudreau, 2010). These might be attributed to a lack of trust and the urge to include partners. The development of adequate IT competencies is still a basic requirement, and a central challenge for platform implementation (Ravichandran, 2017). This also includes the integration of customers (Xie et al., 2016), and the fulfillment of the goals of several customer groups (Hagiu & Wright, 2015; Kiel et al., 2017).

Managerial implications

The results of our research indicate recommendations for management and corporate practice. We propose the following principles should be integrated into corresponding strategies for implementing digital platforms:

1. Information and trends need to be analysed and processed, particularly regarding market developments and competitive factors. In doing so, external triggers can be contrasted with internal competitive and strategic factors to verify individual platform benefits. This implies that, internal initiators from management and functional areas alike play an important role for initiating new developments, and hence should be highlighted and given importance.

2. Before implementing a platform, a thorough analysis of platform requirements should be undertaken. Including and taking on partner and customer perspectives, both internal and external ones, helps to improve specifications. Beside integrative and economic requirements, technical specifications are paramount. Nevertheless, platforms imply scalability and continuing development. Therefore, a continuous improvement approach that includes internal preparation, testing and feedback loops, leads to a smoother platform fit for all actors' requirements.

3. Change management measures help to ensure a smooth transition into the platform environment. For this purpose, training concepts and communication support the implementation. Management should support the company cultural change by providing sufficient information and funding. These measures should be backed by the adjustment of existing business models and ongoing partner management.

Limitations and further research

Although our results go beyond the mere corporate perspective, by depicting organizational factors that influence individual innovation acceptance, a truly holistic view remains to be investigated. The requirements and challenges identified in this study, suggest benefits and risks of digital platform implementation. However, an investigation of opportunities and ventures, especially concerning a sustainable integration of digital platforms into business routines, would amend our results. Finally, we discussed that digital platforms, just like Industry 4.0, impact value creation profoundly, and thus have major implications for traditional business models. The nature and structure of these implications caused by such platforms, remains to be uncovered.

Considering the comparable novelty of the research area, it is noteworthy that many of the examined companies have only been dealing with the topic of digital platforms for a short period of time. Consequently, many changes are just emerging in the course of Industry 4.0 implementation. Hence, the study's results cover only the current state of the field, still prior to a consolidated use of digital platforms in industrial practice, and should be closely accompanied in future research. Accordingly, this study provides valuable insights into current initiators, requirements, processes and challenges of platform implementation, which should be re-confirmed at a later point of development.

Kick-Start for Connectivity - How to Implement Digital Platforms Successfully in Industry 4.0

Marie-Christin Schmidt, Johannes W. Veile, Julian M. Müller & Kai-Ingo Voigt

Appendix - Table of Results

Theme	*Aggregate dimensions*[1]	*Second order themes*[1]	*First-order (informant) concepts*
Initiators	External Initiators (11)	Supplier (1)	Tier 1-Supplier
		Customers (12)	Customer Requirements, Advantages and Issues
	Internal Initiators (26)	Top Management (15)	General Management, Management Board, CPO, Parent company
		Functional Areas (14)	R&D, Project Management, Digitalization Dep., Engineering, Quality Dep., Product Management, IT Dep., Innovation Dep.
Triggers	External Triggers (29)	Market (12)	Market Conditions, Trends, Potentials and Needs, Competition
		Digitalization (14)	Entering Digitalization, Added-value through Digit., Optimization of Processes and Data through Digit.
		Collaboration and Connectivity (6)	Linking Functional Areas, Worldwide Collaboration and Connectivity, Data Exchange and Visualization
	Internal Triggers (19)	Competitive Factors (14)	Cost reduction, Increase in Sales, Increase in Efficiency
		Strategic Developments (9)	New Business Models, Improved Service Offerings, Strategic Orientation towards the Future
Requirements	Economic Requirements (10)	Value Added (5)	Depiction of Business Model, Value Creation, Increased Efficiency, Efforts-Benefits Ratio
		Financial Aspects (7)	Price-Performance Ratio, Cost Optimization, Price Cut, Staff Savings
	Technical Requirements (32)	Functionality (15)	Flexibility, Standardization, Scalability, Application Spectrum, Analyses, Digitalization, Optimization of Processes and Devices
		Usability (6)	Facilitation, Operability, Automatization of Standard Processes, Self-explanatory Use, Personalization
		Transparency (4)	Filtering Data, Data Visualization, Modular System
		Performance (13)	Availability, Reliability, Stability, Topicality
		Security (7)	Data, Access and System Security
		Data (6)	Comprehensive Data Collection and Analysis, Processing Data independent of Software and Hardware
	Integrative Requirements (13)	Collaboration (9)	Communication with Customers and Partners, Internal Cooperation
		Interconnection (11)	Connectivity, Integration of Devices and Applications, Openness

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Implementation Process	Costumer and Partner Management (6)	Customer Support (3)	Customer Management, Partner Management, Collaboration Possibilities
		Awareness Level (3)	Internal Marketing, Inclusion of Educational Institutions
	Building Expertise (16)	Gain initial Knowledge (2)	Recruiting international Specialists, Acquire Market Competencies
		Developer Selection (12)	Choice of Provider, Expertise in industrial Context, Offer Analysis, External Tendering, Decision concerning Externalization
		Know-How (3)	Development of R&D department, Expanding Expert Knowledge
		Standardization (2)	Standardization of security topics and of further applications
		Further Development (4)	Successive Expansion and Improvements, Less On-Premise
	Management of Requirements (21)	Analysis of Technology (2)	Determination of Strengths and Weaknesses, Examining Software Standards, Benchmarking to other Companies
		Analysing Customer Needs (8)	Customer Survey, User Involvement
		Definition of Platform Requirements (9)	Determination of Scope of the Offer, Development Steps and Platform Architecture, Definition of Degree of Customization, Elaboration of List of Requirements
		Project Requirements (8)	Project Organization, Strategy Development, Financing
	Launch (28)	Internal Preparations for Platform (11)	Preparation of Infrastructure, Development of Platform, Expansion to entire Company, Replacement of previous Models, Milestone Process
		Test Phase (11)	Pilot Projects, Prototypisation
		Pre-Launch Phase (9)	Opening, Integration of Partners, Communication to Partners
		Initial Launching Phase (3)	Technical Problem Solving, Data Exchange
Challenges	Technological Challenges (27)	Security (11)	Data Security, Adjustment of Safety Standards, General Security Concerns
		Functionality und Usability (14)	Capacity, Performance, Data Exchange, Application Offer, Infrastructure, Transparency
		Hardware (4)	Device Variety, Connection and Development
		Software (7)	Software Architecture, Development and Specifications
	Economic challenges (7)	Profitability (6)	Scalability, Business Model Alignment, Financing
		Sales (4)	Pricing model, Payment, Contract Generation, Transformation of Offer
	Collaborative Challenges (28)	Distrust (6)	Generating Trust, Competitive Thinking, Generate Mutual Understanding
		Partner Inclusion (26)	Partner Attitude and Generation, Country-specific Challenges, Timing for Integration, Support and Communication
		Legal Aspects (4)	Programming and Property Rights, Rights of Use, Contract Design
	Internal Challenges (19)	New Ways of Working (11)	Agility, Change of Processes, Dependency on external Influences
		Expertise (10)	Know-How Requirements, Stakeholder Management
		Openness for Changes (3)	Change of Mind-set, Embedding in Corporate Identity

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Measures	Change Management (29)	HR Management (13)	Communication, Innovator / Project Team, Contracting new Employees, Training Concepts
		Management Support (4)	Decision-Makers' Support, Support Concepts
		Corporate Culture (5)	Culture Change, Change of Mind-set
		Information (5)	Knowledge Acquisition, Global Information Distribution
		Project Management (12)	Definition of Requirements and Objectives, Inclusion of Project Participants, Test Run, Agile Methods
	Adjustment of Framework Conditions (6)	Adjustment of Business Models (1)	Business Model Change, Cost Reduction
		Technology (5)	Application Development, Abstraction Model
		Certification (3)	Certification Process, Quality Assurance, Security Concepts
	Partner Management (5)	Customer Acquisition (4)	Identification of Customer Visionaries, Using different Communication Channels
		Customer Development (5)	Customer Integration and Training, Pilot Customers, Consideration of Feedback and Trends

[1] Frequency of mentions (out of 32 experts) indicated in brackets; multiple responses allowed.

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> *"Having ideas is like having chessmen moving forward; they may be beaten, but they may start a winning game."*
>
> Johann Wolfgang von Goethe
> Statesman and writer

Literature has pointed to the importance of feedback on creative ideas in innovation management processes. However, little is known about the practices that constitute the feedback process and their effect on employees' future willingness to consistently and recurrently contribute with creative ideas to organized innovation management efforts. In this research, we draw on data from a single case study at a German multinational manufacturing firm. We show the flip side of managerial attempts to provide feedback and foster employees' creative output. In particular, we identify distinct practices organizational actors employ along the sequence of idea generation, elaboration, championing, and implementation, and find that the practices can turn organized innovation management efforts into a political process. Furthermore, we present a virtuous and a vicious circle of managerial attempts to manage creativity in innovation processes. In doing so, we highlight the value of taking a practice lens to better understand the challenges in organized innovation management efforts and propose future research in other contexts. We suggest that managers should flexibly design organized innovation management processes to account for radical ideas and to pay close attention to a coherent communication when providing feedback and encouraging employees to contrive creative ideas. Our work contributes to the body of research on innovation management by shedding light on the dark side of organized innovation management efforts.

1. Introduction

In order to absorb and leverage the potentials from most recent technological developments (for example, digitalization, advanced robotics and additive production techniques), firms must reach out to their employees and their creative minds. That way firms generate and exploit ideas how to best connect novel outside technological developments with existing internal processes in innovation management efforts. Hence, fostering employees' willingness to come up with creative ideas is considered to be an integral part of innovation processes (Garud et al. 2013), and organizations put significant effort in managing creativity as a key element of their innovation management agendas.

Because "all novel ideas must be critically revised before they come to fruition" (Garud et al., 2013: 783), scholarly work highlights the role of managers' feedback on creative ideas in innovation management processes (George, 2007). Researchers point to the fact that feedback not only influences the development of creative ideas to turn them into marketable products and services (Harrison and Rouse, 2015), but also determines actors' willingness to come up with creative ideas and to participate pro-actively in future innovation processes (Amabile, 1988). The burden literature on creativity has shown that feedback has a significant and yet complex influence on creativity. However, research dealing with the mechanisms and underlying practices through which such influences occur remains sparse (Anderson et al. 2014; Harrison and Rouse, 2015). This is surprising given that the underlying managerial practices, i.e. actors' doings, are a key to explain the success of innovation management efforts and, consequently, an organization's ability to constantly innovate.

Accordingly, the objective of this paper is to provide insights on managerial practices that unfold as ideas emerge, are developed, and are implemented systematically within firms. Particularly, we explore managerial practices along the journey sequence of idea generation, idea elaboration, idea championing, and idea implementation (Perry-Smith and Mannucci, 2017), thus taking into account effects and consequences for innovation management. Thereby, we aim at answering

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the following research question: How do actors respond to feedback on their creative work and how does that feedback interlink with structured firm innovation management processes? To do so, we draw on data from a longitudinal case study at a German multinational manufacturing firm, and empirically examine structural mechanisms and managerial practices that influence creative actors on their idea journey.

In doing so, we contribute to the existing innovation management and creativity literature by revealing a flip side of organized innovation management efforts, and how managers reverse attempts to foster creative output for innovations into political actions, which ultimately hamper creative output. We further contribute to research by presenting how either a virtuous or vicious circle impacts an organization's ability to innovate, and unfolds in the management of creativity. Additionally, this study provides various practical insights that can help organizations to improve their innovation management efforts by revealing practices that managers may use in the context of creativity and innovation.

In the remainder of this article, we first briefly explore the concept of creativity and its importance in innovation processes. We then show the current understanding of the influence of feedback on creativity, with both positive and negative impacts. After describing the method applied, we then present the findings of our study. In the final section, we discuss the results and explicate implications for academia and management alike.

2. Related Literature and Conceptual Background

Creativity is defined as "the production of novel and useful ideas by an individual or small group of individuals working together" (Amabile, 1988: 126), and is considered an important source of competitive advantage (Anderson et al., 2014). Among other factors, performance evaluation and feedback have been found to play a pivotal role for creativity (George, 2007). First, it greatly contributes to shaping creative prototypes (Harrison and Rouse, 2015), and thus, to the possibility of implementing a creative idea. Second, it influences actors' future creative performance (Amabile, 1988).

With regard to the latter, research has pointed to the role of managers as follows (see: George, 2007). For example, leaders can foster creativity through providing a supportive context, which can be accomplished by providing developmental feedback, i.e. informal feedback that points to improvement without using pressure. Feedback from managers, if perceived as useful, fosters individuals' creativity, especially when they are unsatisfied with their work environment. There is also a relationship between the provision of feedback and the presence of creative co-workers which, taken together, fosters the production of creative output as well.

The vast amount of literature dealing with feedback and creativity has deeply contributed to a better understanding of the relationship between feedback and creative performance. However, with regard to innovation processes in organizations, managerial feedback must also be understood as a way of managing innovations (Anderson et al., 2014), entailing decisions based on multiple criteria for whether or not to pursue proposed (creative) ideas, or to modify them. For example, research emphasized that creative ideas may be produced by employees, but are not necessarily implemented as intended or are even rejected, when decision-making boards can choose between different ideas to be realized (Baer, 2012; Piezunka and Dahlander, 2019). Consequently, managers face the challenge of promoting the production of creative output as part of their innovation management efforts, along with also revising and rejecting (auspicious) proposed ideas.

To get a more nuanced view on the challenges that idea inventors and decision makers face when dealing with creativity and feedback in innovation processes, Perry-Smith and Mannucci (2017) conceptualize that ideas take a journey —from conception to (non-)completion. Remarkably, research taking a processual view (Fortwengel et al., 2017) examining the managerial practices during the journey ideas take, and how feedback receivers respond to feedback givers at different stages of the journey, remains scarce (Anderson et al., 2014). This is surprising given that creativity can only be understood in relation to an evaluated outcome that is negotiated in a process of social interaction, and that is likely to differ at various stages along the journey an idea takes. Furthermore, practices that come into play during such social interactions are constitutive for a work environment that largely influences organizational members' creativity performance.

Therefore, in this work, we draw on innovation management literature as well as on literature discussing the nature and role of feedback for creativity in innovation processes, and ask how actors respond to feedback on their creative work. Our aim is to identify managerial practices as well as organized innovation

management efforts that generate effects on employees, thereby pointing to potential challenges of processing creative ideas in an organizational context.

3. Research Methods

Empirical approach and case description

As we approached a new research topic for this paper, we decided for a qualitative-empirical research design (Yin, 2014). Such an approach is especially helpful to explore new research settings as it allows for uncovering causality, and goes beyond pure description, especially giving contextualization as possible. Even though existing research has provided a number of ideas on creativity, feedback and its connection with innovation management, the procedural perspective and its underlying mechanisms remain largely unexplored.

Following our research question, we sought to explore focal phenomena in the context in which they occur (Meredith, 1998), while being able to embrace existing findings and theory for a more focused exploration and substantiation of our results (Eisenhardt, 1989). In this regard, our research approach can best be described as theory elaboration (Vaughan, 1992), in contrast with theory testing (Popper, 1959), and grounded theory (Glaser and Strauss, 1967). In particular, we applied a qualitative, inductive research design comprising a longitudinal single case study with embedded multiple units of analysis (Yin, 2014). This approach allowed us to identify and explore relevant constructs and interrelationships, adding description and understanding of the interactions, meanings, and processes that constitute real-life settings (Gephart, 2004). Because the focal organization represents a case that made the phenomenon of interest accessible to investigation with the possibility of applying results to similar situations, and given the longitudinal design, a single-case study was appropriate for our empirical exploration (Mariotto et al., 2014; Siggelkow, 2007; Yin, 2014).

We approached the production facility of a world-wide manufacturing company headquartered in Germany, and observed the organization's operations for two years. Because the organization heavily relies on innovation management, the case was suitable to illuminate and extend relationships and logic around constructs, or in other words, the case was chosen for its potential contribution to conceptual advancement (Glaser and Strauss, 1967; Eisenhardt and Graebner, 2007; Siggelkow, 2007). Specifically, the production site installed several initiatives to encourage employees to come up with creative ideas that could enhance its innovation performance. Furthermore, the management team also looked for improvement initiatives that might be implemented across various production facilities. Interestingly, the management team also called for "unconventional" ideas in an attempt to promote not only incremental, but also radical change.

To conclude, the chosen case and the study design allow for relational inference rather than representational inference (Meredith, 1998), in that it is not meant to represent a random or stratified sample from a population (Flyvbjerg, 2006).

Data collection and analysis

The case study approach enabled the use of multiple methods of data collection for an in-depth exploration of the phenomenon within its natural setting (Meredith, 1998; Yin, 2014). We observed managers and employees involved in organized innovation management processes for two years. The approach allowed us to investigate the focal phenomena from different angles, tapping into a wide range of individual experiences and perspectives from numerous

Table 1. Data collection and analysis

Data type		*Use in the analysis*
Interviews	45	Familiarizing with the research context, capture managers' and employees reflexive thoughts about innovation management efforts and feedback processes.
Field notes	80	Identification of practices during feedback interactions, triangulation of findings from interviews and document analysis.
Documents	23	Familiarization with the research context, triangulation of findings from the interviews and field notes.

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informants (Jick, 1979; Stuart et al., 2002). In particular, one researcher did on-site field work, accompanying actors during their daily routines, and attending ad hoc and frequently organized formal and informal gatherings where innovation activities played a major role. Furthermore, we carried out interviews and analyzed internal documents to facilitate the comparability of the findings, and to retain flexibility to probe deeper into emergent themes by eliciting examples, illustrations, and other insights (Barratt et al., 2011; Pratt, 2009). The interviews lasted 45 to 90 minutes. As a result, our data set consists of participant observation, interviews, documents, and field notes from numerous informal talks. The outlined approach enabled us to gain understanding of the phenomena through the views of those studied, and to examine and articulate processes (Pratt, 2009), including the meanings ascribed by informants to actions and settings (Gephart, 2004). When entering the empirical field, we applied a practice lens (Feldman and Orlikowski, 2011), thus paying particular attention to the actors' and their regularities. The following table provides an overview of the data collected and its use in the analysis.

For data analysis, we followed the so-called "Gioia Methodology" (Gioia et al., 2013). Thus, we started with "open coding" and clustered our findings into "first-order concepts". These concepts were grouped and clustered into theoretically abstracted "second-order themes". Finally, the themes were grouped into aggregated dimensions and later processed into a framework grounded in empirical data. The following figure shows the coding structure of our project.

During the process of coding the empirical material, we iteratively moved between (new) empirical data and (emergent) findings, and constantly checked for alternative explanations. When doing so, we applied an insider-outsider approach (Langley and Abdallah,

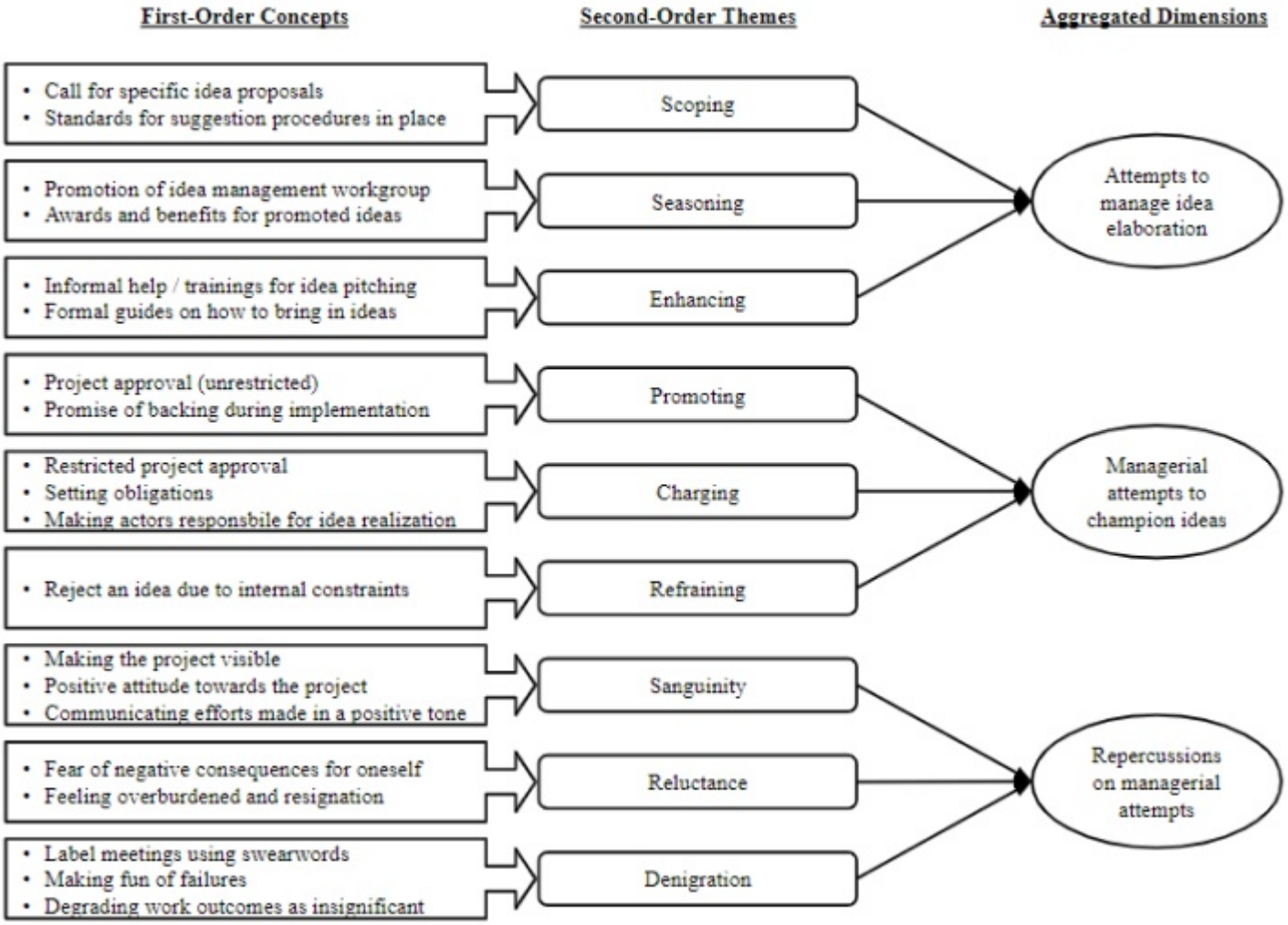

Figure 1. Coding-scheme of managerial attempts to manage creativity and outcomes

2011). That is, one author worked in the company as a guest researcher and got deeper involved in the observations made, while the other authors kept a more detached stance and played the role of a sceptic and critic when discussing results. Thus, data collection and analysis benefited from a balance between involvement and detachment.

We stopped gathering new data once no new results were obtained and saturation was reached (Glaser and Strauss, 1967). To increase reliability, we presented preliminary results to the company, checking their feedback.

4. Findings

We start this section by giving an overview of the main themes and second order concepts. In doing so, the idea journey (Perry-Smith and Mannucci, 2017) constitutes our conceptual foundation as we describe how managers try to foster the elaboration of ideas ("attempts to manage idea elaboration"), how they try to influence the development of ideas and communicate their decisions about project realization ("managerial attempts to championing ideas"), and how employees react to those managerial attempts in the innovation management process ("repercussions on managerial attempts"). The section closes with a theoretical framework that shows how the explored practices relate to each other and how the repercussions, in turn, influence employees' future engagement in organized processes where they can suggest their novel and (presumably) useful ideas.

Attempts to manage idea elaboration: Scoping, Seasoning, and Enhancing

When entering the company, we recognized a plethora of approaches and instruments that were installed in the course of establishing a full blown innovation management system. In particular, the company's management was seeking to foster their innovation capabilities, which represented one of the primary corporate goals.

In order to foster innovativeness, the company incorporated specific actions to increase the amount of developed ideas that are potentially novel and useful, i.e. creative. First, managers tried to steer employees' attention to areas where innovative ideas are needed. Therefore, the company provided information via the intranet that delineates areas the company is looking for innovative ideas, and the company initialized idea workshops with a focus on specific problems or challenges the company faces. Furthermore, the company set up a guideline to describe in a detailed way what innovations should look like, for example, the need to reduce costs to a certain minimum amount. We summarize and define these activities as "scoping" because in employing these practices, the company assures that employees only suggest ideas that are within management's scope of interest.

In addition, the company offers specific training, for example, creativity techniques like "design thinking" and presentation skills, to enhance employees' abilities to develop and present their ideas properly. We summarize and term these efforts "enhancing" since they are designed to foster employees' capabilities to come up with creative ideas according to standards for innovative ideas set out by the company's management. Thus, "enhancing" and "scoping" are designed to work concordantly to foster the suggestion of ideas that are potentially novel and could be useful for the company. On the one hand, employees know exactly what an innovative idea should look like to be taken into account. On the other hand, employees are given help to elaborate their ideas so that they can convince the management team to implement them.

While the first two practices enhance employees' capabilities to suggest ideas, management also introduced provisions to foster employees' willingness to suggest ideas. For example, the company awards the best ideas, and rewards the suggestion of ideas by setting incentives. Idea workshops are advertised heavily, and management communicates the importance as well as the benefits novel ideas can have for the company, and for those who engage in suggesting ideas. We summarize and term these managerial attempts "seasoning" given the fact that they are designed to make participation in management's installed initiatives for idea management more attractive for employees.

The company's attempts to manage idea elaboration, i.e. "scoping", "enhancing", and "seasoning" foster the production of developed ideas to be presented in front of decision boards as part of an established innovation management process. This way they can compete for resources aimed at further development or implementation in the company.

Managerial attempts to champion ideas: Promoting, Charging, Refraining

Once ideas are developed, they are processed by institutionalized review boards. These boards consist of top and middle managers that are eligible to decide on whether ideas are pursued or not. Thus, these managers

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decide on the realization of ideas and how they could be implemented. This includes making decisions on releasing resources that are needed to further develop an idea, i.e. money needed to build prototypes, reduced working time for employees to further pursue the idea, and idea implementation in the company itself. We observed three managerial practices when employees tried to convince the board of reviewers to support their idea. First, managers approved the idea as it was or requested only minimal changes. Simultaneously, managers communicated their appreciation of the efforts invested so far, and promised to help during further steps, thus making leeway for implementation of the idea. We termed this practice "promoting" since managers gave unrestricted approval and support of the idea.

When managers might be convinced by an idea, they can also give "conditional approval". They do so by putting the employee in charge of success for further developing or implementing the idea. As one manager put it when asked about the steering committee's decision philosophy when in doubt about the project's success:

> *"He who suggests has to deliver."*
> (Member of the review board, Interview #4)

Furthermore, managers formulate restrictions for implementing the idea, articulate expectations towards the performance of the employee as the "project manager for the idea", and explicitly address issues to be resolved by the employee (for example, approval of expected values of key performance indicators). We termed this practice "charging" since the employee is set in charge for the success of the idea.

Finally, managers might also reject an idea by highlighting internal constraints. In doing so, they refer to scarce resources, expect the idea not to be implementable due to cultural and political boundaries (for example, other departments affected by the idea might resist it), or reject it due to other current priorities among management. We termed this practice "refraining" because managers simultaneously express their appreciation of the idea and possible value it has for the company, while rejecting it due to restrictions they cannot influence. While "promoting" and "charging" result in the implementation or further development of the idea, "refraining" ultimately leads to abandoning the idea as presented.

Repercussions on managerial attempts: Sanguinity, Reluctance, Denigration

The explored managerial attempts at championing ideas lead to different repercussions related to employees. Once the presented idea is approved by the review board (that is, either through promoting or charging), the aim is to get the idea realized. Realization can take the form of producing a prototype or introducing new or adapted processes, respectively.

During the realization process, employees who originated the idea are typically highly committed to it and keen on bringing the project to a successful end. In particular, employees whose ideas are promoted by the review board feel emotionally involved and show a positive attitude towards the project. Besides working on the project, employees try to make the project visible by spreading the word about their activities. Similarly, efforts made in order to realize the project are communicated with a positive tone throughout the company. Since these employees feel deep emotional involvement and focus on the positive aspects of the project when talking about it, we termed this repercussion "sanguinity".

Quite the contrary, often people who are set in charge and held responsible for the success of the project, start fearing negative consequences. The fear of negative consequences refers to the success or failure of the project itself, overcoming resistant forces within the company, and potentially going worse off in balancing the demands, from daily work and being the project leader of their own idea. Given the multiple demands, employees can feel overburdened concerning their manager's expectations. When being confronted with the task of delivering a versatile set of prepared information designed to anticipate the success and impact of a project they came up with (ideated) to the management board, employees may even engage in resignation. We term this repercussion "reluctance" emphasizing an employee's negative attitude towards the project they are supposed to realize. For example, one employee reported:

> *"I am frightened of the management board when it comes to project reviews."* (Engineering Manager, Interview #18)

Finally, employees whose ideas have been rejected and will not be attempted or realized, question the process of innovation management. Although their ideas have been developed and presented according to the standards set up by the management team, the transparency of the rejection decision is called into

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question. Typically, the managers' argumentation that rejecting an idea is based on internal constraints is at odds with the open call for innovative ideas. This circumstance makes employees doubt the seriousness of the company's innovation management initiatives. They may even start labelling the established innovation management tools, typically meetings, and other approaches meant to foster the creation of new ideas, using swearwords. For example, one manager put it as follows:

> *"In our company, 'steering committee' is a faux-pas word."* (Engineering Manager, Interview #12)

Besides labelling established innovation management approaches using negatively connoted words, employees tell episodes of projects that were unsuccessful, make fun of failures that happen during innovation projects, or degrade outcomes of improvement initiatives as insignificant, based on the innovation management process used. We subsume and term these practices "denigration". We observed that denigration could come from the instantaneous result of rejected ideas, or be a consequence of employees over-engaging in "reluctance" during the implementation phase of their idea.

Virtuous and vicious circle of managerial attempts to manage creativity

The repercussions of managerial attempts to manage creativity impacts employees' willingness to engage in the efforts being made to foster the suggestion of novel and useful ideas. We identify a virtuous circle in which sanguinity about realized projects fosters a suggestion of ideas, and a vicious cycle that prevents actors from suggesting ideas as a result of the denigration of innovation management efforts initialized by the company. The following figure illustrates the process described above, and locates the practices identified as well as repercussions, within the framework of the "idea journey" as proposed by Perry-Smith and Mannucci (2017).

The idea journey consists of the phases "idea generation", "elaboration", "championing", and "implementation". We identified managerial attempts to manage the elaboration of ideas, that is, actions to promote the sharing of developed ideas in presentation to the review board. Further, the explored managerial attempts to champion ideas (and decide on their implementation) led to various repercussions related to the employees' commitment to the organization's innovation management efforts. Employees whose idea

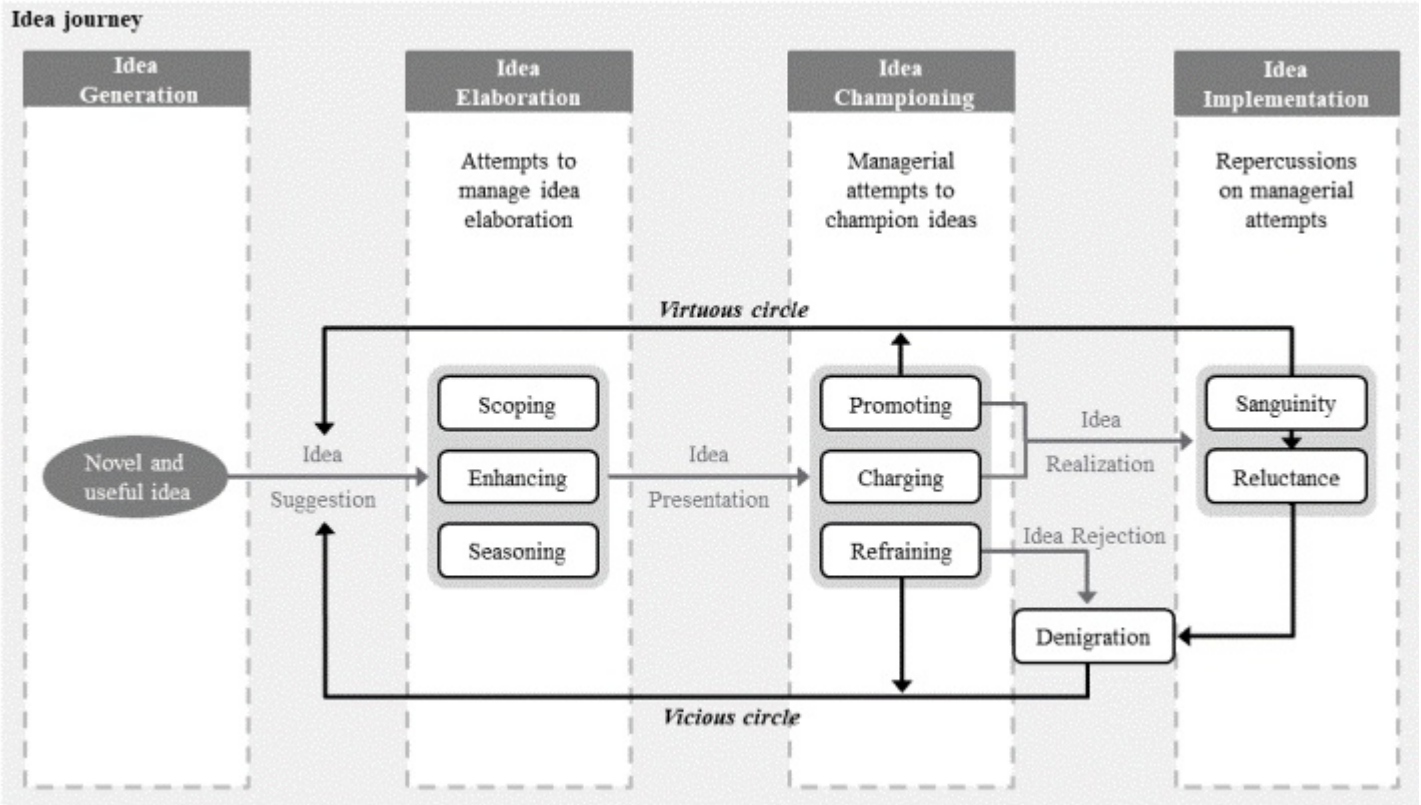

Figure 2. Virtuous and vicious circle of managerial attempts to manage creativity

is backed by the review board feel supported and communicate achievements made in a positive tone with respect to the idea they suggested. This attitude can be seen even in cases of experienced setbacks during the realization phase of the idea. Positive examples of realized projects are also highlighted by the management team as "beacons" of the company's innovation management efforts. Consequently, "promoting" and "sanguinity" have a positive effect on employees' willingness to come up with novel and useful ideas, which is why we introduce the notion of a "virtuous circle" to describe this effect.

On the other hand, employees' willingness to contribute to the organization's innovation management efforts is negatively affected once other employees start denigrating them. As described before, the way management refuses to support an idea is at odds with the attempts to manage idea elaboration, making employees doubt the fairness and transparency of the decisions made by the review board. Employees may also start questioning the authenticity of the communicated need to be more innovative due to opposing statements from senior managers involved in implementation processes. For example, a senior manager commented on their company's innovation efforts:

> "*We can care about innovations once we are on track with our core business.*" (Participant observation)

In turn, employees may start to call into question both the attempts to manage championing ideas and idea elaboration. Through denigration, the authenticity of managerial attempts to manage idea elaboration is called into question, preventing employees from suggesting (future) ideas. Furthermore, refraining from ideas that have been developed according to the required standards fuels a negative attitude towards the rationale behind innovation management initiatives. Thus, employees perceive management's commitment to innovation and the call for creative ideas as mere lip service. We call this phenomenon a "vicious circle" to describe the de-authentication of practices in managing idea elaboration (which is fuelled by refrain from proposing ideas), which disincentivizes employees from suggesting new creative ideas.

5. Discussion and Conclusion

We shed light on the complexities inherent in the process of generating and developing creative ideas. In particular, we reveal distinct managerial practices where actors draw on internal complexities, as well as resource constraints, to steer the development of creative ideas. We further identify dysfunctionalities inherent in such processes and find that enacting practices is constitutive for a "climate" that impacts actors' willingness to participate in innovation projects, as well as to contribute their creative ideas in the future. Thereby, we show how managers foster or impede the development of creative ideas intentionally, and also unintentionally. We propose both a virtuous and vicious cycle to explain how managerial actions impact an organization's capability to innovate. Our paper aims to contribute to the advancement of theoretical and practical knowledge on creativity and innovation management as follows.

First, our study demonstrates the usefulness of a practice lens for advancing theoretical and practical knowledge on creativity and innovation management as proposed by Crossan and Apaydin (2010). Our findings show how the capability to innovate comes into being in and through managerial interactions, rather than just ascribing it to a firm based on its past successes in implementing new and useful ideas within the organization. In doing so, we shed light on the link between individual level interactions and organizational level outcomes. Thus, we show the dynamics of daily interactions and possible spirals they produce through reinforcing mechanisms. In this vein, we present distinct practices that are key drivers for the establishment of a "climate" (Andriopoulos, 2001) that is (non-)supportive for creative performance, and we propose a vicious and a virtuous cycle to explain the inherent dynamics of the process.

Second, we follow the call of several researchers (e.g. Harrison and Rouse, 2015) to pay closer attention to the (seemingly) mundane practices that foster or impede the invention and development of new ideas in organizations. In particular, we shed light on the contradiction between managerial talk (promoting creative ideas) and action (refraining from proposed ideas). While previous research looked at the consequences that managers experience from "de-coupling" talk and action (i.e. Schaefer, 2018), we examine the consequences on the employees' side, as well as the innovation management efforts that arise from managers' diverging statements and behaviours. Furthermore, while previous research by Harrison and Rouse (2015) showed the tactics that feedback givers and receivers use to develop creative prototypes, we shed light on the practices through which feedback impacts future creative performance, emphasizing the

limitations of institutional efforts to organize creativity.

Third, previous research highlighted that innovation consists of idea creation and implementation, the latter being a political process (Baer, 2012). By focusing on the practices along the idea journey proposed by Perry-Smith and Mannucci (2017), we combine the different phases and show how the political process impacts idea generation, and that even participation in idea systems may turn out to be perceived as political action. While several researchers showed under which circumstances actors are more or less willing to continue contributing with creative ideas when facing negative feedback or a rejection (Kim and Kim, 2019; Piezunka and Dahlander, 2019), we extend their research and propose that actors may also engage in political actions, and start de-legitimizing managerial efforts aimed at fostering innovation output.

In revealing practices that managers use in the context of creativity and innovation, we provide practical insights that can help organizations to improve their efforts in managing innovation processes. First, managers aware of the right practices and their effects can adapt their feedback behaviour to foster creativity and innovation within their team, and provide an organizational context that supports innovation. In particular, managers should pay attention that communication at different stages of the idea journey is coherent. In our case, highlighting the need for new and even radical ideas was at odds with the line of argumentation about why some proposed ideas were not realized. This, in turn, fuelled employees' doubts about the seriousness of management's efforts in fostering creativity and innovation.

Second, we recommend setting up organizational processes to facilitate open communication and allow for more flexibility in evaluating and developing creative ideas. In our case, employees had the feeling of entering unidirectional communication when engaging with the board where their ideas were finally evaluated. Although Perry-Smith and Mannucci (2017) conceptualize that idea generators may move back and forth between idea elaboration and idea championing, that is, convincing relevant people to release resources for idea implementation, our case shows that the attempt to manage creativity with designated stage gates of the idea journey, did not provide the flexibility to rework some of the ideas proposed so that they finally could pass the review board.

Regarding our empirical research design and results, our study faces some limitations, and points toward needs for future research. In particular, the design of a single case study is suitable for exploring the complexities in innovation management processes, but at the same time limits the generalizability of our study's results. Given a production facility as context for the study, where emphasis was on generating creative solutions to improve efficiency and effectiveness, we propose carrying out research in other suitable contexts, such as in product development departments or professional service firms. Furthermore, in this paper we tried to show how individual actions mount up to be constitutive for an organization's ability to come up with creative ideas by introducing the notion of a vicious and a virtuous circle. Future research might explore under which circumstances (new) employees, especially those who have not been previously involved in creativity management efforts, are more or less likely to be retracted by one or the other circle.

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Digital User Involvement in a Multi-Context Living Lab Environment

Lotta Haukipuro and Satu Väinämö

"*Digital IT creates a paradigm shift in role, responsibility, attitude, and aptitude.*"

Pearl Zhu
The Change Agent, CIO

This article provides new knowledge on the long-term use and value of a digital user involvement tool as a part of a living lab particularly in ICT, health and public service development contexts. Research has been carried out within the authentic living lab environment in 2011-2018. Empirical evidence is gathered from case living lab digital user involvement platform and activities conducted in multiple contexts. The primary source of information are the 70 in-depth interviews with the customer companies, public organizations and other stakeholders. The digital user community and user involvement tool-specific value for the development of products and services are a fast, easy and efficient user involvement regardless of time and location, tailored online methods based on the need of the customer, and the richness and quality of the end-user feedback.

1. Introduction

The significance of users in generating commercially feasible innovations has been recognized for decades, for example, von Hippel introduced the concept of User Innovation in the 80s (von Hippel, 1986; Herstatt and von Hippel, 1992). After the Open Innovation (OI) approach (Chesbrough, 2003) emerged in new service development, elaborate networks in which companies co-create to generate new products and services have been increasingly researched and established (Chesbrough and Appleyard, 2007; Chesbrough, Lettl and Ritter, 2018). The main shared thought in user innovation and open innovation approaches is an acknowledged need for external knowledge for innovation (West and Bogers, 2014). According to Wilkinson and De Angeli (2014) among others, the inclusion of users throughout the design process is crucial to the improved adoption of final solutions. They state that the examination of user needs has been prosperous in particular for the development of new products. The significance of open innovation and end-user involvement has been recognized also at the European Union level where the living labs strategy was established in the 2000s, and furthered with the promotion of open and collaborative innovation processes (Curley, 2016; Salmelin, 2016). According to a recent report from the European Union open innovation working group (ERAC, 2019), open innovation means that civil society, science, industry, and government work together in dynamic, diverse innovation ecosystems. The report suggests living labs as an example of innovation centres that are being established in universities and other public organizations.

The living lab approach, resting upon OI and user innovation paradigms, has been in the eye of scholars since the 2000s. According to Almirall et al. (2012), living labs are driven by two main ideas. Users are equal co-creators with other participants, and experimentation is conducted in real-world settings. Living labs are seen as an appropriate choice of innovation methodology when the fit of a particular technology or a set of technologies to a precise context is significant. A broad variety of slightly different living lab definitions can be found in the literature (see Leminen, 2015). In this article, a living lab refers to a network that integrates both user-centric research and open innovation (Leminen, Westerlund and Nyström, 2012), and where users and other relevant stakeholders are being involved in innovating and developing products and services in a real-life environment. Living labs are seen as a multidisciplinary research area with influences from innovation

management studies, among other fields. The main elements of a living lab are co-creation, exploration, experimentation and evaluation (ERAC, 2019), characterised by a multi-method approach and active user involvement (ENoLL, 2019).

There is still a need for further studies of living lab processes and methods (Følstad, 2008; Dell'Era and Landoni, 2014), and of their implementation as well as value, which prior research has not paid enough attention. Due to the temporary, pragmatic and heterogeneous nature of living lab initiatives, their impact evaluation typically stays on the descriptive level (Ballon, van Hoed and Schuurman, 2018). However, according to researchers, there is growing demand for long-term living lab studies that serve to help practitioners succeed in their living lab activities (Rosado et al., 2015; Westerlund, Leminen and Rajahonka, 2018). Hence, in order to foster innovation and to facilitate responsible innovations, it is of utmost significance to understand the value of the living lab approach. As globalization, digitalization and competition drive the dynamic pace of change in the modern world, disciplines focussing on innovation, including living labs, are not left without influence, as the role of digital tools in open innovation activities has been emphasized. Thus, the long-term study of a digital user involvement tool as part of a living lab brings novel knowledge. It regards the value of this type of tool, as well as methods for user involvement in product and service development in several contexts.

2. Digital User Involvement in Living Lab Environment

As a multi-method approach is characteristic of living labs, a broad variety of user involvement methods have been utilized in living lab activities. A living lab is both a concept and a methodology. It combines different types of research methods including traditional and ICT enabled methods (Tang et al., 2012; Tang and Hämäläinen, 2014). According to a literature review by Følstad (2008), the user involvement methods in living labs typically consist of ethnographic methods like observation as well as other methods such as interviews, questionnaires and focus groups. Although traditional methods have been perceived as suitable for at least some living lab studies, they have not demonstrated any major methodological advances.

While the possibilities from ICT have emerged, new technology-enabled innovation methods have also received growing attention. A shift from user-centric towards community-centric involvement has taken place, but there are still only a few studies regarding the potential of, for example, a digital living lab's user communities. Community interaction, commitment and co-creation to achieve positive results in digital user communities for innovation purposes are essential (Brandtzaeg et al., 2010). Veeckman et al. (2013), recommend that a living lab should have access to a specific group of users, since there is a often a time-consuming need to recruit users for each living lab activity. Furthermore, strong community support is needed to keep users motivated to participate in living lab activities. Innovation taking place through open innovation communities (West and Bogers, 2014), and user communities with the help of collaborative digital tools has been connected to great disruptive potential through cost- and time-saving in research and innovation activities (Brandtzaeg et al., 2010; Curley, 2016). Piller, Ihl and Vossen (2010) used the term 'customer community' to refer to Internet-based communities or virtual meeting places that are based upon shared enthusiasm and knowledge concerning products or services. They divided customer communities into product-related discussion forums, and communities of creation where novel ideas and concepts are formed. Digital user involvement and collaborative digital tools have become part of a common method used in living labs, nevertheless, long-term research about it is missing (Leminen and Westerlund, 2017). According to Ståhlbröst and Holst (2013), IT based tools and methodologies in living labs can function as twin-world mediators that facilitate an interconnection between real-world devices and their virtual counterparts. The activities carried out in online contexts are thus both real and realistic to actors. However, the literature on innovation system value based on digital user communities is still scarce (Arnkil et al., 2010; De Moor et al., 2010; Xie and Jia, 2016; Huang et al., 2018).

The case of a digital user involvement tool and user community

A digital user community and user involvement tool PATIO with over 1000 voluntary registered users has been utilised in the activities of a local living lab since 2011 (Anttiroiko 2016; Huang et al, 2018; Haukipuro, 2019). PATIO provides companies, organizations and research institutes an opportunity to participate in the development of products and services through an easy-to-deploy digital tool. The aim is to bring together product or service developers and potential users for product or service development or co-creation. Since 2011, more than one hundred different test projects or activities have been carried out using PATIO. The

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activity spectrum has varied from idea generation to evaluation and testing of, for instance, mobile applications, devices, or diverse public services, as well as field-specific solutions. The main methods of PATIO include *online discussion, surveys, user diaries* and an *evaluation jury*.

A typical activity in PATIO starts with identifying customer needs. Customers usually need test users for some product or service development-related activity, which they can conduct by themselves, or specialised living lab l services and methods for user involvement. Sometimes, the best way to collect user experience is a survey, in cases when there is a need for a large amount of responses or quantitative data. In contrast, interactive online discussions offer a well-working qualitative method for a public (open) or a selected (closed) group of users. The PATIO user diary, based on the diary study research method that is used to collect qualitative data about user behaviour, activity and experiences over time (Flaherty, 2016), has been used to collect the user experiences of, for example, a home-tested product or report a user's observations regarding a topic through user-sent pictures. User diary and survey contents are visible only to the user and PATIO moderator, whereas a forum discussion is visible to all accepted participants. PATIO activities can be set as public (anyone can see the content, but only registered users can comment on the forum), or private (only participants accepted by the moderator can see the content). After user studies have been implemented and data collected, the next step is to analyze and report the findings to the customer. Or, in case the customer will analyze the data themselves, the raw data are given to them.

Without a pool of registered users, PATIO would be a mere tool or collection of online methods. Thus, the importance of the user community cannot be overemphasized. The PATIO user community has been growing constantly from just a few active users in 2010 into an active community of more than one thousand users in 2018. The increase in the number of users has been recognized as a twofold phenomenon: attracting new users to register, arises from PATIO having interesting content (Laizane and Haukipuro, 2012; Huang et al., 2018). Thus, while the activities and topics in PATIO have been diverse, the user community is diverse as well.

The principle of PATIO is that users are anonymous to each other, and participate on a voluntary unpaid basis. Depending on activity, users can participate through an online discussion forum, where user identities are not revealed, but nick names are used, a survey, a user diary or various on-site activities such as user testing, focus group discussions or co-creation events. The online discussion in PATIO differs from a classic discussion forum. In PATIO, discussions are always moderated and led by a PATIO moderator(s), and preferably also by a customer representative. PATIO discussion topics can be opened by the moderators only, which makes the activities systematic and focused, yet enables interaction between users.

3. Methodology

The benefits of the case study approach have been recognized in different fields of qualitative research. Yin (1989, 2005) defines the case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used". The fundamental thought behind case research is the multifaceted view it can provide of a situation in its context (Halinen and Törnroos, 2005). The relation between a phenomenon and its context can be understood through the case study approach (Dubois and Gadde, 2002). Compared to the quantitative research approach, depth and comprehensiveness (Easton, 1995) are the defining characteristics of qualitative case research. Hence, the case study enables deep understanding of a specific phenomenon and is particularly suitable for exploration of a new or unique phenomenon (e.g. Eisenhardt, 1989).

Considering the nature of the living lab research environment from which the mainly qualitative research data were gathered, the case study design was regarded as an appropriate approach. The living lab network can be comparable to contemporary business networks, for which case study methods are recommended (Halinen and Törnroos, 2005). Furthermore, when aiming to increase understanding of a living lab environment and user-centric methods in different contexts, the study seeks to answer the "how" and "why" questions which are typical for case studies (Yin, 2005). Stake (1995) emphasized the advantages of case studies in terms of providing new insights for stakeholders, as a case study facilitates the investigation of a research subject in a real-life context.

The data collection methods utilized in this research consist of semi-structured in-depth interviews, discussions, meetings, meeting memos, workshop data, different documentation of activities, reports and a vast

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amount of data collected through the case's digital user involvement tool PATIO in 2011-2018. Additional project-specific data such as numerous meeting memos were available. Interviews (Arksey and Knight, 1999) were used as the primary data collection method, consisting of altogether 70 semi-structured in-depth interview sessions conducted in 2013-2018 with identified key informants such as customer company representatives, public sector service providers, researchers and other stakeholders. In several sessions, multiple informants were present. All interviews were recorded, transcribed, along with notes.

In the data analysis, triangulation (Golafshani, 2003), thematic analysis (e.g., Aronson, 1994), and categorization techniques were applied. Triangulation (Denzin, 1973), the use of multiple data collection and analysis methods to search for convergence (Golafshani, 2003), was applied. Data collection and data analysis were conducted concurrently as this helped identify gaps in the collected data (Miles and Huberman, 1994; Miles, Huberman and Saldaña, 2014).

4. Findings

The study contributes to the literature regarding citizen participation and living labs, and the development of efficient digital tools in this context. As previous research has not focused enough on citizen participation in innovation processes, the study contributes to this deficiency by showing how a digital user involvement tool and user community can involve end users in the needs of both the public sector and companies. The findings show that PATIO is an appropriate tool for reaching target-group specific users when compared with traditional user recruitment and involvement, which is often reported as time-consuming and costly. Thus, PATIO can be regarded as an effective tool for user involvement and citizen participation, that has proven to work well, in service and product development, and in city planning contexts. Overall, the findings and perceptions concerning PATIO have been mainly positive, hence supporting previous findings that regarded the feasibility of PATIO in the development of products and services. However, development ideas, such as new feature proposals for the PATIO system have also been brought up by customers.

Altogether, 1825 users have participated in the activities initiated or conducted in PATIO. In addition, for direct user recruitment types of activities, the exact number of participants recruited from the PATIO user community was not always known due to external contact points. Among the cases are 9 product, 27 application, and 35 service-related activities. The rest consist of non-categorized activities marked as “other”. The maturity of the products/services/application regarding 25 activities has been on the idea level, 35 on the concept level, 21 on the prototype level, and 18 on the market level, or otherwise ready or already existing solutions. In some cases, overlapping or multiple categories were applicable to these activities, for instance, in the eHealth user workshop PATIO activity, in which were involved the solutions of several companies, including both product and service ideas. The activities include 27 in which the customer was a startup or SME, 6 large enterprise owned activities, 46 research institute activities, and 31 public organization-driven activities. The relatively high number of research institute activities can be explained by the location of PATIO inside the University, as well as connection to several research projects. The duration of the activities ranged from a week to a year, however, the active phase was typically not more than two weeks. The activities' purpose is idea or feedback collection regarding a product, a service or an idea, user testing and user recruitment for varying purposes, typically a user study conducted by customer. There are also extensive user research activities that combine all the aforementioned purposes and utilize a broad variety of methods. Among the methods included in the PATIO system were online discussions in the PATIO forum (used in 60 activities), user diaries (used in 6 activities), an evaluation jury (3), and surveys (24), which can mean a survey implemented by PATIO or a survey implemented by a customer that was embedded in the PATIO survey page.

PATIO's context-specific use

The three main contexts in which PATIO has been used for digital user involvement are *ICT*, *health* and *public service development*. A large part of all activities conducted in PATIO have been ICT related, with user involvement in the development and testing of mobile applications and devices. PATIO has been tried to recruit users for testing, and also collecting user experience through surveys, user diaries and online discussions. For instance, ten local families tested a device in their homes and reported their use experience through the PATIO user diary. In another study, 25 selected participants used the user diary to report their use experience by mobile camera device. In both studies, surveys were also used. Hence, the customer companies received a large amount of rich data collected via multiple methods that could be used for further development of the products (Haukipuro, 2019).

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Table 1. PATIO activities in numbers

Number of activities (1/2011-6/2018)		**102**
Number of participants		1825
Type of solution being developed and tested	Application	27
	Product	9
	Service	35
	Other	31
Development phase of the solution	Idea	25
	Concept	35
	Prototype	21
	Existing product/service	18
Type of customer	Startup	27
	Large enterprise	6
	Public organisation	31
	Research institute	46
PATIO methods used in the activities	Online discussion	60
	Survey	24
	User diary	6
	Evaluation jury	3

Furthermore, in a 2018 activity conducted in PATIO, 36 users in total participated in the evaluation of a mobile application aimed at influencing public decision-making (Huang et al., 2018; Haukipuro, 2019). Characteristic for ICT-based development activities is that they are short-term and take place in certain phases of development, including user testing of a prototype or concept evaluation. According to customer feedback collected at the end of each activity, companies typically received improvement ideas, such as new feature proposals for their products, reports of bugs found in the software, usability issues, and overall feedback that has helped companies improve the quality of their products and solutions. In optimal cases, the user testing occurs before launch, when changes are still possible and cost-efficient to implement compared to after launching. This has been the case in most of the activities conducted, though there have been a few cases in which the results of user testing had a drastic and unwanted impact: a decision to terminate the tested product or solution (Haukipuro, 2019).

PATIO has been used for health-related user involvement in several activities such as developing eHealth product prototypes, and developing and testing health products, services and processes (Haukipuro, 2019). For example, PATIO was part of a new hospital innovation process where PATIO's evaluation jury feature was used in the evaluation of companies' development ideas and concepts within a hospital environment. Furthermore, PATIO was used for engaging health professionals and companies in digital co-creation through surveys and online discussion based on, for example, health product concepts and prototypes (Haukipuro, Väinämö and Hyrkäs, 2018). It was found that digital tools can be useful also in a traditional and hierarchy-based organization's innovation activities, although compared to other use environments, successfully using them requires a lot of preparation and guidance. These activities initiated a new, long-term hospital innovation procedure in which digital tools have a significant role.

PATIO has been part of *public service development* activities in the context of smart city development of virtual services and urban planning (Haukipuro, 2019). The online discussion forum and surveys were used to collect citizen insights on public services in different occasions. Virtual services utilized the PATIO discussion forum for two different purposes. First, a collection of general citizens insights towards virtual services was featured in a public discussion. Second, a separate discussion for the employees and the authorities providing services was organized. In the case of the new

city district development, the discussion forum and surveys were applied to engage citizens in urban planning. The citizen involvement process was repeated in several phases as the planning proceeded.

Summary of the main value of PATIO
The findings rely on the case studies and the empirical data collected in 2011-2018 in diverse living lab activities. The categories were decided after analysing the information collected from customers and other stakeholders, and through knowledge and know-how gained from the use of the PATIO tool for different purposes. To summarize the findings regarding the digital user community and user involvement tool PATIO in the development of products and services, the main value of PATIO for public and private sector customers can be summarised with eight categories:

Cost-efficiency refers to resource savings as customers make use of PATIO as a cost-effective tool for user recruitment, user testing, and moderation. For example, user recruitment is often regarded as a time-consuming and costly task, especially for small companies. The PATIO tool tackles this challenge by enabling easy and fast user recruitment. Target-group-specific users can be found without much effort from the database.

Customers also value PATIO's *timing & flexibility* as it enables iterative product or service development in different phases, such as the idea phase, concept phase, and prototype phase. Methods can be tailored according to the needs of the customer, for example, in-depth online discussion or a user diary is perceived as valuable by some customers, whereas a survey is preferred on other occasions.

Ease of use; PATIO is perceived as easy to use by customer organization representatives who have actively participated in the moderation of online activities. The use of the tool does not require any specific technical skills.

Customers have been satisfied with *the quality of the results* obtained from PATIO activities. The choice of which methods to use in order to achieve good results requires expertise. As PATIO activities are mostly facilitated and planned by experts, the quality of results is perceived as good. One user diary by a researcher was perceived to help keep the activity focused. Multiple methods and a diverse user community tend to produce rich data. Especially moderated in-depth online discussions may provide valuable information regarding the everyday life of citizens. *Fast and easy user involvement*, user recruitment, user screening and feedback collection are PATIO's main asset. Users can be recruited for online activities, on-site user testing, or a combination of both. Users can be easily reached for discussion online after on-site user testing when needed. PATIO's user community consists of people with diverse backgrounds: students, technology enthusiasts, elderly people, and professionals.

Open & closed participation is enabled in PATIO through open (public) activities, such as online discussion that anyone can view (even if not registered) and contribute to (when registered), and closed (private) activities to which users willing to participate are selected through certain criteria provided by customers. Each way of participating has its advantages: open activity can be seen to increase information and visibility of a certain theme such as city planning, whereas closed activity is perceived to increase the commitment of public sector employees, serving as a virtual meeting place for employees that might be located far away from each other, and enable easy in-depth data collection.

PATIO's *multi-method approach* is also valuable for customers. The main methods are online discussion (open or closed), surveys and user diaries. An evaluation jury as a method is tailored for easy and anonymous involvement of professionals and others for various evaluation purposes, irregardless time and place. Each method can be used individually, or all can be used together within the same activity. The methods are tailored based on customer needs, which ensures quality results. The use of multiple methods can also increase the reliability of results through parallel findings via different methods.

PATIO also supports *sustainability* through time and place independence, which is important for customers whose aim is to provide virtual meeting places, for employees or organizations to have an evaluation jury in PATIO, or to enable international user involvement encompassing environmental sustainability.

5. Discussion

Considering the under-researched area of digital user involvement within living lab environments, this article provides new knowledge that builds on long-term data from living lab activities in several contexts, such as ICT, health and public service development. The activities conducted in these areas show that there are some differences, for example, that ICT related user involvement activities typically are short-term, and

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usually take place in a certain phase of development such as prototype testing. In health and public service development contexts, the activities have been long-term user involvement repeated in different phases of development, for example, in city planning. The applicability of a digital user involvement tool and methods also differs within contexts. In particular, the health context differed from other contexts, in that the use of the digital tool and methods as a part of innovation activities required more preparation and guidance. However, regardless of the context, digital user involvement furthered product and service development.

The wide-ranging empirical data collected through PATIO from different types of customers and living lab activities has provided new knowledge about the use, applicability and value of this type of digital tool as part of a living lab. The findings show the value of PATIO as an easy, cost- and resource-effective way to involve users in various development activities, through a multi-method approach. From the local ecosystem perspective, PATIO has played an important role in the promotion of user-centric development practices among local businesses and the public sector because, among other reasons, PATIO has provided companies and organizations with a new, easy and efficient way to promote and carry out user-centric development activities facilitated by local living labs. Presumably, user testing, online discussions, surveys, and other user and citizen involvement activities conducted through PATIO have influenced the development of usable, desirable, and successful products and services. A combination of user community management and data collection through several methods differentiates PATIO from typical user involvement tools such as surveys posted to email lists. Figure 1 depicts the PATIO model for digital user involvement.

Based on the experience and numerous studies conducted using PATIO, the right timing has been recognized as important when conducting activities; the earlier the feedback is collected, the easier it is to consider end-user feedback and apply it, for example, with modifications to products or services. However, experience with PATIO activities conducted too early shows that in an activity where the aim was to collect feedback on healthcare product concepts from hospital professionals, feedback was not beneficial from the development point of view, as the product concept was not mature enough. One of PATIO's identified strengths is the results quality as it enables collection of in-depth user experiences through a multi-method approach, facilitated by the living lab. Based on customer interviews, feedback and data collected from more than 100 activities conducted in PATIO, the few customers who were not pleased with the results had considered PATIO as merely a survey tool for reaching the masses, whereas customers who obtained qualitative in-depth data were most satisfied with the results. Hence, the change of attitude also requires clarifying this essential difference between basic online survey tools, discussion

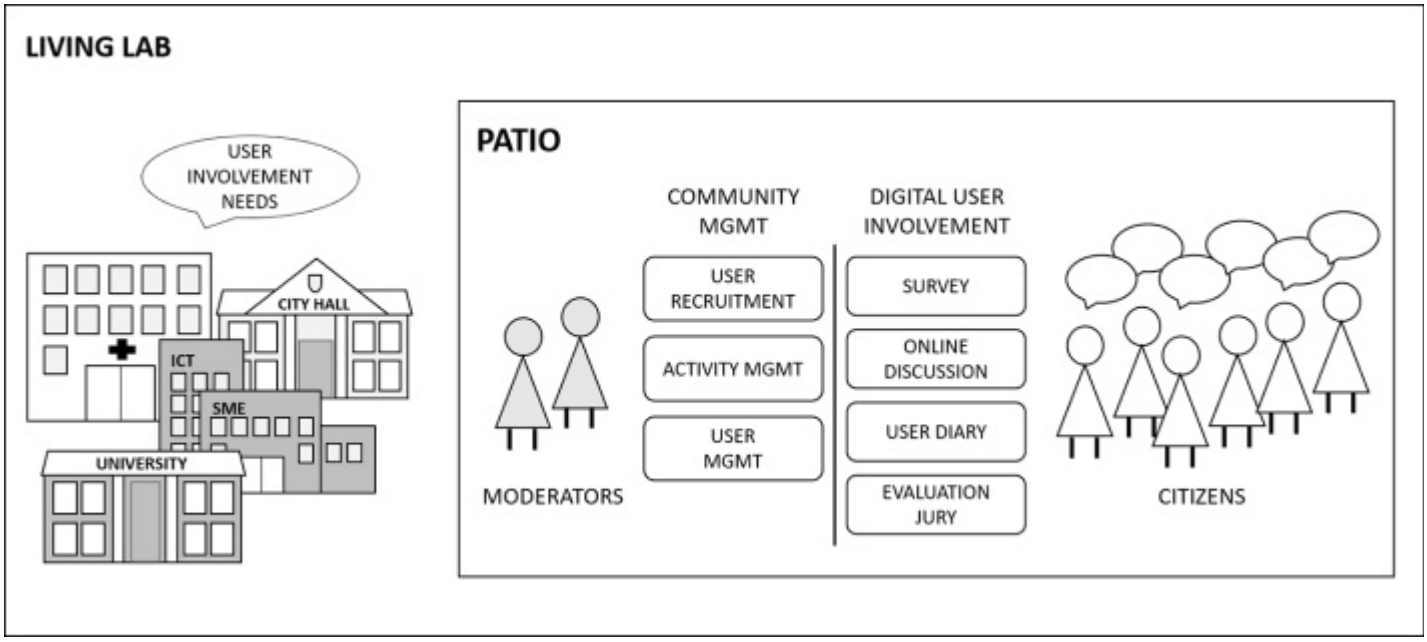

Figure 1. The PATIO digital user involvement model.

forums or social media. We discovered that PATIO's main asset, its user community, consists of diverse, motivated people who are willing to participate and devote time for evaluating and testing products and services. Fostering community vitality and development through providing and promoting diverse living lab activities is especially important as the diverse and active user community is crucial for the vitality of PATIO and on a larger scale, the whole living lab.

Considering the under-researched area of collaborative digital innovation tools (De Moor et al., 2010; West and Bogers, 2014; Leminen and Westerlund, 2017) that can have a significant role in living labs in the increasingly digitalized world, findings regarding the long-term use of this type of tool are significant for researchers as well as practice-oriented living lab stakeholders and customers. Novel long-term knowledge acquisition regarding user involvement in living lab activities through PATIO contributes to research on living lab practices (e.g. Veeckman et al., 2013; Schuurman et al., 2016) in terms of increasing our understanding of the value of these types of tools and methods in enhancing living lab practices. The findings show that early involvement of end-users and stakeholders can save resources and costs, and enhance the quality of products and services. Managers should utilize user-centric development services provided by living labs to ensure their products or services meet the needs of target group customers. The findings also provide information for managers regarding, online user involvement methods. According to the findings, online methods should be utilized for solutions mature enough (at least at the concept-level) in order to obtain best results. Furthermore, the facilitation of online involvement requires a kind of expertise that companies often do not possess. Thus, a living lab's expertise is recommended to be utilized for online user involvement activities. To conclude, we believe that end-user and citizen involvement in different product and service development activities through the living lab approach should become rather a normal, common and continuous practice, rather than just a temporary experiment.

6. Conclusions

This article presented several benefits of digital user involvement in a living lab environment. Based on the findings, digital user community and user involvement tool-specific benefits for developing products and services can be summarized as fast, easy and efficient user involvement, regardless of time and location, tailored online methods based on the need of the customer, and rich quality of end-user feedback. In more detail, the PATIO-specific value categories are identified as *Cost-efficiency, Timing & flexibility, Ease of use, Quality of the results, User involvement, Open & closed participation, Multi-method approach* and *Sustainability*. According to the findings, online methods should be utilized for solutions mature enough (e.g. concept-level) in order to obtain best results. (Duplicated in previous paragraph)

As the need for user involvement knowledge and practices in product and service development activities has been raised among companies, public service developers and researchers, this article responds to this need by providing new knowledge on the long-term use and value of a digital user involvement tool as part of a living lab. The findings of the study encourage managers to utilize the services provided by living labs in order to ensure the use of appropriate living lab methods and tools to obtain the best results. Furthermore, the study stresses the value of end-user involvement for companies at the correct phases of product and service development.

The long-term experience and results of using this type of tool in product and service development activities shows that the combination of an active user community and tailored online methods makes user involvement smooth, easy and adaptable to a diverse context such as ICT, health and public service development activities. Findings of the study promote the use of digital user involvement mechanisms in daily living lab activities. However, as this study focused on the customer perspective, further research taking into account the end-user and facilitator perspective is also needed, regarding how to maintain, manage and motivate a user community, and how to select the most suitable online methods for each environment and activity to achieve the best results. Accordingly, the long-term impact of this type of tool and methods (e.g. for customer companies) should be researched further through follow-up studies within a certain time period.

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Appendix - Key concepts

Context here means the interrelated conditions in which something exists or occurs (Merriam-Webster, 2018).

Customer value defined by Woodruff (1997) is "a customer's perceived preference for and evaluation of those product attributes, attribute performances, and consequences arising from use that facilitate (or block) achieving the customer's goals and purposes in use situations".

ICT refers to Information and Communications Technology.

Innovation refers here to the definition by Skillicorn (2016): "Executing an idea, which addresses a specific challenge and achieves value for both the company and customer."

Living lab is "a network that integrates both user-centric research and open innovation" (Leminen et al., 2012), and where users and other relevant stakeholders are involved to innovate and develop products and services in a real-life environment.

Living lab approach refers here to the use of living lab methods and tools in the development of products and services.

Open innovation (OI) refers to innovation in which a company's outside innovation sources are taken advantage of: "The use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (Chesbrough et al., 2006: 1).

SME (Small and Medium-sized Enterprise) is defined according to EU recommendation (European Commission, 2003), i.e., by the number of employees (<250), turnover (<50€million), and balance sheet total (<43€million).

User involvement refers here to product or service development activities, in which end-users are considered co-developers through various methods. The central notion in the research of user involvement means moving users from being objects of research to become active participants.

User-centric development adopts the principles of user-centered / user-centred design (User-Centred Design, 2009), considering all phases of the product life cycle, including users and use contexts of activities, such as prototyping, implementation and testing. The objective of user-centric development can be both improving an existing product and developing new products.

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Beyond the Hype: A Bibliometric Analysis Deconstructing Research on Digitalization

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> *"Taxonomy is described sometimes as a science and sometimes as an art, but really it's a battleground."*
>
> Bill Bryson
> Author

The accelerating emergent field of research addressing digitalization and related topics is complex, unstructured and hyped. Consequently, both research and practice lack a rigorous foundation of prior published research to underpin and direct future exploration into the opportunities and challenges provided by these exciting new digital technologies. This study employed a bibliometric analysis to explore extant published research within the digitalization field. We identified key articles that have enabled us to distinguish between interrelated digitalization concepts. Subsequently, we propose a taxonomy with characteristics for different levels of digitalization. The taxonomy contributes dimensions that create different commercial and organizational opportunities and challenges at various levels. The taxonomy offers a vantage point for subsequent empirical and conceptual research to extend insights on related digitalization themes, and especially those related to innovation and strategy decisions on scalability, automation, channel selection and connectivity.

1. Introduction

Anything relating to digitalization is certainly in vogue these days, and academic research is in fast pursuit. Currently, much of the research in this area is explanatory or conceptual, and not empirical, and exists in case studies that are spread across different disciplines (for example, strategy, management, innovation, and informatics). An initial search on Google Scholar reveals an overwhelming amount of suggested articles for search terms, such as: "digitalization" with 58,100 links, "digital disruption" with 5,570 links, or "digital transformation" with 25,500 links. In addition to this abundance of published research, much attention is now on digital technology developments driven by technology vendors. Reports describe new types of digital technologies such as: Internet of Things (IoT), machine learning (ML) and artificial intelligence (AI), virtual and augmented reality (VR and AR), or blockchain, to mention a few. A number of reports, for instance by consultancy firms, also give speculative estimates of the numbers of workers that will be affected by these technologies. In short, the accelerating emergent field of research that addresses "digitalization" and related topics is complex, unstructured and hyped. Consequently, both research and practice lack a rigorous foundation of prior published research to underpin and direct future exploration into the new digital technologies.

A prerequisite condition to obtain a clearer picture of the contemporary phenomenon of digitalization is to achieve an overview of it, that goes beyond the current hype. There is a need to extend prior research that attempted to provide conceptual clarifications (e.g. Nambisan et al, 2017; Yoo et al., 2012; Yoo et al., 2010) and a uniform definition and taxonomy of the multiple and interrelated terms used in current digitalization research. The ambition of this paper is therefore to address the following research question: *How can the concept of digitalization be framed into a rigorous conceptual foundation that can support research and practice alike?*

To explore the research question we employed a structured literature search to extract a final search database that could be used for bibliometric analysis, and to identify key articles for content analysis. The search resulted in an initial sample of 1307 articles, which were reduced to 197 for our bibliometric analysis, thus resulting in a final sample of 18 articles upon which we conducted content analysis. Moreover, we utilized bibliometric analysis to identify key articles that enabled us to distinguish between digitalization concepts. On this basis we are now able to propose a basic taxonomy. This taxonomy includes different levels of digitalization, relating to several dimensions that create varied organizational and commercial opportunities and challenges. The taxonomy offers a vantage point for

subsequent empirical and conceptual research to extend insights on related digitalization themes, especially related to innovation and strategy decisions on scalability, automation, channel selection and connectivity.

2. Theory

McAfee (2009) refer to "digitalization" as the pace of change in society driven by digital technological development, involving multiple technologies at different stages of maturity that will converge and create new technologies. There exists no established consensus framework within digitalization theory. While digitalization has been a topic in information systems research for decades, the current wave of digitalization is different, according to Legner et al. (2017): it is driven by us. This calls for a broader field of research to merge efforts that deal with the complexity of this development, and to further our understanding of the impact of digitalization, and its potential societal, organizational and commercial implications. Similar to Legner et al., Brenner et al. (2014) argue that the power unlocked in information technology (IT) is shifting to users who are increasingly expecting sophisticated digital services and products.

The increasing expectations from users and the rapid innovation of IT within the last three decades is putting pressure on leaders in commercial and public organizations that are being challenged by disruptive start-ups, calling for a better understanding of how different levels of digitalization will impact their business. IT innovation has come along with the development of new systems, software applications and standards that support and shape business activities in various ways, many that are forcing organizations to deal with an increasing amount of data, and acting in complex and growing networks (Heilig et al., 2017). This environment of continuing technological change, according to Heilig, Lalla-Ruiz and Voß (2017), may require or even promote shifts in organizational structures, processes, and strategies. This further underpins the need for structuring digitalization research especially in regards to organizational impact. Additionally, while some argue technological advances drives digitalization, Kane et al. (2015) conducted research wherein they suggest that strategy, not technology, drives DT. They found that maturing digital businesses are focused on integrating digital technologies in the service of transforming how their businesses work, and that talent engagement and business model innovations have a clear digital strategy in organizations where digital technologies have transformed processes (Kane et al., 2015). Correspondingly, there is an increasing acknowledgement of the important organizational implications of digitalization emerging within both research fields of information systems and organization science (e.g. Lyytinen et al., 2016; Nambisan et al., 2017; Tilson et al., 2010; Yoo et al., 2010). However, extant digitalization research remains fragmented, and a majority of studies remain focused on technological complexity, rather than with understanding the organizational complexity in which technology is implemented and utilized (Andal-Ancion et al., 2003).

Moreover, there exists a plethora of interrelated terms, such as digization, digitization, digitalization and DT (Negroponte, 2015). Researchers have defined the terms digitization, digitalization and digital transformation in previous research (Loebbecke & Picot, 2015; Negroponte, 1995; Aron & Waller, 2014; Andal-Ancion et al., 2003). However, these terms are applied differently in different studies and are suggested to address everything from stages (Loebbecke & Picot, 2015) in the development of different applications and types of digital technology, to the ambition underpinning the utilization of these technologies. Furthermore, there exists no clarity regarding which concept is appropriate to use for describing each different digital process, and the benefit this process seeks to achieve. Indeed, there are several conceptualizations of each term, and to date no consensus exists on the different levels of digitalization. Also related is the term "disruption", which refers to a situation where existing companies are substituted or replaced by new ones (Bradley et al., 2015).

While the Industrial Revolution in the late eighteenth century relieved manual labour, the second machine age of the current era, with computers and other digital advances are predicted to relieve cognitive tasks (Brynjolfsson & McAfee, 2014). Recently, several waves of advances in digital technology have fundamentally transformed business and society, contributing to the complexity of the field (Legner et al., 2017). The first wave focused on converting analogue to digital information, leading to higher automation in work routines. The second wave established the Internet as a global communications infrastructure, resulting in, for example, changes in a firm's value creation logic, along with new types of businesses. The third wave, which we are experiencing today, involves converging SMAC (social, mobile, analytics, and cloud) technologies that have brought the vision of omnipresent computing much closer to reality. Moreover, digitalization is constituted by a variety of emerging technologies at different stages of maturity and market acceptance. It has been

suggested that these will converge and mutually strengthen each other in a kind of digital revolution (Manyika et al., 2013).

Notably, two main dimensions have been identified to enable comprehending the different emerging types of technology (Brynjolfsson & McAfee, 2014). First, increased machine power, including emerging technologies such as AI, big data, augmented reality, advanced robotics, autonomous vehicles and 3D-printing. Second, increased connectivity, including technologies such as mobile internet, social media, audion and video conferencing, IoT, cloud and fog, as well as blockchain. The combined effect of all of these emerging technologies on employees, customers and organizations is as of yet unknown. All of these technologies are assumed to have large consequences for firms in marketing and business model innovations (BM) (Ng & Wakenshaw, 2017). Similar to the widely accepted assumption that these technologies in combination are likely to have a considerable impact on expert based businesses (Jesuthasan, et al., 2016), existing research has also pointed to professional service firms as a type of business where the impact of digitalization will be greatest (Manyika et al., 2013; Zott & Amit, 2017). This also elucidates how digitalisation, with related themes such as digital disruption and digital transformation (DT), requires conceptual clarification that attends to the contextual complexities associated with utilizing digital technologies in different industries. Accordingly, there is a need for extending prior research based on a taxonomy that helps clarify how digital strategy and digital innovation can be practised across different industries, beyond the current conception of digitalization as a homogeneous phenomenon.

Consequently, we see a pressing need to take stock of the body of current published research addressing the organizational implications of digitalization, and related terms, placing a specific emphasis on how different concepts are characterised, as well as describing the relationship between terms.

3. Methods

We employ science mapping from the discipline of bibliometrics with the aim to provide a systematic and thorough review of digitalization research, specifically related to disruption and transformation. Bibliometrics refer to *"the collection, the handling, and the analysis of quantitative bibliographic data, derived from scientific publications"* (Verbeek et al., 2002: 181). A systematic review adopts a replicable, scientific, and transparent process based on the theoretical synthesis of existing studies, thus differing from general reviews (Cook et al., 1997). Structural reviews allow us to, 1) examine relations between topic areas, and 2) use some form of quantification to shortly compile a large amount of literature (Porter, et al., 2002). While the common research paper cites around twenty references, providing an incomplete picture of the research context, a broad literature scan can, according to Porter, Kongthon, and Lu (2002: 351) *"extend the span of science by better linking efforts across research domains. Topical relationships, research trends, and complementary capabilities can be discovered, thereby facilitating research projects"*. In addition, as structural reviews to some degree employ a form of quantification and objective analysis, such reviews *"improve the review process by synthesizing research in a systematic, transparent and reproducible manner"* (Tranfield, et al., 2003: 207). Thus, structural reviews help overcome one of the traditional review paper's limitations: its lack of rigour.

To provide an objective and systematic review of the literature containing keywords of both one or more of the concepts digit* and either transform* or disrupt*, we employed the VOSviewer science mapping framework (Van Eck et al., 2010; Van Eck & Waltman, 2014). By using VOSviewer science mapping, we were able to examine in rich detail the intellectual content and structure of research on digitalization concepts linked with transformation and/or disruption. Further we employed content analysis to a selection of papers from our final search database, selecting the papers based on both traditional and bibliometric criteria. The content analysis allowed us to make replicable and valid conjectures by interpreting the textual material.

3.1 Sample

A four-stage process was used to identify papers for analysis. First, we searched Web of Science (WoS) for articles using the search string Title=((Digit* AND Transform*) OR (Digit* AND Disrupt*)), thereby identifying 1,307 papers. Second, we excluded only 2019 from the publishing year, keeping all whole years to retain potential developments in the field. Third, we included articles, proceedings papers, book reviews, reviews, book chapters, and editorial material. Fourth, we systematically excluded research categories in WoS that did not contain information about the concepts of digitization, digitalization or DT, thus removing categories focusing on technology description and specifications, rather than digital change. To assess categories relevant to answer our research question, we applied three selection methods based on the number

of articles within each category. For categories with 30 or more papers, we performed a bibliographic co-occurrence analysis using a threshold of 5 to identify relevant keywords. Analysing the clusters in each category revealed if articles focused on technological attributes or digitalization concepts. Further, to ensure that high-impact articles within categories that were discarded by the bibliometric analysis were not overlooked, we read the abstracts of the 20 most cited papers for each category. Finally, for categories with less than 30 results, we read the abstract of all papers to assess their relevance. Our final literature search downloaded from WoS following the four step process contained 197 papers.

The same process was performed with a topic search using the same criteria as described above. In this case, clusters from analysing the resulting database revealed keywords mainly related to hardware attributes of technology. Abstract readings further confirmed that the papers in the database mainly described usage of different technologies. Thus, as initial analysis suggested a title search would make us better equipped to answer our research question, we chose to build our paper on a title sample that resulted in a final search database containing 197 papers.

3.2 Analysis

The analysis was threefold. First, we performed a descriptive analysis of our final search database to ascertain the history of the field, and its development within journals and disciplines. The purpose was both to identify which disciplines drive digit* research, and to assess the distribution and impact of the various journals. To gain insight into emerging concepts and conceptualization within disciplines, we studied how terms have changed over time, and across journal categories. Second, we did a bibliometric analysis of the final search database in order to classify the relevant keyword clusters for each of the digit* concepts, and to categorize the disciplines associated with the terms. This analysis further enabled us to discover the development of keyword clusters over time, identifying emerging and trending "hot" concepts. Finally, it enabled us to pinpoint the most cited papers and thus helped us learn which main disciplines are referenced in our final search database papers. The bibliometric analysis was also conducted to contribute to literature review by identifying the most influential articles, using a content analysis of the 18 most relevant papers (see Appendix I). This related to our research to identify any conformity and contrast among the digitalization concepts.

3.2.1 Descriptive analysis

For the descriptive analysis, we used a final search database and converted this into an Excel file. We added a column for journal category (i.e. People and Organization, Strategy, Technology and IT, Business, Cross-disciplinary work, Economy, Law, Library and archival science and Management), and a column for the "digitalization" concept, both populated manually. Assessment of appropriate value for the journal column was based on the journal's discipline, which was addressed by visiting each journal's website. The appropriate value for the digitalization column was based on three factors: paper title, keywords, and abstract. When all columns were populated with values, the Excel sheet was connected to Microsoft's analytical service Power BI for data visualization.

3.2.2 Bibliometric analysis

To obtain a better overview of the identified articles, we saved all 197 articles in one file, thus permitting a thorough bibliometric analysis (Markoulli et al., 2017). To conduct the analysis we applied the VOSviewer software and identified clusters of interrelated digit* articles. We created a Thesaurus file to combine similar words with different spellings, where, for example, the label "Business models" was replaced by "Business model". This was done to ensure more trustworthy clusters. General terms like "Transformation" were not combined with "Digital transformation", as these grasp broader than digital change specifically. Thesaurus was also used for the co-citation analysis, but with the intention to make each point in the clusters more intuitive and the map easier to read visually. Co-citation and Co-occurrence analyses were conducted to compute the relevance of keywords and citations between them, and bibliographic coupling was conducted to find the most influential articles within the final search database. The discipline category for each cluster was identified by doing an Eigenvector Centrality (EC) analysis in Gephi for both the co-occurrence and co-citation separately. The GML files was imported to Gephi with graph type "undirected", indicating that papers are not necessarily referring to each other both ways.

3.2.3 Content analysis

To ensure for relevance and identify the unit for further literature review, we did a three step-process to make a selection from the set of 197 articles. First, we read the abstract of all articles to ensure thematic relevance, and selected the ones that informed or defined the phenomenon of digit* terms. During the reading, articles were scored based on their relevance related to

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the research question, on the following scale: (A) Relevant; (B) Borderline Relevant; and (C) Irrelevant. During this process the papers that didn't contain concepts of digital change were discarded as irrelevant, for example, papers with a core focus on hardware and technological attributes. Second, to ensure papers in our content analysis were based on purely objective criteria, the five articles with the highest citation score, as well as the five papers with the highest EC (that is, network centrality) were included. EC measures approximate importance of each node in the graph, and the core idea in EC is that an important node usually is connected to important neighbours (Wang et al., 2012). Thus, it identifies relevant articles in the final search database with the assumption that each node's centrality is the sum of the centrality values of the nodes it is connected to. To calculate the EC we did a bibliographic coupling analysis in VOSviewer with "Documents" as the unit of analysis, saved the resulting map as a GML file, and imported it to Gephi to complete the analysis. The selection result included 18 out of 197 papers. Of the top five cited papers, four overlapped with the fifteen retrieved from abstract readings. Further, of the top five papers retrieved from EC, two overlapped with the 15 retrieved from the reading of abstracts. For details about the 18 selected articles included in the content analysis, please see Appendix I.

The content analysis was conducted by reading and assessing the 18 papers identified through the three selection criteria. We read all papers and coded them in Excel to provide an overview of how each paper described the respective digit* concept and how the purpose of it was defined. Further, the content analysis was split by collecting information from all digitization-, digitalization-, and DT papers in separate tables to easier identify the content and common features of each concept.

4. Findings

Overall, our study reveals that there has been an exponential growth in published digi* themed papers over time, a trend indicating that there might be several research papers in progress and in proceedings (figure 1).

Moreover, a majority of these papers are published in lower ranked journals, indicating that research on digital change is primarily represented in smaller and niche journals. The journals are spread across nine different categories, where the strategy category only includes two papers. As strategy is a highly relevant aspect of the digitalization process, the lack of strategy journals writing about these changes indicate that research still remains in its incipient stage (figure 2). We have categorized journals based on subjective criteria, which could be considered a limitation of our data material. Further, the categorization of journals into digital concepts was based on title, abstract, and keyword only, which could be a source of error.

The co-citation analysis we did revealed that there were four different disciplines that most papers referred to, in which method was one of them. Moreover, 30 of the papers in our final search database had citations to qualitative method sources (figure 3), and none to quantitative method sources. This may further indicate

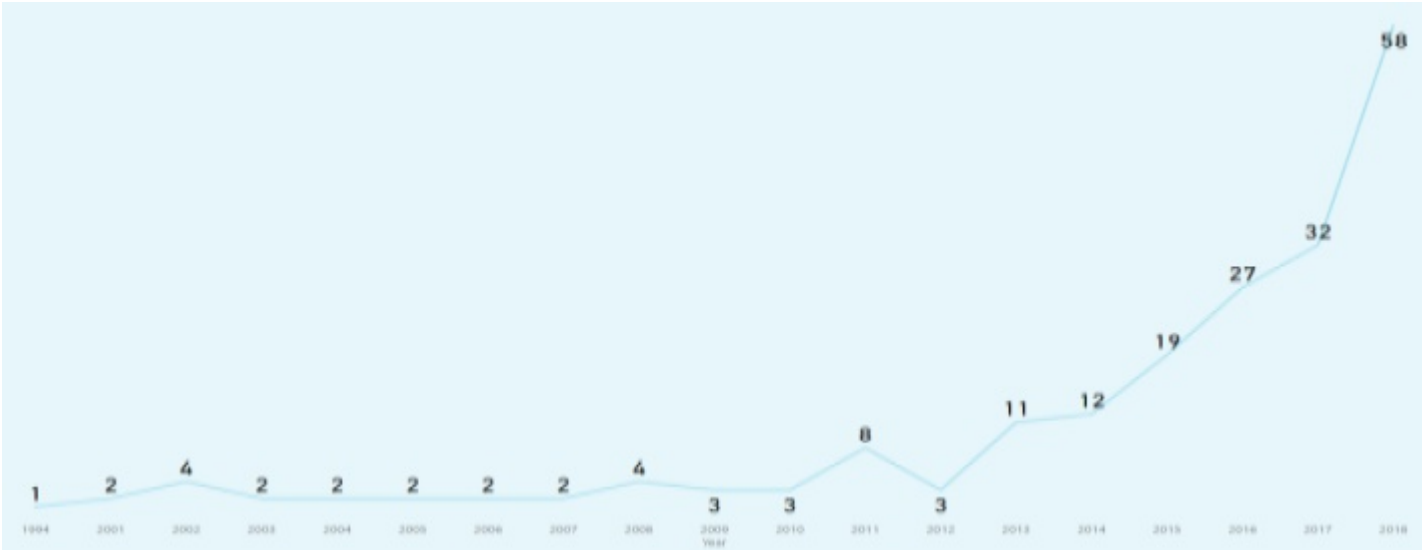

Figure 1. Development in publications per year (N=197 papers)

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	Q1	Q2	Q3	Q4	Q0	Total
1994				1		1
2001		1		1		2
2002			1	1	2	4
2003	1			1		2
2004	1	1				2
2005	1				1	2
2006		1			1	2
2007					2	2
2008	2	1	1			4
2009	1	1			1	3
2010	3					3
2011	4			1	3	8
2012				1	2	3
2013	7	1	1		2	11
2014	6	2	1		3	12
2015	5	2	2	1	9	19
2016	9	4	2	3	9	27
2017	9	4	2	1	16	32
2018	13	9	8	2	26	58
Total	**62**	**27**	**18**	**13**	**77**	**197**

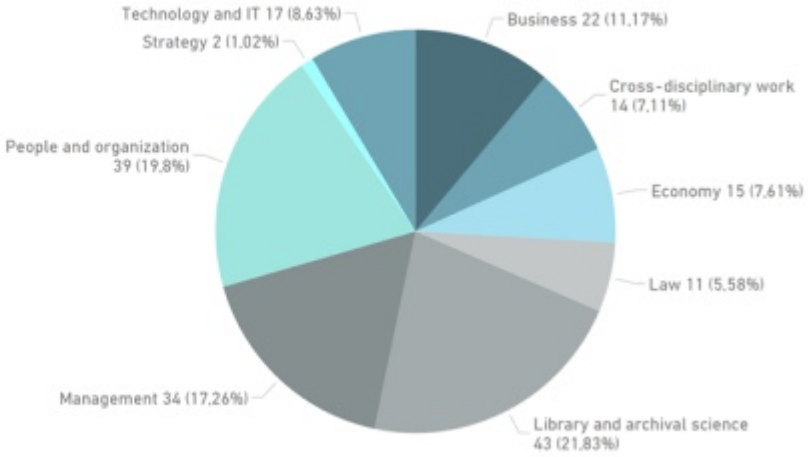

Figure 2. Publication percentage within each SJR category per year

that the research on digitalization is at a young and growing stage.

4.1 Digitization

The content analysis revealed a broad consensus on digitization primarily revolving around converting analogue information to digital with the purpose of achieving cost and efficiency goals (see e.g. Bhimani & Willcocks, 2014; Desai, 2013; Gaigher et al., 2014; Heilig, et al., 2017; Janowski, 2015; Moreau, 2013; Schallmo et al., 2017; Valenduc & Vendramin, 2017).This is consistent with the findings of bibliometric analysis that disclosed relations between 'digitization' and "Technology". Further, digitization connects with "Organization", "Innovation", and "Management", which also can be explained by findings in content analysis. For example, we find some authors go beyond describing the concept of digitization as a conversion method for storage and information purposes, and rather focus on internal organizational processes at the activities level where it may be used for management purposes by structuring large amounts of data for business, and is seen as a tool to facilitate cost reduction and process automation. Some further describe digitization as a step in the DT process, viewing digitization as a disruptive change through making digitized products available, and thus affecting parts of the BM and organizational strategy. The content analysis thereby substantiates the findings in our bibliometric co-occurrence analysis (figure 4).

The connection between "digitization" and "Digital transformation" may also be explained by the descriptive analysis, in which most of the papers included in the "Library and archival science" journal category revolved around digitization and DT. This

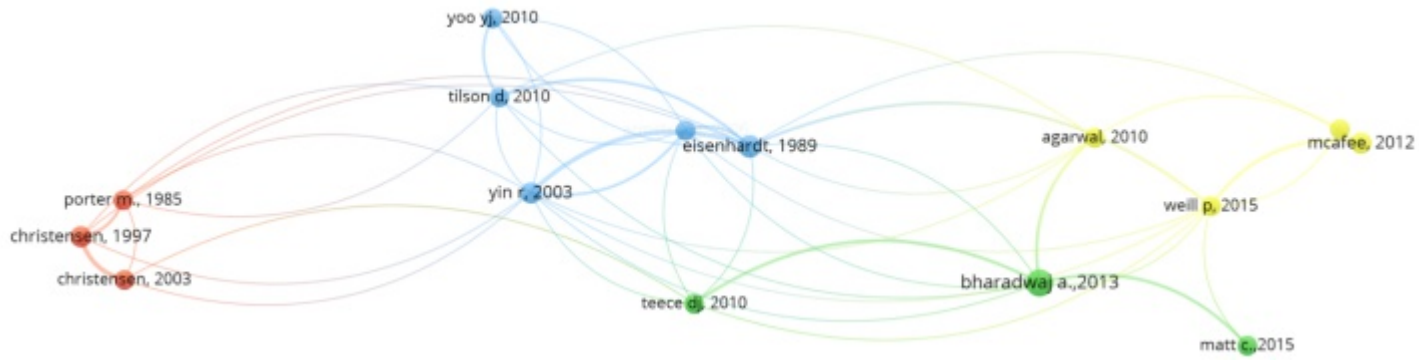

Figure 3. VoS-Viewer map showing co-citation analysis cluster

business area traditionally has large amounts of analogue information, and will naturally be affected by digital storage and information sharing opportunities through technological advancements. This may also facilitate value creation, and fundamentally transform BM innovation opportunities. Finally, while a large and consistent number of publications on digitization has accrued, it appears digitization is not a 'hot topic' in digitalization research at this time, as it peaked in February 2016. This may be explained by the large percentage growth in digitalization and DT research in recent years, as digitization is described as a tool in these processes.

4.2 Digitalization

According to findings in the content analysis, digitalization is closely related to the concept of digitization. However, authors commonly argue that digitalization goes beyond shifting from analogue to digital information. Digitization can be seen as a part of the digitalization process, where authors describe this level of digitalization as, for example, a sociotechnical process of applying digitizing techniques to a broader social and institutional context, and as a change at the process level through changing organizational structures, internal interactions, and transactions with customers and stakeholders (see e.g. Heilig et al., 2017; Hänninen et al, 2018; Stoeckli et al., 2018; Valenduc & Vendramin, 2017). This information points to findings in the co-occurrence analysis, where "Technology", "Big data", "Strategy", "Performance" and "Information Technology" relate to digitalization. Further, "Business model" and "Digital transformation" are closely related to digitalization, and findings in the content analysis suggest that digitalization is a tool for BM innovation, as it can contribute to a shift from product to service based BMs, which substantiates the findings in our bibliometric co-occurrence analysis. The content analysis also uncovered that while digitalization, like digitization, focuses on cost and efficiency opportunities, it also revolves around social changes in markets and the workforce, and may facilitate for network and value opportunities.

The descriptive analysis revealed that digitalization is evenly distributed across all journal categories, except

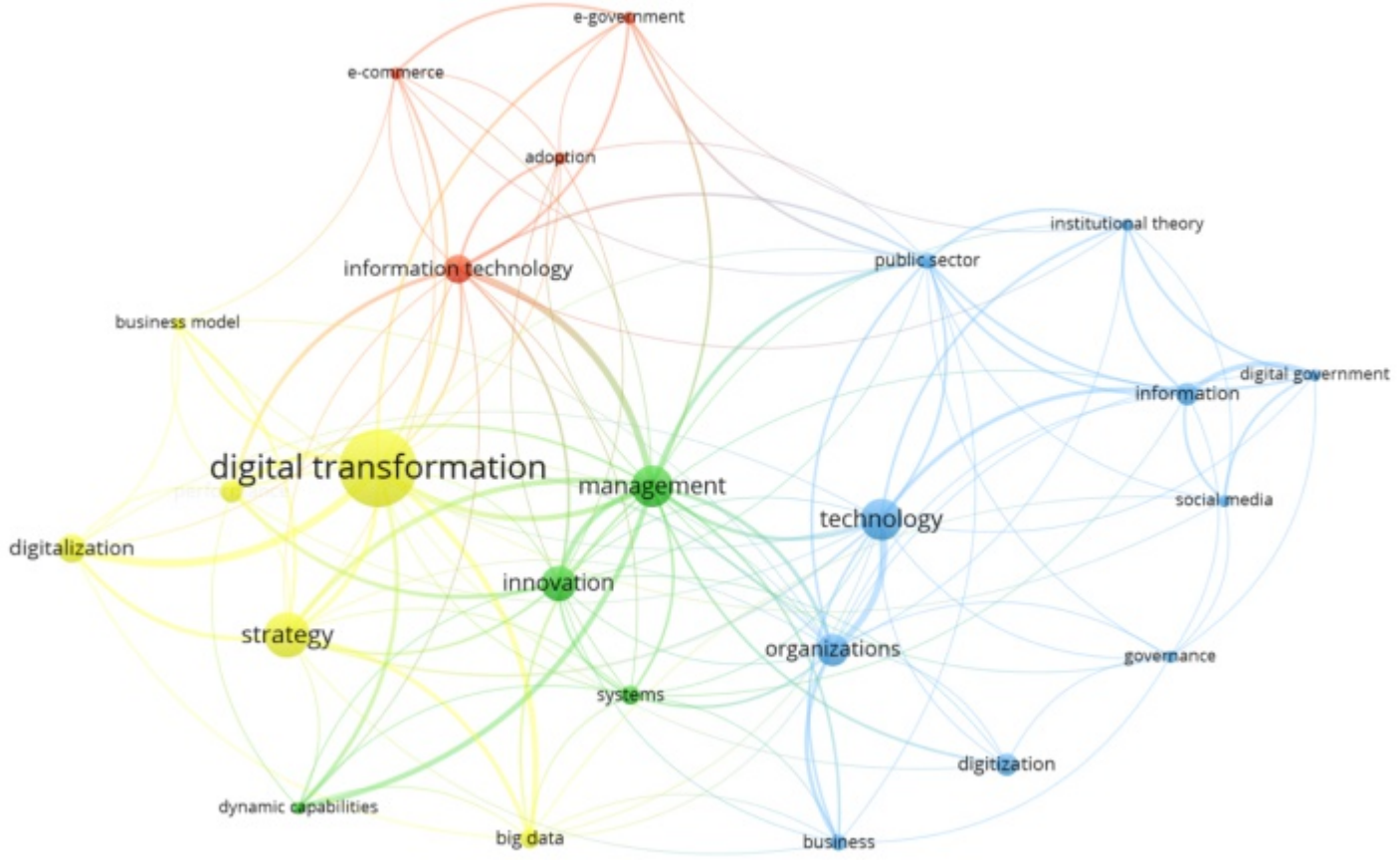

Figure 4. VoS-Viewer map with co-occurrence analysis using keywords as unit of analysis

for "Library and archive" and "Strategy". In our final search database, digitalization papers were least represented out of the digit* concepts. However, "digitalization" far preceded the other digitalization concepts when doing our initial search on Google Scholar, which may indicate that this term is used to describe technological attributes, a theme we systematically excluded from our database. The first article involving digitalization in our final search database was in 2014, followed by a stable distribution of digitalization articles throughout the period 2014-2018. The number of digitization papers as a percentage of total published each year has however been declining during the period, while publications on this concept peaked in May/June 2017.

4.3 Digital transformation

Content analysis revealed that authors commonly agree that DT is concerned with the changes digital technologies can bring about in a company's BM, or BM adaption or transformation as a result of technological progress and innovation (see e.g. Andal-Ancion et al., 2003; Hess et al., 2016; Janowski, 2015; Kotarba, 2018; Liu et al., 2011; Loonam et al., 2018; Schallmo et al., 2017). This substantiates several findings in the bibliometric co-occurrence analysis, for example, that DT relates to "Innovation", "Business models", "Dynamic capabilities", "Performance", "Adoption", and "Organization". Further, while some authors find that part of the purpose of DT is at the organizational process level, the majority agree that it goes beyond the two previous levels of digitalization, and relates to BM innovation in value propositions, networks and relationships. These findings support the relations between "Social Media", "Information Technology", "Systems", "Management", and "Strategy" found in the co-occurrence analysis. The co-occurrence analysis also discloses that this level of digitalization relates to the former two, which may be explained by digitization and digitalization being described as steps in DT. Further, while DT is commonly described as an organizational and ecosystem level change that creates opportunities in value creation, value propositions, networks and relationships, it is noteworthy that cost reduction and efficiency are also mentioned as part of the purpose of DT.

Articles with a primary focus on DT are represented in all journal categories, but the largest share are found in the "Management" and "Technology and IT" categories. Moreover, DT has the largest share of papers in all categories, except in the "Library and archival science" and "Law" categories, where digitization represents the largest share. This may be due to both industries being heavily document and information reliant. Finally, the percentage of DT articles is increasing, and according to our bibliometric overlay visualisation the topic peaked in July 2017.

5. Conceptualization

We identified articles that have enabled us to distinguish between concepts, making it possible to suggest a taxonomy (figure 5).

The taxonomy creates several opportunities and challenges on each digitalization level through associated dimensions. It identifies three dimensions (cost reduction, connectivity and value creation) that vary across the three digitalization levels.

The ***cost reduction*** dimension involves all three digitalization concepts. Digitization can lead to asynchronous information, opportunities in production scaling, a shorter publishing value chain, better control and customer overview. As for digitalization, it goes beyond digitization as a broader sociotechnical process of applying digitizing techniques on a larger scale to social and institutional contexts, with such things as cost reduction and efficiency as results. Similarly, the

		Presuppose previous level	Dimensions Challenges and opportunities		
Level			Cost reduction	Connectivity	Value creation
Digital transformation	Organizational and ecosystem level		X	X	X
Digitalization	Organizational process level		X	X	
Digitization	Activities level		X		

Figure 5. Taxonomy of interrelated digitalization terms with dimensions and levels

content analysis revealed that part of the purpose of DT is cost reduction and efficiency, while at the same time having a broader span of opportunities and challenges beyond these benefits. Cost reduction through efficiency gains in the literature are closely related to emerging discussions of automation.

The ***connectivity*** dimension comprises both digitalization and DT. For digitalization, it represents an opportunity to connect activities as these are digitalized. The researchers in our content sample overall agree that digitalization will change organizational structures and interactions both internally and externally, affecting how firms compete and transact with customers. For DT the dimension represents an opportunity to cooperate between different actors or create ecosystems, where new, digitally enabled products or services encourage demand via non-traditional methods. The process of DT further poses an opportunity to form new entities and relationships driven by the application of IT, working as an enabler of change to the current paradigms of organizations and individuals. Thus, new partnerships are enabled at this level through usage of advanced technologies, that in turn facilitates instant connectivity and access to growing sources of data that support cross-service opportunities. Connectivity is in literature related to discussions of channel selection and scalability.

In the ***value creation*** dimension, DT is represented. Both digitization and digitalization can achieve value through opportunity costs for available resources that can liberate time for other value-retrieving activities. DT on the other hand represents opportunities for value creation, as explicitly uncovered in the content analysis. Changes in value creation due to DT derive from the way in which digital technologies alter a firm's BM. While organizations can go through a BM innovation regardless of whether they include digital processes, the value creation in DT relates to connectivities derived from digitalization (for example, developments in the value proposition related to multi-service platforms, created to attract global customers and service providers). Further, some authors claim value creation in relation to DT stems from how digital strategies and related transformation allow new ways of creating value (for example, co-creation or product and service complementarities through network participation).

Our study reveals that the three concepts of digitalization concern digital change at different levels of the organization. The digitization concept is at the activities level, whereas the other two are at the organizational level, increasingly extending beyond the intra-organizational context into the inter-organizational context, and throughout the entire ecosystem. Although it has been claimed that processes can be digitized (e.g. Gaigher et al., 2014), this only describes digitization of existing activities (for example, information, physical or analogue documents, knowledge). Thus, digitization more broadly concerns changing and automating activities that pre-exist in organizations. There is thus a consensus in the articles reviewed that digitalization goes beyond digitization.

Digitalization involves application of technology to broader social and institutional contexts, and thereby contributes to the servitization of organizations, and affects how they compete and interact. Hence, digitalization has an organizational focus on business processes change, related to providing digitally enabled services. Finally, DT is described as a broader process of transforming an organization by affecting the organization's business processes (for example, products, structures, processes, organizational behaviours), and is thus complemented by changes in BMs. DT also facilitates new social networks and new partnership formation, thus relating to changes at the ecosystem-level.

6. Conclusion

By conducting a structured assessment of extant published research to address the question, *How can the concept of digitalization be framed into a rigorous conceptual foundation that can support research and practice alike?*, this paper provides a foundation for studying the currently hyped phenomenon of digitalization and related topics, such as digital disruption and DT.

The study confirms that the field remains immature and fragmented, and despite revealing that all identified articles in our sampled content analysis address digitalization as an important aspect of changes in organizations and related strategy development, few strategy journals deal with digit* concepts. Indeed, no comprehensive description of how strategy should be adapted to technological adaptations exists, or at least only a very limited one. The small amount of published quantitative research probably reflects the limited understanding people have about how different technologies relate to different organizational outcomes.

In order to provide a vantage point upon which such research efforts could be based, we offered a taxonomy

with a clear delimitation of interrelated terms and themes, emphasising the organizational and commercial implications of different related terms, rather than identifying the type of technology applied or degree of technological complexity involved. This taxonomy identifies the level of analysis associated with each of its constituent terms; digitization, digitalization and DT, connected in a step-wise process. For example, digitization is described as a stage that alone offers limited value in terms of improving operations, and thus digitized information is referred to as an aspect of digitalization.

A quite different term, digitalization is instead a general tool for BM innovation, as it can contribute to the shift from product to service based businesses. DT relates to the intra-organizational level, involving the external environment with implications for all three dimensions. Therefore, the taxonomy offers a vantage point for subsequent empirical and conceptual research to extend insights on related digitalization themes, especially related to innovation and strategy decisions on scalability, automation, channel selection and connectivity. Whereas extant research suggest that digitalization with its related terms Digitization and DT reflect both development stages and ambitions associated with the utilization of new technology, our taxonomy establishes a firm link to strategy, as suggested by Kane et al. (2015) on three distinct levels (activities, organizational process or organizational and ecosystem level). Deciding on digital innovation and digital strategy is currently of primary concern to practitioners when navigating an increasingly disruptive environment.

The implications for practice are to understand that digitalization is more strategic than technological. At all three levels, adopting technology has strategic implications. At the digitization level, data limited to one activity can provide opportunities for cost reduction. Digitization involves transforming analogous data, such as patient records in a hospital, to a digital format, and thus extending its potential for utilization through scalability, asynchronous, and spatial access. Digital transformation on the other hand has far reaching strategic implications, as utilising technology will involve organizational change, new value propositions and business models, and an ability to connect with partners across an ecosystem. The suggested taxonomy can thus provide a navigational tool for practitioners when deciding on digital innovation and digital strategy, and link these to the identified dimensions of challenges and opportunities (cost reduction, connectivity and value creation), across industries with different contextual complexities.

Our study condensed an overwhelming amount of digitalization research into a digestible 18 papers spanning across five interrelated disciplines. Moreover, we proposed a taxonomy that can be utilized to inform innovation and strategy discussions within firms when deciding on future directions for their digitalization efforts. In particular, our suggested taxonomy offers an explicit emphasis on organizational and commercial consequences of different digitalization ambitions. We suggest that managerial teams discussing the selection and implementation of digital technologies consider the organizational perspective underpinning our suggested taxonomy when addressing their digital innovation strategy in general, and in particular when deciding on BM innovation, digital disruption, DT, disruptive innovation, and Industry 4.0.

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Appendix I

List of articles selected for content analysis:

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Beyond the Hype: A Bibliometric Analysis Deconstructing Research on Digitalization

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Giving Science Innovation Systems a 'Nudge'

Kirsty de Jong, Urs Daellenbach, Sally Davenport, Jarrod Haar and Shirley Leitch

> *"Decision makers do not make choices in a vacuum. They make them in an environment where many features, noticed and unnoticed, can influence their decisions. The person who creates that environment is…a choice architect."*
>
> Richard Thaler, Cass Sunstein & John Balz
> Authors of "Choice Architecture",
> in *The Behavioral Foundations of Public Policy*

In this article we consider the role that contextual factors play in science innovation systems - that is, the choice architecture, that influences the orientation and outcomes of publicly-funded research. More specifically, we examine how choice architects, particularly policymakers and funding administrators, can affect the decision-making behaviour of researchers. The context for today's science innovation systems continues to shift as governments seek solutions to the world's "grand societal challenges" such as climate change and ageing populations, in addition to greater and more demonstrable impact from funded research. This means that the assumptions of "basic research [being] performed without thought of practical ends" (Bush, 1945) that have shaped such projects, actually run counter to the growing expectations of greater commercialisation and use of multidisciplinary mission-led approaches. We argue that a closer examination of the choice architecture of publicly-funded research is required to understand and address how these potentially conflicting objectives may be pursued most productively through interventions that could form the basis of a novel, behaviourally-based toolkit for science innovation policy.

Introduction

Choice architecture "refers to the practice of influencing choice by changing the manner in which options are presented to people" (Samson, 2018: 125). Choice architecture can be thought of as an aggregate of "nudges", which Thaler and Sunstein define as "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid" (2008: 6). Choice architecture has its roots in behavioural economics, which as a discipline, incorporates evidence from psychology about the effect of innate human response and experience on economic decisions. Behavioural economics developed to address the perceived inefficacy of theories of rationality that featured prominently in the economics literature; the view that people make consistently rational decisions was seen as incompatible with a much more complex reality where a multitude of factors - such as biases and heuristics - undermine the likelihood of this occurring (Thaler & Sunstein, 2009; Samson, 2018).

Science researchers appear to face a similar conundrum with regard to governments' and policymakers' prevailing views of how science innovation develops (Jahnke, 2015). While behavioural economics acknowledges that people are operating in increasingly complex everyday environments that impact the way they make decisions (Thaler & Sunstein, 2009), the same phenomenon can be observed in science innovation systems today (Whitley et al., 2018; Dowling, 2018; Van de Ven et al., 2017; Nicholls, 2017). Complexity in science innovation systems is a corollary of calls for more interdisciplinary, mission-orientated approaches to address grand societal challenges (Robinson & Mazzucato, 2018), and greater governmental pressure to see demonstrable impact from their investment in science research (e.g., MBIE, 2015; Dowling, 2018). The negative implications this has for researchers' experience of science management and administration within the innovation system has been recognised (Whitley et al., 2018; Dowling, 2018; Van de Ven et al., 2017; Nicholls, 2017). Despite this, there has been limited change made to the processes for identifying projects and funding research.

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Using a behavioural science lens, we are able to shed new light on how elements of the science innovation system - namely government policy and research funding - might influence research orientation and outcomes in a way that undermines goals relating to mission-led science and impact. Using choice architecture as a framework for our argument and analysis, we highlight how a combination of interventions in science research management and administration could be used to reorientate research in such a way that it supports the aforementioned aims, with a view to these interventions forming the basis of a novel behaviourally-based toolkit for science innovation policy.

Current Science Innovation Systems: Understating Complexity of Basic Research

Science innovation systems (and more recent reference to innovation ecosystems: Jackson, 2011), both national and regional, relate to "the linkages among the actors involved in innovation" (OECD, 1997: 9). It involves interaction between these actors (public and private) and the activities (creating, changing and diffusing) they undertake to generate valuable new technology and knowledge (Freeman 1994; Lundval, 1992). Governments are motivated to invest and participate in science innovation systems because technological innovation has a positive impact on national wellbeing (Gluckman, 2015). Their involvement in science innovation processes typically includes (but is not limited to), setting the policies and priorities for innovation, and/or providing the funding for it. Presumably, this requires governments, and particularly policymakers, to have an accurate and pragmatic view of the innovation process. Counterintuitively, though, this appears often to not be the case (Van de Ven et al., 2017).

This gap in understanding exists because the "processes that encourage the development and adoption of game-changing innovations are more complex than the people creating government policies and practices consider" (Van de Ven et al., 2017: 94). An investigation of the views of over 3,700 American scientists (Pew Research Center, 2015) reported that "much of the public - and many politicians - do not have a general understanding of the scientific process; knowledge critical for smart decision-making in our increasingly technological society" (Jahnke, 2015: 1). This is problematic because governments and policymakers are most often the primary choice architects of science innovation processes: how they construct the policy and research funding arena will naturally exert both intended and unanticipated influence on research orientation and outcomes.

This problem can be in part attributed to the way in which Vannevar Bush conceptualised the innovation process in the United States of America's first attempt at an official innovation policy: his 1945 report *Science: The Endless Frontier* (Pielke, 2010). In this report, Bush, now "regarded as the architect of all government funding for university research" (Jahnke, 2015: 8), formalised the notion that the journey from science innovation to commercialisation progresses through an identifiable set of linear stages (Van de Ven, 2017). This view endures because of similarly structured, more contemporary frameworks like the technology readiness levels (TRLs); the innovation funnel (IfM, 2019); and the stage-gate model, the latter which many organisations now utilise to manage research and development, despite extant cautions against confining it within rigid, lock-step, linear, or bureaucratic processes (Cooper, 2008). These frameworks reflect not only a lack of understanding about the realities of the innovation process - characterised as it is by uncertainty, lags, and "multiple feedback loops in which the downstream activities of development and deployment generate both new problems and new knowledge that change the agendas of the upstream stages of research and development" (Van de Ven et al., 2017: 97) - but an optimism too. That this unpredictability and interplay can occur across "single [… or] multiple … streams of scientific or technological development" (Ibid) only serves to increase the complexity involved; a factor under-acknowledged in these frameworks.

We argue that a broader effect of such frameworks tends to be the embedding of positive assumptions about linear transformations and the potential for sequential controlled resolution of uncertainties in science innovation research and development in the minds of policy and funding administrators. These assumptions manifest in the way granting agencies typically require reports to reflect distinct and progressive stages of research, and the way they allocate types of funding to research projects depending on the stage that they begin or intend to conclude, with different expectations attached for each. For example, basic research (TRL 1-3) is often happily devoid of the requirement to engage with or consider potential stakeholders, whose involvement is needed at later stages of development.

Undertaking research that involves complex, difficult to understand, and uncertain conditions, when funded via

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policies and processes that assume a linear, staged, controllable research endeavour, represents two conflicting sets of circumstances whose incompatibility we argue, can makes things harder for researchers. In addition, it can negatively affect research orientation and outcomes by impeding researchers' ability to deliver basic, let alone impactful, research. In the following sections, we explore in more depth the ways in which this can occur.

Influences on Innovation Orientation and Outcomes in Publicly Funded Research

1. Government policy

The relationship between government policy and science innovation is a long-standing one, with historical roots as deep as 18th century European imperialism. Bush's argument for a centralised government funding system in the USA led to the establishment of the National Science Foundation, with other countries successively following suit (Gluckman, 2015). This helped to 'entrench the concept of government patronage of scientific research' (Pielke, 2010: 923).

Government policy is understood to influence research orientation and outcomes in one of two ways: first, in a remedial sense; investing in areas neglected by the private sector. For example, because many businesses seek shorter term returns for their investments (for example, Lumpkin et al., 2010), this typically disincentivises them from investing in basic research where the outcomes are not known and deliverables less certain. To compensate for this, governments tend to invest in basic research and/or projects in the public's interest. Second, governments may use policy to catalyse more radical change in the direction of innovation research.

Setting science "missions" has become an increasingly common way of doing this, and missions have gradually evolved to reflect a democratisation of science, and a decentralisation of its orchestrating actors (Robinson & Mazzucato, 2018). In general, missions (past and present) have sought to align technological development to meet government goals (Robinson & Mazzucato, 2018). Mission-led science in the 20th century was used competitively by governments to progress their nation's health and wealth, particularly during periods of conflict (Gluckman, 2015). Governments would, in advance, identify their objective, desired outcome, and the technological enabler in the middle (for example, using a rocket to be the first country to land on the Moon). Contemporary missions differ in that they are more often applied to grand societal challenges whose effects extend beyond borders; involve unpredictable technological developments; are inherently complex; and are not amenable to solutions currently available (Robinson & Mazzucato, 2018), all characteristics which are associated with basic research. Such a combination of factors demands a more collective approach than has been employed in the past, as their inherent difficulty requires involvement from a wider cross-section of society (including industry), to provide access to a greater diversity of input (Kuhlmann & Rip, 2018; Robinson & Mazzucato, 2018). This has important implications for choice architects, as it is likely to require changes in how science and innovation are both managed and organised "at the societal/national systems level" (Robinson & Mazzucato, 2018: 938); with "technological, behavioural and systemic changes" (Mazzucato, 2016: 140), and a "willingness to explore varieties of extant and new approaches" (Kuhlmann & Rip, 2018: 448). Such changes are made possible by changes to policy.

2. Funding

One implication of a shifting policy landscape is its effects on research funding. Given this rise of "new constellations of innovation actors" (Kuhlmann & Rip, 2018: 448), researchers increasingly "have to share their authority over research goals with more varied sets of actors, many of which have developed strong expectations concerning research goals and are using their control of funding to exercise authority accordingly" (Whitley et al., 2018: 111). These actors, including public research councils, private foundations and charities, are made more powerful by the widespread downturn in public research grants, which has contributed to increasing the level of competition between researchers for funding (Whitley et al., 2018). Funding thus assumes more scope to be perceived as a coercive mechanism orientating research toward the outcomes that funders want. Indeed, research funding has been described as "a battleground for different agents with different strategies, and its structure will be a crucial element in the development of new forms of knowledge production" (Benner & Sandström, 2000: 301).

Actors, notably, will vary in how and to what extent they seek to design the conditions relating to research inputs, outputs, and methodologies. Clarity of conditions and expectations tends to be greater with industry grants and less so in the case of publicly-funded, socially-orientated science, especially when it is mission-led (Hottenrott &

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Lawson, 2013). This variation reflects in part the social norms concomitant to each of these groups. In behavioural science, social norms are incredibly influential on behaviour (Gockeritz et al., 2010; Reynolds et al., 2014), as they govern how people behave in certain groups by communicating what that group deems acceptable (Samson, 2018). Descriptive norms *describe* "normal" behaviour, with normal being what the majority is generally understood to do. Injunctive norms are those "rules or beliefs as to what constitutes morally approved and disapproved conduct" (Reynolds et al., 2014: 2, citing Cialdini et al., 1990: 1015). In-group social norms originate from the social interplay of individuals already psychologically connected by pre-existing and mutual membership to a social group. Academic work has theoretically linked, using real world examples, how the established norms of different actors within science innovation systems have contributed to: a) funding models that support the interests of particular groups like research councils run by academics; and b) funding models that can challenge and seek to *change* the status quo to engender different research results. Norms represent a "dominant institutional order" (Benner & Sandström, 2000: 291), and are thus expressed through mechanisms like criteria, incentives and research evaluation, which can, in turn, impact expectations around administrative processes like review, reporting and approval (Benner & Sandström, 2000). In a rare study of the effect of incentives on public grants alone, incentives geared toward supporting researchers' explorative and creative behaviours were shown to "exert a profound influence on the subsequent development of breakthrough ideas", leading to remarkable growth in publication rates (Azoulay et al., 2011: 530). Such incentives are antithetical to the typically inflexible and "risk averse" funding models that can orientate research proposals toward "relatively safe avenues that build directly on previous results at the expense of truly explorative research" (Ibid: 531).

Whitley et al. suggest other ways that funders might influence research orientation and outcomes: "scientific communities [might use] reputational mechanisms" and "science policy and funding [...] expectations tied to resources" (2018: 113). Authorities can also impact how science innovation develops more generally because of their role in shaping and/or activating the environmental conditions that determine individual absorptive capacity; the "epistemic pluralism" needed for basic research and aberrant approaches (Ibid: 124); and "protected space": time and resources researchers have to explore the things they want to without threat to their reputation or career and/or intervention (Ibid: 112). While these factors are expressions of norms, they also reflect the environmental features that constitute the choice architecture of science innovation systems, (which are at times felt as a nudge). We argue that the typical choice architecture of most science innovation systems nudges researchers towards decisions in favour of the status quo, rather than the novel and the unknown, which orientates research and potentially its outcomes away from the realm of basic research.

Method and Context: How New Zealand Missions are Architecting for Change

New Zealand (NZ) is a useful context to examine the positive potential of behavioural science on the organisation and management of science innovation systems. This is because within its mission-led science activities, its government has recently outsourced the role of choice architect, one normally held by science advisors and policymakers, to the management teams of all eleven mission-led grand societal challenges that are currently being funded in NZ. These management teams have been given the prerogative to depart from the status quo in terms of the governance, management, administration and evaluation of science research to involve a broad-base of actors (including industry, Māori: the indigenous population, students and early career researchers), as well as to establish their own funding processes for the distribution of grants. This builds comparative cases in terms of policy and funding between the incumbent system, and mission-led, so called "National Science Challenges" (NSCs).

Here, however, we examine only the *Science for Technological Innovation* (SfTI) NSC. Within its community of over 300 researchers is a small social science team with the ability and the mandate to collect data related to the aforementioned aspects. The inclusion of this team in SfTI and its longitudinal nature is unprecedented in New Zealand. The "mission" of the SfTI NSC is to enhance NZ's capacity to use physical sciences and engineering for economic growth, and thus the remainder (and majority) of its participants are researchers in one of these two disciplines. SfTI aims to invest in basic research (or in this case, "stretch science") and multidisciplinary teams, to foster the best science most relevant (or "sticky") to NZ.

The social science team, *Building NZ's Innovation Capacity* (BNZIC), is one of the seven Spearhead (larger teams) that are funded in Phase 1 of SfTI, alongside 30+ smaller "high risk and reward" Seed projects. BNZIC obtained the data that informed this article among

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numerous others, through observation, interview, survey, and other documentary (minutes and email correspondence) methods. The longitudinal data has been collected from SfTI's inception in 2015, and at a regular interval since. This is projected to officially conclude in 2024. Having access to all SfTI-funded researchers adds to its comprehensiveness.

The data captures a trajectory of research orientation and outcomes, as well as internal and external impacts and engagements that have occurred, allowing us as part of BNZIC to better understand how the latter might influence the former. The data also probe the researcher experience within SfTI, in contrast to other funding approaches. This has been subsequently analysed using a grounded approach that extracts themes within/across research projects to identify which factors seem most closely connected to differing outcomes. Survey and other primary data augmented and provided a cross-check for these qualitative findings. Informed by these (and future) findings, the SfTI management team are in a position to design and enhance its choice architecture in an iterative and interactive process.

The expectation to deliver economic and/or societal benefit to the country, that is, 'impact', applies to all NSC research projects. At the same time, uncertainty and lags between sticky stretch science research and impact, are beginning to be recognised, yet still feature prominently in SfTI's key performance indicators (MBIE, 2015). Creating a choice architecture that encourages and engages stretch science research, while delivering on the impact imperative (with novel projects that can be commercialised), is the challenge of management teams. By applying a behavioural science lens to this challenge and the wider context so far discussed, we are able to offer an alternative interpretation of, and explanation as to how and why, aspects of both systems (new and old) might be helping or hindering the achievement of outcomes and impact.

The Case of Science for Technological Innovation: What We've Learnt so Far About Architecting for Impact

1. Friction costs and bounded rationality are growing problems for researchers that can exacerbate their status quo bias and orientate their research projects to the familiar

For some in the New Zealand science community, the impact imperative has instilled a "fear" of "government micro-managing research funding", when researchers are already "saddled with exorbitant levels of form filling, reporting and grant seeking" (Nicholls, 2017: 1, 6). Such friction costs, that is, elements of a process that may be minute, yet make something much more difficult (Service, 2014), are common in science innovation systems, coalescing mainly around review, approval and reporting (Van de Ven et al., 2017). Benner and Sandström argue that "existing institutional structures tend to hinder the evolution of new organisational routines" (2000: 301). We identify these friction costs as an obstruction to pro-stretch routines, and argue that they add an extra level of complexity and uncertainty for researchers whose "rationality [when making decisions about and during their research] is bounded because there are limits to our thinking capacity, available information, and time" (Simon, 1982 as cited by Samson, 2018: 124). How this potentially affects research orientation and outcomes emerges in the "satisficing" behaviour that tends to follow.

Satisficing is an heuristic that people fall back on when faced with bounded rationality. It supplants optimised decision-making with a "combination of sufficing and satisfying" (Samson, 2018: 147) and the selection of "options that meet…basic decision criteria" (Ibid: 147). Using heuristics to manage complexity (Tversky & Kahneman, 1974) can be problematic in the long run because "their use can also lead to systematic biases" (Thaler & Sunstein, 2008: 23). We observe this in the augmented status quo bias of researchers who pursue projects in which the science trajectory is known, or work has already progressed, instead of novel stretch science. We posit that operating in the context of the impact imperative, where funding expectations and friction costs are high, can shift researchers' primary decision-making criteria to delivering at least some more certain output(s), that is, it orientates their research to the familiar where the likelihood of some success is higher, and with less risks of the unknown, thus inadvertently leading to less stretch science.

Reducing friction costs is one way to address bounded rationality and mitigate some of the complexity that we argue disincentivises basic research. SfTI has approached this by introducing revised templates for submitting proposals that involve less time/effort to complete, encourage true novelty and stretch to be targeted, while still identifying key milestones and deliverables prior to funding that then form the basis for future reporting. Researchers have found these *"processes have been relatively light touch. We haven't been excessively hassled*"; they've been *"quite easy - just flowed naturally"*, in part because there is seen to be *"plenty of support"*. Comparatively, *"I think SfTI is doing much better than other funding agencies I have been*

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working with". In terms of reporting, *"SfTI have a quick turnaround time on assessment and things like that"*; *"[w]hile they do have the yearly milestones, there's not a lot of reporting requirements. There's nothing that's too time-consuming"*. Another researcher *"remember[s] spending a lot more time on the [other funder's] yearly report"*, while others even find SfTI's *"monitoring much more engaging"* (Research Notes, 2019).

2. Funders' optimism bias may disincentivise researchers from pursuing basic research and stretch science

Exacerbating our first insight is funders' optimism bias about what funded researchers can achieve within a research project timeframe. This is symptomatic of the primary underlying issue we highlighted earlier, that is, choice architects of science innovation systems often do not perceive the complexities involved in the innovation process and consequently set expectations (such as rapid commercialisation) that are unrealistic within the parameters of a grant. Growing scarcity of public funding has contributed to increased competition between researchers (Whitley et al., 2018), who, in a bid to secure it, may avoid the unpredictability of pursuing riskier basic research in favour of the kinds of projects that are easier to connect to measures of impact.

Optimism bias is directed toward future events (Samson, 2019), and thus becomes especially relevant when an investment into a desired future event or outcome, like commercialisation, has been made. Researchers in the SfTI model did, at times, interpret their funders' behaviour as optimistically biased about the realities of the innovation process in NZ. *"If SfTI people expect us to have some sort of commercialisation after we finish this, which is in one year or two years, or three years, that is not realistic. If [this] is the case, then SfTI should not fund it"*. Similarly, another noted *"with this type of research, we can't have [an] immediate industry outcome at all, because - the reason is, we don't have industry support - and also the research is very much fundamental, which means it's far away from commercialisation - too far away"*. They understood the reason why SfTI has a focus on research impact. *"I can see why the NZ Government [giving the money] would want this to turn into commercialisation. But…the idea that you put some money into [X] in New Zealand, and that's going to develop commercial economic benefit for New Zealand, [that's] naïve…it's a worldwide eco-system…expecting New Zealand to build its own little eco-system is not going to work"* (Research Notes, 2019).

3. Large, multidisciplinary teams can be harnessed to socially norm desirable behaviour

Science missions aimed at addressing grand societal challenges need larger, diverse and multidisciplinary teams because the complexity of such challenges demands a multi-pronged approach. This requires actors to engage with different actors across the innovation ecosystem (Robinson & Mazzucato, 2018; Kuhlmann & Rip, 2018). Engaging with industry is often viewed as a discretionary exercise for academics (Tartari & Breschi, 2012), yet it can be an important part of making progress on grand societal challenges and generating impact. In the case of NZ, equally important is engaging with Māori and Māori organisations to "unlock the science and innovation potential of Māori knowledge, resources and people" (MBIE, 2019). Our evidence suggests that the SfTI management team's efforts to socially normalise these two types of engagement are working. This is a conclusion we have drawn from the fact that many Seed projects are proactively doing so, even though this is not a major criterion of their funding as it is for Spearheads. This appears in part due to the descriptive and injunctive normalisation of engagement likely socialised through regular interactions with SfTI management as well as Spearhead researchers at the Challenge's annual researcher workshop.

Here, again, are our interviewees speaking: *"The workshops in Auckland where…you're networking with other SfTI people - meeting some of the bigger [Spearhead] programs - you see how they've commercialised their products"*. Another researcher describes the impact that SfTI management had when they *"came and talked to us (before we'd even bid for any money) about Vision Mātauranga, about a Māori worldview, …and that really struck me, because it sounds like just the most fantastic way to actually get a holistic view of what you're doing rather than how much money is this costing [or…] how much money we're going to get out of it"*. Similar views were echoed in that *"the [Māori] component is better integrated in SfTI than some of the other Science Challenges, I'd say, and some of the other funding processes"* (Research Notes, 2019).

4. Researchers can be nudged into greater pro-commercialisation behaviour using the messenger effect

Nudges can be built into choice architecture to change behaviour. Nudges are considered as such provided they do not stop people from doing other things or substantially alter any economic incentives, and remain relatively effortless (administratively and financially) to evade (Thaler & Sunstein, 2008). Given the policy focus on impact, SfTI have used nudges to get researchers to consider commercialisation of their stretch research.

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They are generally nudged by theme leaders: members of the management team who act as technical and personal mentors to Seed and Spearhead project leaders. The inclusion of theme leaders as messengers and the depth of personalised interaction and feedback they afford, *"is very different from other funding agencies"*. Theme leaders were *"always offering contacts for commercialisation or anything like that"*, with most viewing this encouragement to connect to industry as being *"completely appropriate"*. These types of nudges influenced research orientation and outcomes in that, for some, *"every minute of the way, we're looking at the practical application"*.

A behavioural analysis would attribute the effectiveness of these nudges in part to their salience, given that they are delivered in such a highly personalised way. Humans are predisposed to observe what "we can understand [and] those things we can easily 'encode'…we are much more likely to be able to encode things that are presented in ways that relate directly to our personal experiences" (Dolan et al., 2010: 23). Theme leaders nudged researchers in their own environments, taking time to visit them personally in their offices and labs. A natural (and desirable) corollary of this is that relationships and "personal connections" started to develop. Researchers responded better to theme leader outreach because, for example, *"I know who these people are, so that's better than you just get an email from a name that you don't know"*.

A caveat, though, is that nudging for commercialisation to meet the expected outcomes of funders exhibiting optimism bias, could have the potential to reorientate stretch research projects and cap experimental learning. During a project, researchers potentially *"learn a lot of cool science things that are worth exploration that we could keep looking at, but of course we also want to end up with something that's eventually on the market, and that we can point to as something that's finally been commercialised"*. For some researchers, *"talking to industry"* has meant *"we've probably been pushed more to get things out and tested. Whereas otherwise, I probably would be spending more time in kind of the fundamental [to] understand science of what's going on, and more lab work"*. This was similar for another researcher who reorientated the project after initially *"thinking they [industry] would want something that was exceptionally better, but no, they were just happy to have a safer replacement"*. We would posit that these types of nudges have the potential to be counter-effective when they lead to behaviour that undermines the potential for broader longer-term impact embedded in stretch/basic research.

Implications and Limitations

This article fits in with a wider international trend of using behavioural science to improve and inform public policy. There are approximately 196 behavioural insights teams around the world dedicated to this very task. To date, their work has generally been consolidated in areas related to health, labour, energy, and the environment (Samson, 2018). For us, science and innovation policy was the natural next step, especially given that grand societal challenges are a new global policy priority (Kuhlmann & Rip, 2018; Else, 2018). Behavioural science offers significant value to any consideration of new and existing policy because with it comes a plethora of transferable and accessible tools, trials, case studies, methodologies, and insights (see Samson, 2018 & 2019; Dolan et al., 2010; Haynes et al., 2013).

What can other scholars learn from this? A greater appreciation of the covert and influential nature of choice architecture, and the potential that behavourial science has for providing new, thought-provoking interpretations of old problems. For practitioners, we hope to offer the beginnings of a behaviourally-based toolkit for science innovation policy, as it moves through a new era of government involvement and interest.

Our "findings" and implications are transferable to other countries and contexts from two perspectives. First, science innovation systems around the world are being acknowledged as more complex, suggesting the presence of friction costs and bounded rationality (Dowling, 2015; Pfotenhauer et al., 2016). Second, from the point of view that the contributions of behavioural science are predicated on the belief that "human judgement and decision making is mostly based on simple, fast and complexity-reducing heuristics that may lead to systematic biases", therefore assumptions about behaviour under certain conditions can be made (Emmerling, 2019: 40). However, responsible use of behavioural insights and interventions requires acknowledgement of the fact that behaviour is a product of the individual, their environment, and the interaction between the two, making behaviour highly contextualised at the micro level (Holzwarth, 2019; Emmerling, 2019).

Yet despite the rich theoretical and empirical foundation for our ideas, potential biases should be acknowledged, such as the problem of generalising from small samples (Tversky & Kahneman, 1982). Our study continues to grow in size (from 4 to eventually 10 Spearheads and close to 50 Seed projects), but given SfTI is actively

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seeking to shift behaviours, new interventions continue to be implemented, making it difficult to fully disentangle their impact from other actions. To counter these effects, our research methodology involves multi-party theory development and duplicate coding of data for cross-validation. Our data may have some limitations in terms of its representativeness though, given that the NSC's intentionally seek those with high capability, which may lead to a skewed set of behaviours.

Future research could go some way to mitigating some of these limitations through generating samples from other contexts both in New Zealand and internationally. In addition, future research could be directed toward developing a typology or index of policy and funding standards in use around the world, with a similar analysis (through a behavioural science lens) undertaken for each entry to determine how it might affect research orientation and outcomes. While such standards have been legitimised over time due to their benefits, they may now stand as an impediment to evolving "institutional orders" (Benner & Sandström, 2000, p.291), and calls for change at the macro level (Mazzucato, 2016; Robinson & Mazzucato, 2018; Kuhlmann & Rip, 2018), in the context of 21st century science innovation. Indeed, we would suggest that expecting change at a micro level without changes at the macro level is hopeful (and optimistic!) at best.

Conclusion

Identifying and understanding some of the choice architecture in science innovation systems that influences researchers' engagement with stretch or basic research has been the focus of this article. We have argued that this can be traced back, at least in part, to a knowledge gap between those creating the science and those creating the conditions for undertaking the science. The effect of such a gap is increased complexity for researchers operating within a choice architecture that seeks both stretch and impact from publicly-funded research, but does not address or accommodate the real constraints on researchers' ability to do so, namely the uncertainties, lags, and risks that are an inherent part of the science innovation process. Crucial influences on research orientation and outcomes in this context are government policies, like those for mission-led innovation, and the conditions, processes, and incentives attached to funding. Given the researcher concerns we have discussed, we would argue that the tried and true approaches to funding basic research will not be wholly effective when new policy initiatives are layered on to incumbent processes.

To determine influential factors more systematically, we have taken the approach of analysing this complex issue through a behavioural science lens, drawing on data from the *Science for Technological Innovation* National Science Challenge, one of New Zealand's eleven mission-led science projects. Given our unique position to observe and interact with the choice architects of this Challenge, we have identified a range of insights that can inform practice elsewhere, as well as when new policy initiatives emerge in NZ's future. These include how reducing the friction costs that are placed on researchers can address their bounded rationality and therefore potentially diminish their status quo bias; that funders need to recognise their optimism bias about achieving impact as it may create disincentives for researchers to pursue types of research in which the outcomes are less known; that desirable research orientations (such as those that combine different ontological and epistemological perspectives) and outcomes (like commercialisation) can be established or aspired to through social normalising; and finally, that nudging can also be used to orientate research toward commercialisable outcomes, which is especially effective when made more salient through personalisation. These findings are offered as the beginning of a behaviourally-based toolkit for science innovation systems to develop a choice architecture that more effectively fosters research with multiple and potentially conflicting objectives, such as basic/stretch research that nevertheless delivers impact.

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Towards a Taxonomy of E-commerce: Characterizing Content Creator-Based Business Models

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> *"True value is content in context."*
>
> L. Gordon Crovitz
> Former president,
> Dow Jones Electronic Publishing

Currently, new business models can be observed in content creator-based e-commerce. The research on e-commerce has grown rapidly and new concepts have emerged such as social commerce, platforms, and user-generated content. However, no overarching perspective has yet been formulated for distinguishing new content creator-based business models within e-commerce. The aim of this paper is therefore to characterize content creator-based business models by formulating a taxonomy of e-commerce based on a structured literature review of the concepts mentioned above. The results of our study point toward eight types of content creator-based business models. Our paper outlines theoretical and practical implications for the emerging phenomenon of content creator-based business, which we refer to as intellectual commerce. In addition, we describe 19 concepts related to Web 1.0, Web 2.0, and e-commerce.

Introduction

During the past 15 years, consumers have become important actors in creating content in digital media and on digital platforms. Some of them have succeeded in monetizing their efforts. This group of content creators tend to be business-oriented, and are represented, for example, by bloggers (Van Esch et al., 2018), YouTubers, and gamers (Postigo, 2016), who can more or less make a living from their activities on the Internet. It has been argued for instance that content creators in virtual worlds can earn hundreds of thousands of dollars (Scarle et al., 2012). The businesses of these content creators are partially based on a combination of e-commerce (Zwass, 1996) and user-generated content (UGC), which is defined as publicly accessible creative works made by non-professionals (Banks & Humphreys, 2008; Figallo & Rhine, 2001). The phenomenon of business-oriented content creators is growing and a new type of business model seems to be emerging. Although increasing awareness is growing that content creator-based business exists, the importance of user-generated content and the consumer perspective on both consumer-to-business (C2B) and consumer-to-consumer (C2C) e-commerce have received relatively little attention in the literature (Vanmeter et al., 2015; Wang et al., 2002; Yrjölä et al., 2017).

As current research is still scarce and disparate, more insight is needed into how to connect this new phenomenon to the current knowledge of business models (Foss & Saebi, 2016), in order to understand content creator-based business and outline their characteristics. Several literature streams have been identified as relevant that may form a foundation for understanding the new content creator-based businesses that are being established. These include e-commerce (Zwass, 1996), social commerce (Stephen & Toubia, 2009), platforms (Dufva et al., 2017; Hagiu & Wright, 2014; Korhonen et al., 2017), and user-generated content (Van Dijck, 2009). Based on an overview of the current literature, we explore how insights from businesses and content creators within e-commerce and social commerce may be relevant for understanding the emergence of business-oriented content creators and their various types of business models.

The literature on business models and e-commerce (Amit & Zott, 2001) is rapidly growing. Although there is an abundance of definitions and results available, there is still a lack of a coherent terminology. For example, scholars describe the new business models in different ways, using different concepts (Cucculelli & Bettinelli, 2015; Foss & Saebi, 2016; Jensen, 2014; Kotarba, 2018; Weill et al., 2011; Zott et al., 2011). Examples of the

different e-commerce concepts that are available in the field are, for instance, pure e-commerce, partial e-commerce, long tail, short tail, consumer-to-business, consumer-to-consumer, two-sided markets, multisided platforms, copyright and blockchains (descriptions of the concepts are found in the Appendix). Some research has focused on business models and e-commerce (Timmers, 1998), some on business models and user-generated content (Harrison & Barthel, 2009), and others on business models and consumer-to-consumer relations (Wang & Zhang, 2012).

An integrated and holistic understanding is nevertheless lacking, while it seems that studies concerning e-commerce and related concepts have focused on creating contributions often with quite narrow views, rather than on producing an overarching perspective that includes central concepts. A similar observation has been made related to business model research (Zott et al., 2011). By using e-commerce as a common denominator, the aim of this paper is to increase understanding of the emerging phenomenon of content creator-based business models. Our particular interest concerns the following questions: (1) How can content creator-based business models be characterized?, and (2) What are the specific characteristics of how value is created, captured and protected by content creators?

Studies of Business Models

Despite being introduced by scholars during the 1960s, '70s and '80s, the business model (BM) concept did not become popular in the web community until the late 1990s, when it was boosted by media as a buzzword in the emerging era of e-commerce (Chesbrough & Rosenbloom, 2002; Frankenberger et al., 2013). There is still no generally accepted definition of a business model. Instead there are many different interpretations and characterizations of what a business model really is. Timmers (1998) defined business model as an architecture for product, service, and information flow, including a description of the various business actors and their roles, a description of potential benefits for the actors, and a description of sources and revenues. He also identified three types of structures within e-commerce: the e-shop, e-mall and e-auction. Amit and Zott (2001) explored the theoretical foundations of e-business using several theoretical perspectives, including transaction cost economics, resource-based views, Schumpeterian innovations (for example, creative destruction and value creation), and strategic networks. They concluded that all of these perspectives provide insights into the drivers of value creation in e-business and contribute to understanding the business models underlying e-commerce. Based on their work, they suggest that the main sources of value creation in e-businesses are connected to efficiency, complementarity, novelty, and lock-in (for instance, key features of a service which keeps the user attracted to the service) (Zott & Amit, 2010). Several definitions of business models have recently been introduced. For instance, Teece (2010) described a business model as the design or architecture of value creation, value delivery, and value capture mechanisms employed by a particular business. Chesbrough (2007) pointed out that the business model is more important than the technology itself, and that every company has a business model whether they articulate it or not. Other scholars, such as Baden-Fuller and Morgan (2010), have argued that the business model and business model innovation are key components to competitive advantage. Chesbrough (2007) also suggested a business model framework for assessing the potential for business model innovation, in other words changing the existing business model or creating a new business model. Business model innovation has been defined by Björkdahl and Holmén (2013) as the implementation of a new business model to the firm. Frankenberger et al. (2013) instead stressed that business model innovation represents a novel way that businesses create and capture value.

During the same period, along with increasing awareness about the importance of e-commerce, Anderson (2007) articulated the differences between traditional commerce and e-commerce. He specifically stressed that e-commerce allows for a so-called long tail. Compared to the traditional short-tail demand curve where the market consists of a few high-volume producers, many niche products and low volumes in the long tail may actually result in higher value (Anderson, 2008; Swan, 2017).

During the last decade, several structures and typologies have emerged, such as the Business Model Canvas (Osterwalder & Pigneur, 2010), the St. Gallen Business Model Navigator (Gassmann et al., 2013), and the five-V framework (Taran et al., 2015). As the business model concept developed rapidly, it created complexity and diversity within the research field. Zott et al. (2011) pointed out that current literature largely has been conducted in silos, according to the interest of each respective researcher. Other scholars, such as Weill et al. (2011) and Cucculelli and Bettinelli (2015), agree that there is a lack of consensus among scholars of what a business model really is. Some of them have questioned whether there is a need for a universally accepted view (Jensen, 2014). This culminated in the paper "Fifteen Years of Research on Business Model Innovation: How

Far Have We Come, and Where Should We Go?" (Foss & Saebi, 2016), where they concluded that business models are important, but that research lacks underpinning and that the empirical inquiry is not cumulative, and therefore lacks clarity regarding gaps, contingencies and outcomes.

Method

In order to characterize content creator-based business models, we collected secondary data on current e-commerce-related literature, focusing on the concepts and terminology that are central in the literature. The study was carried out between January and September 2019, and was mainly based on a systematic literature review of peer-reviewed articles using the database Scopus. We started our initial search with search terms such as e-commerce, social commerce, platforms, and user-generated content. These search terms emerged from an initial understanding and readings of the few contributions made on e-commerce and user-generated content. The main search terms (main concepts) are presented in Table 1. We limited our search to journals in the areas of social sciences, business management and accounting and economics, econometrics and finance. In addition, to limiting the search scope, we decided to leave out all articles that were specifically focused on business-to-business (B2B) relationships. We also did not consider any business-to-government (B2G) or consumer-to-government relationships (C2G). The term platform resulted in too many irrelevant results (13,903) for which reason we decided to start our search using multisided platforms which gave 27 results.

Our selection of relevant articles for each term was then carried out in three steps. First, we viewed all, or at least the top hundred most cited articles, and downloaded the full article of the most relevant, according to their titles and abstracts. Second, we carried out the same procedure by viewing the oldest articles with the intent to find origins and definitions, and also to provide material for an overarching view (for example, how and when terms were introduced). Third, we viewed and downloaded the newest and most relevant articles in order to be able to include current emerging terms and results. We also applied the snowball method, in other words, some of the articles generated new references and new terms (additional concepts), which we decided to include in our work, see Table 1.

We also discovered other related keywords, and in order to determine their relevance and importance, analyzed them by counting the total number of articles as well as plotting a trend curve for each term between 1991 and 2019 (see Table 2). The search was carried out on Scopus with the same limitations as above, except that we also included the occurrence of conference papers. Our main concepts are important due to a large number of articles,

Main concepts	*Results*
{e-commerce} OR {electronic commerce}	10,162
{Multisided platforms}	23
{Social commerce}	262
{User-generated content} OR {User generated content}	1,238
Additional concepts	*Results*
{E-business}	1,613
{Consumer-to-consumer} OR {C2C}	253
{Consumer-to-business} OR {C2B}	17
{Content platforms}	21
{Long-tail} OR {Long tail}	291
{Pure e-commerce} OR {Full e-commerce}	2
{Online-to-offline e-commerce} OR {O2O commerce}	15
{Technological platforms}	94
{User-created content} OR {User created content}	34
{Virtual commerce}	4

Table 1. Search terms on Scopus

such as 26,397 for e-commerce, and also because of an ascending trend for social commerce, multisided platforms, and user-generated content. It can also be seen that some of the concepts started being used much earlier than when they gained broader attention, such as by word-of-mouth or long tail. (We also found several other types of commerce, such as Collaborative, Facebook, Knowledge, Location, Mobile, Online-to-offline, Tablet, and Virtual commerce. We will not explain and include these concepts in our work, but decided to include them in Table 2 as the trends may still be of value.)

In total, more than 250 papers were examined in some degree of detail. After analyzing the collected material, we chose to use an inductive approach inspired by Boell et al. (2014), as well as a bottom-up approach to create our taxonomy (Baden-Fuller & Morgan, 2010). As we listed and started to categorize all keywords on a whiteboard, we soon found interconnections and relations between them, and ended up creating a categorization. In e-commerce, we found, for example, Web 1.0, business-to-consumer (B2C), C2C, e-shops, e-malls and e-auctions, while for social commerce we found Web 2.0, C2C, C2B, word-of-mouth, trust, branding, group purchase, user-generated content, platforms, and content creators. By using this basis in combination with business model theory, we decided to use the terms value creation, value capture and business model type (BM type), as subheadings when we characterized the content creator business models. As we started to look into the characterization of business

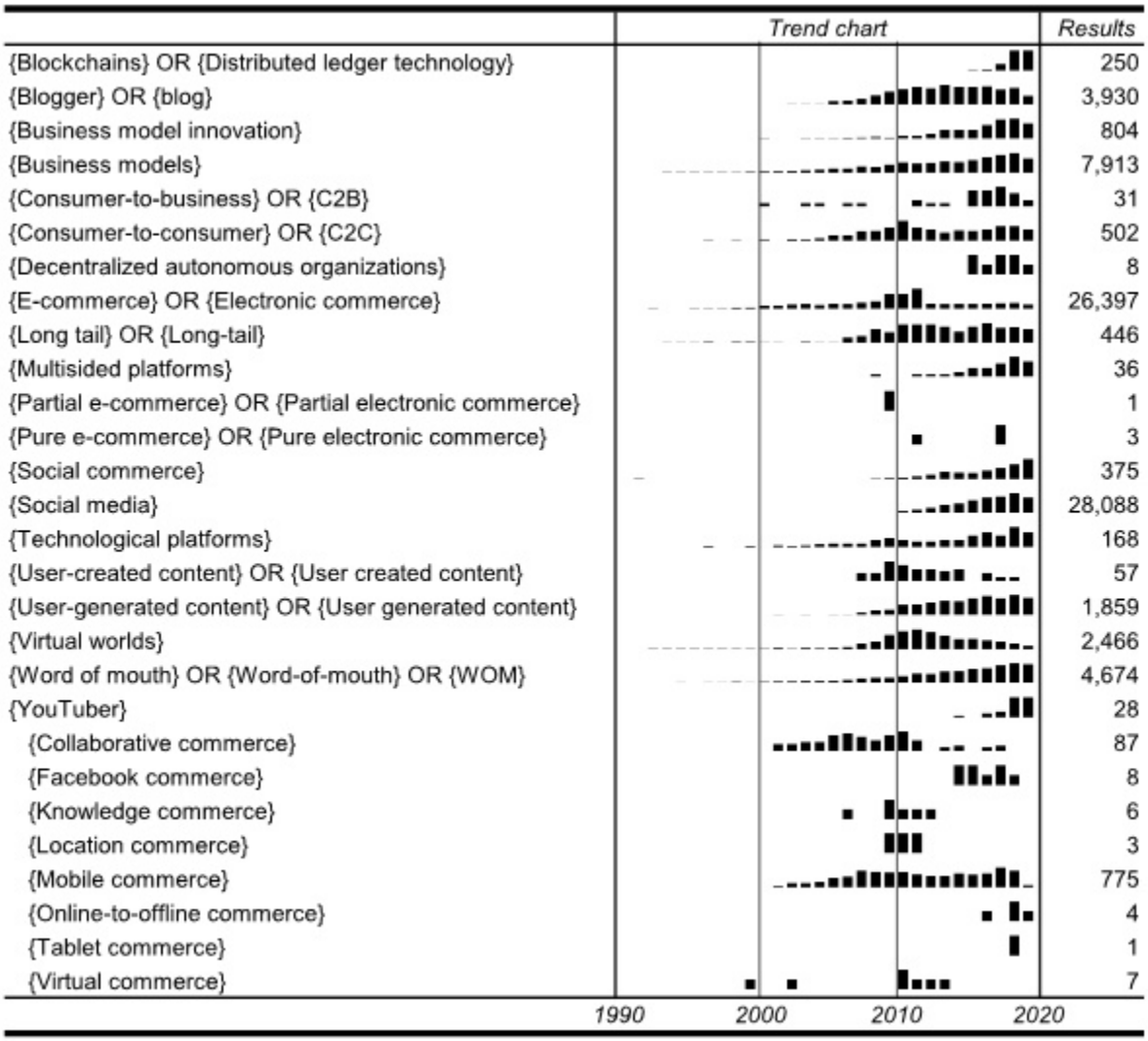

Table 2. Trend of published articles on Scopus

model types according to our first research question, we could see that the protection according to our second research question seemed to be dependent on whether the content had been created inside or outside of a platform. As we started to deal with the different combinations of where the value can be created and captured, we finally ended up with the structure represented in Table 3, showing eight types of content creator-based business models. We decided to use brackets [ ] to symbolize when the value creation and value capture occurred inside the boundaries of a platform. Surprisingly, when adding examples for the eight business model types we only succeeded in finding examples for seven of them.

Below, the results of the literature study are described in a detailed account of the findings related to the main concepts. Based on this, in the discussion section, we point to potential gaps and propose an agenda for future research that will contribute to an in-depth understanding of content creator-based business models.

Results

We first present the results from our literature review, and highlight the main concepts: electronic commerce, social commerce, platforms, and user-generated content. Second, we present the results of our business model characterization. And finally we present a summary of all results as a taxonomy of e-commerce (Appendix).

Electronic Commerce

The introduction of the World Wide Web in the early 1990s, denoted as Web 1.0 (Singh et al., 2008), gave rise to a new type of online commerce, referred to as e-commerce. Zwass (1996) defined e-commerce as sharing business information, maintaining business relationships, and conducting business transactions through telecommunications networks. Timmers (1998) defined e-commerce, according to the definition of the European Commission in 1997, as doing business electronically. He also characterized e-commerce as the electronic trading of physical goods and intangibles, such as information, through e-shops, e-malls (websites with multiple e-shops), or e-auctions. Choi et al. (1997) defined e-commerce according to the following three dimensions: agent (for example a supplier), channel (for example a website), and product or service, all three of which can be in the physical or virtual domain, and where at least one of them needs to be in the virtual domain in order to count as e-commerce. If a business is working solely within virtual dimensions, it is referred to as pure e-commerce, in other words, the agent, channel, and product or service are solely handled within the virtual domain. Wu et al. (2011) stated that the most common business relations within e-commerce are B2B, B2C, and C2C. Online auctions are based on C2C relations, for instance, where consumers can make transactions directly with each other. Group buying is considered a unique, innovative, and interesting online C2B business model type, which enables buyers to obtain volume discounts and helps sellers to sell a considerable number of items (Wang et al., 2016). Chen et al. (2008) referred to previous findings stating that C2C business was emerging but C2B business seemed to be under-represented.

Social Commerce

Social commerce or social e-commerce is based on Web 2.0, a term popularized by Tim O'Reilly and Dale Dougherty in 2004 (Singh et al., 2008). Harrison and Barthel (2009) point out that Web 2.0 is not a new technology, but instead an introduction of several new tools on the Internet, such as asynchronous JavaScript and XML, together referred to as AJAX. They also add that these tools create and enable an architecture for participation and user interactions, shared knowledge and shared information among consumers, and also agree that Web 2.0 is about participating while Web 1.0 is about receiving information. This view is also supported by Busalim and Hussin (2016), who argue that e-commerce provides a classic one-way business relationship where information rarely is sent back to the seller or other customers, as compared to social commerce, which is seen as a multidimensional information flow between customers and sellers. Stephen and Toubia (2009) point out that social commerce can connect online shops to other online retailers through marketplaces.

Marketplaces usually comprise a large number of e-shops, which increases the service of the customer demand according to the long-tail concept (Anderson, 2008). Kim (2013) sees social commerce as users participating in buying and selling products and services through digital platforms. The term social commerce was introduced by Yahoo in 2005 to describe a new collaborative shopping feature on its shopping platform that allowed consumers to create, share, and comment on product lists (Wang & Zhang, 2012). Many consider social commerce as collective bargaining power for end-users, and argue that the Internet has shifted the bargaining power away from sellers to consumers (Kim, 2013). Banks and Humphreys (2008), Kane (2007) and Kim et al. (2008) see social commerce as utilizing Web 2.0 in e-commerce, particularly core Web 2.0 features,

such as user-generated content and content sharing. Huang and Benyoucef (2015) contribute the view that social commerce can be achieved in the following two ways: bringing e-commerce to social media or bringing social media to e-commerce websites. Social commerce can also be explained from many different perspectives, such as marketing, retailing, computer science, sociology, and psychology, making it hard to agree on a common definition (Huang & Benyoucef, 2015). Busalim and Hussin (2016), as well as Yadav et al. (2013), support that view, arguing that there is a lack of clarity in the literature regarding the meaning and domain of social commerce.

Like for business models, Liang et al. (2011) state that there is no agreed definition of social commerce, but they identify two fundamental elements, namely social media and commercial activities. Social commerce is mainly seen by scholars as a subset of e-commerce (Hajli, 2014; Kim, 2013; Stephen & Toubia, 2010). Huang and Benyoucef (2013) claim that social commerce is not fully understood, and Zhang and Benyoucef (2016) state that the literature in social commerce reveals multiple inconsistencies. Libai et al. (2010) claim that C2C has the potential to change consumers' preferences, actual purchase behaviour, or the way they further interact with others through the power of word-of-mouth. Before word-of-mouth, individuals spread news about a brand through offline C2C interactions, in various environments face-to-face (in store, at home, in cars, at work), where C2C in stores was likely to be the most powerful (Figallo & Rhine, 2001; Libai et al., 2010). Hajli (2014) defines word-of-mouth as the occurrence when consumers share their experiences about a product or present their view to other consumers. According to Gefen (2000), word-of-mouth is important not only for branding, but also for gaining trust. Hennig-Thurau and Walsh (2003) found that consumers read online recommendations to save time in decision-making and to improve buying decisions.

Platforms

Platforms started to appear thanks to Web 2.0 technologies, which Rochet and Tirole (2003) described as two-sided markets. They discussed the challenge of getting the two sides (for instance, suppliers and customers or content creators and viewers) on board, which is referred to as the chicken-and-egg problem. Platforms can deal with more than two sides however. For example, Hagiu and Wright (2014) defined multisided platforms as organizations that get two or more sides on board and enable direct interactions between them. Garcia-Swartz and Garcia-Vicente (2015) characterized platforms as managing two or more distinct types of customers (users, application developers, handset manufacturers, network operators and advertisers). Korhonen et al. (2017) see platforms as multisided markets where value is created for all members of the network, and in which the purpose of a platform is to facilitate the exchange of products, which can be goods, greater accessibility, speed, efficiency, user experience, and convenience, and also enabling novel types of business models. Korhonen et al. mention that the definition of platforms has been inconsistent, although it has proliferated in management research. Gawer (2014) refers to technological platforms and central firms, such as Google, Apple, and Facebook. She also states that there are two fundamental views regarding platforms, namely the economic view as described by Rochet and Tirole (2003), and also an engineering view. Saarijärvi et al. (2018) note that despite the increasing amount of literature surrounding C2C e-commerce, the role of the platform has remained largely unexplored, and the literature still lacks insights on the distinct characterizations of different C2C e-commerce platforms, as well as how they influence consumers' perceptions of value and future behaviour.

Some platforms consist of virtual worlds, for which Kaplan and Haenlein (2010) characterized two types: virtual social worlds where users appear as avatars and interact as in real life, and virtual gaming worlds where users behave according to stricter rules. Value and transactions do not necessarily need to go through platforms, but with new technology such as peer-to-peer (P2P) communication and blockchains, can now be transferred directly between consumers (Swan, 2017; Tapscott, 2017). This type of value transfer can also make use of blockchain-based applications such as smart contracts and decentralized autonomous organizations (DAOs) (Mehar et al., 2019; Ryan, 2017), in which a whole organization is represented by rules encoded as a computer program.

User-Generated Content

Barnes (2002) characterizes content creators as users who create digital material (creative works), such as text, images, sounds, videos, and combinations of these, all of which are subject to copyright law (see also Kaplan and Haenlein, 2010). Dye (2006) states that content creators are consumers as well. In 2009, Van Dijck categorized these creators into the following three classes: entertainment, career, and family. Van Dijck also refers to the earliest content creators who were helping AOL in 1999 by monitoring their website for user content. A small number of these content creators, so-called remote staffers, got reimbursed for their contributions, which resulted in major discord among unpaid remote

staffers and ended with a lawsuit against AOL. Other contributions on the Internet were blogs, a shortened version of the term Web Log. Blogs began as Internet journals in the 1990s where people created links to interesting content, and some of them also generated income by promoting a product (Van Esch et al., 2018). More recently, YouTubers have become popular as for example video game commentary (Postigo, 2016). But there are also setbacks with this new phenomenon, when for instance YouTubers are abandoned or accused of misuse by their followers (Jerslev, 2016).

Characterization of Content Creator-based Business Models

From the literature study, we noticed that there seems to be a specific subset of commerce within social commerce, which consists of content creators who contribute their intellectual skills in order to make money (Angehrn et al., 2009; Postigo, 2016; Van Dijck, 2009). We decided to refer to this type of commerce as intellectual commerce, since the commerce of the content creators is based on intellectual creations. The first C in the business relationship C2C and C2B within intellectual commerce here refers to business-oriented content creators (creators). In contrast, regarding the same relations within social commerce, C mainly refers to consumers without intentions of making money. Some content creators may have a legal entity or business, consist of several persons, or be considered professional amateurs.

As seen in Figure 1, we identified that the value of intellectual commerce by a content creator C can be created in two ways: outside a platform, as in Figure 1a, or inside a platform, as in Figure 1b. The value capture turns out to follow the same procedure, namely that value can be captured outside a platform from consumers C or businesses B or inside a platform by consumers [C] or the business (platform itself) [B]. The bidirectional arrows in Figure 1 symbolize the value creation (arrows pointing from the creator) and value capture direction (arrows pointing towards the creator). We would also stress that creations by the creator normally are covered by copyright law when created outside a platform. When created inside a platform, terms mainly apply which may overrule the copyright and limit any further commercialization such as exclusivity rights.

In total we end up with the following eight combinations of content creator-based business models (BM types), as listed in Table 3, and which also corresponds to our first research question of how content creator-based business models can be characterized. In response to our second research question, we can also observe how value is created, captured, and protected, as seen in Figure 1.

Discussion

Value in social commerce is mainly created by content creators and delivered by platforms instead of websites, as in traditional e-commerce. We agree with Hajli (2014), Kim (2013), and Zhang and Benyoucef (2016) in seeing social commerce as a subset of e-commerce. The C2C and C2B relationships are important in social commerce where consumers do not focus on making money. Instead, users are more or less working for free (Postigo, 2016), for instance, by disseminating trust and branding products through word-of-mouth (Halliday, 2016; Jones & Leonard, 2008; Ng, 2013), or uploading images and videos on social media as user-generated content (Van Dijck, 2009).

In intellectual commerce, the content creators are business-oriented, as the C indicates that they all have a business model in mind, as stated by Chesbrough (2007). We have divided intellectual commerce by content creators creating value outside and inside a platform. When content creators create value outside a platform, it needs to be delivered by some external channels that are not considered in this study. Value created inside a

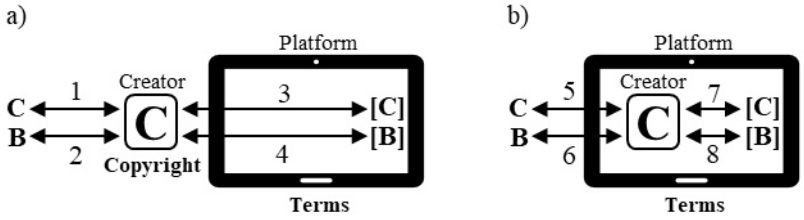

Figure 1. Eight business model types of value creation (arrows pointing out from the large C) and value capture (arrows pointing towards the large C) by business-oriented content creators where a) shows 4 types when value is created outside a platform, and b) shows 4 types when value is created inside a platform.

No.	Value creation	Value capture	Initial rights	BM Type
1	Outside platform	Outside platform	Copyright	C2C
2	Outside platform	Outside platform	Copyright	C2B
3	Outside platform	[Inside platform]	Copyright	C2[C]
4	Outside platform	[Inside platform]	Copyright	C2[B]
5	[Inside platform]	Outside platform	Terms	[C]2C
6	[Inside platform]	Outside platform	Terms	[C]2B
7	[Inside platform]	[Inside platform]	Terms	[C2C]
8	[Inside platform]	[Inside platform]	Terms	[C2B]

Table 3. Eight business model types for content creators within intellectual commerce. The brackets symbolize value limited by the boundaries (terms) of a platform.

platform may be delivered through the platform, and may also be commercialized within the platform. We would also like to clarify that creators can make use of two or more types of business at the same time, for example YouTubers who may be reimbursed by the platform for their content, and at the same time being reimbursed by businesses for promotion of products (Postigo, 2016; Van Dijck, 2009).

Intellectual commerce

Refers to commerce by content creators or more specifically as publicly accessible creative works made by non-professionals (such as UGC) with the intention of making money. The main difference between social commerce and our definition of intellectual commerce is that commerce in social commerce is carried out by businesses, even though creators are providing content. Intellectual commerce refers to business-oriented content creation as it both provides content and makes money. We would also like to clarify that in C2C e-auctions, consumers engage in commerce, but mainly involving physical products rather than original online intellectual contributions.

Explanation of intellectual commerce and content creator-based business model types

Below we describe our eight content creator business model types of intellectual commerce, and have also added some supportive and complementary references.

1. C2C

Some blockchain-based services for content creators enable them to sell or license their material directly to other consumers utilizing blockchain technology, taking care of reimbursements as well as managing property rights. Many of these services are still in an early development stage (McConaghy et al., 2017; Mehar et al., 2019; Nowiński & Kozma, 2017; Ryan, 2017; Swan, 2017).

2. C2B

This relation may refer, for instance, to bloggers and YouTubers who communicate brands of external businesses in their content. This value stream can be accomplished even when a platform is used to commercialize the content. Some bloggers use platforms for their blogs, which may imply limitations (Korhonen et al., 2017; Postigo, 2016; Van Dijck, 2009).

3. C2[C]

The relation refers to creations being developed outside a platform and uploaded to a platform. The creators are reimbursed by consumers within the platform. We have not found any examples of this business model type.

4. C2[B]

This relation refers to creations which are being developed outside the platform and uploaded to a platform. The creators are reimbursed by the platform (rather than by consumers), for example, for providing video contributions to YouTube (Postigo, 2016).

5. [C]2C

The creation is developed within the boundaries of a platform such as a cloud service. The platform allows the creator to download the creation and also allows reimbursement outside of the platform. An example could be an author who writes a manuscript using a cloud service. Distribution to the consumers may be handled by blockchain technology or by means of third-party (intermediary) solutions (McConaghy et al., 2017; Mehar et al., 2019; Nowiński & Kozma, 2017; Ryan, 2017; Swan, 2017).

6. [C]2B

This relation relates to content creators who develop their creative works within the boundaries of a platform, and who are allowed to download, control, and get reimbursed for their creative works outside of the platform. For instance, an author writing a manuscript in a cloud service such as Google Docs, downloads it and submits it to a publisher (Business). By using a platform, the creator may encounter limitations such as not being able to grant exclusivity to the publisher. Another example could be when taking photos with a mobile phone. Depending on which app (phone) or third-party app is used to take the photo, different rights and exclusivity issues may apply (Lippi et al., 2019; Steinfeld, 2016).

7. [C2C]

This type of model mainly refers to virtual worlds where content is created and traded among consumers within the platform, for example, avatars in virtual social worlds such as Second Life (Kaplan & Haenlein, 2010).

8. [C2B]

This last type refers to creators who, for example, develop apps for App Store or Google Play and get reimbursed by those platforms. Once the provided content is created it cannot be used or commercialized outside that specific platform or environment. A borderline case example is Amazon Mechanical Turk, where human intellect is used to solve different tasks, so-called Human Intelligence Tasks (HITs) (Peer et al., 2017).

As the platform provides the market channels, we have noticed that it is hard to find examples of the C2C, and [C]2C relationship. For instance, the C2C relationship has been around since the end of the1990s, and distributed by peer-to-peer software, such as KaZaA (Lambrick, 2009) and Napster (Newman, 2018; Smith, 2004), that led to piracy due to uncontrolled sharing and distribution without any structured possibilities for creators to receive reimbursement. Blockchain technology may again allow for P2P distribution to be carried out as a complement on or to platforms, this time within a semi-controlled manner, and with opportunities to properly reimburse creators. Many blockchain-based start-ups have already been launched (McConaghy et al., 2017; Mehar et al., 2019; Nowiński & Kozma, 2017; Ryan, 2017; Swan, 2017).

As a comment we would like to point out that business relationships seem to have gained in importance since business models can be applied also to content creators and their C2B and C2C relationships. A second comment is that distinguishing where and how value is created may become more important. For instance, if the value is created outside a platform, then it is automatically covered by copyright law according to national and international regulations. If the content instead is created inside a platform (or perhaps within an app), the terms of the platform may set the terms for how the content can be used or distributed inside or outside of that platform.

Conclusions

Our contribution is threefold. First, we have provided a taxonomy where we have explained and characterized 19 concepts within Web 1.0, Web 2.0, and e-commerce (Appendix).

Our second contribution, which corresponds to our first research question, is that we found eight business model types for business-oriented content creators that we have characterized (Figure 1), further explained and discussed. We have given examples for almost all business model types, except for C2[C], which refers to when consumers develop creative works outside a platform, but are reimbursed by consumers within a platform. This business model type seems to be unprecedented, about which we request any available input and suggestions.

Third, we also state that business-oriented content creators or professional amateurs have the intention of getting reimbursed for their efforts, in contrast with traditional content creators as well as the definition of user-generated content within social commerce. They must therefore pay attention to where they develop their creative works. If they develop them outside a platform, then the creative work is normally covered by copyright law as soon as it exists, but if a creative work is made within the boundaries of a platform, then the platform terms will apply and may overrule the copyright or in other ways limit the right to commercialize (for instance, exclusivity rights). This explanation corresponds to our second research question about created value. We introduced the term intellectual commerce to refer to business-oriented content creators making C2C and C2B businesses. This was placed in contrast to the same relations within social commerce, which mainly refer to e-auctions (C2C) or group-buying (C2B). The results imply that it is important for business-oriented content creators to understand the type of consumer and business relations in order to develop an appropriate business model.

As current research has been scarce and disparate we

hope that our more unified view of content creator-based business models can give rise to a better understanding of the research field, thus also leading to more focus on the relevant phenomena. Furthermore, as we have identified different value streams, practitioners may acquire clearer and deeper insights into the prerequisites and conditions for e-commerce, as well as gain a better understanding of its current preconditions and limitations.

Finally, we would like to point out three areas for further research. First, a better understanding with respect to new types of content creator-based business and whether they can be aligned with our eight content creator business model types needs to be developed (for example, by in-depth empirical studies). Second, there seems to be a lack of understanding regarding the key characteristics of intellectual commerce, for instance, whether or not creators care about or are personally invested in business models, and what the main drivers are (money, fame, or perhaps fun) for their participation on platforms. Other questions may apply on how creators protect their values, what the potential setbacks might be, as well as how long they can keep on going. Third and last, we would like to point to policy issues, structures, and legal frameworks, for example, requirements on content creators, as well as the need for registered firms dealing with how taxes and other legal issues are handled.

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Appendix. Taxonomy of e-commerce divided by Web 1.0 and Web 2.0 concepts

Descriptions of concepts and related references

Web 1.0 (Business centric)

The World Wide Web (Web 1.0) was introduced in 1989 by Sir Timothy John Tim Berners-Lee. At that time the web was first utilized by individuals and their personal websites which were connected with hyperlinks. In the mid ’90s, businesses started to get established on the web which gave birth to the business-centric era with increased focus towards business models.

Singh, et al., 2008; Timmers, 1998

Business Models (BM)
There is no generally accepted definition of business models, but one view is that it is a model of how to do business. A business model may be seen as a tool which helps the business to calculate revenues, costs for business actors and their roles, for example, customers, suppliers, and partners. The model may also reveal if the business may be able to sustain itself and how much profit can be expected.

Amit & Zott, 2001; Baden-Fuller & Morgan, 2010; Chesbrough, 2007; Foss & Saebi, 2016; Teece, 2010; Timmers, 1998

Business-to-Consumer (B2C)
A traditional business relationship between a business B and a consumer (customer) C.

Pavlou, 2003

Consumer-to-Consumer (C2C)
Business relationship between two consumers which may utilize an e-auction (within e-commerce) to trade items directly between each other. The term is sometimes also referred to as customer-to-customer or individual-to-individual (I2I). C2C within intellectual commerce refers to a C2C relation where a business-oriented content-creator is doing the commerce based on intellectual skills and creative works.

Antony, Lin & Xu, 2006; Du et al., 2012; Jones & Leonard, 2008; Leonard & Jones, 2010; Libai et al., 2010; Saarijärvi et al., 2018

Copyright
Copyright is a national legal right which helps creators to protect the original expression of their creative work.

Copyright is complex as it comes with many exemptions (e.g. fair use) and many nation-specific conditions. It mainly consists of two rights, an economic right, that for instance allows creators to be reimbursed for their efforts within a limited time period (in some nations 50 or 70 years after the death of the creator), and a moral right, that allows creators to be recognized for their creative works. The economic right is exclusive but quite often transferred to other parties such as a publisher. The right of being recognized normally remains. When creating contributions within a platform in several cases, both the economic and moral rights may be overruled, as for example in Minecraft, where several creators can collaborate and build entire worlds. Copyright does not protect the idea itself but instead the original expression from an idea, referred to as creative works.

García & Gil, 2008; Newman, 2013

Electronic Commerce or e-commerce (EC)
Electronic commerce or e-commerce may be seen as doing business electronically, for instance, throughout online services. The term commerce is related, for example, to buying, selling, and trading activities, and is mainly seen as a subset of e-business, also including other activities such as marketing and other business activities. Some specific terms related to e-commerce are the e-shop, which refers to business sales throughout a website; the e-mall, which refers to a website containing a collection of e-shops, for example, Amazon or Alibaba; and finally, the e-auction, which refers to an online auction where buyers can bid on different items, for example, eBay.

Choi et al., 1997; Timmers, 1998; Wang et al., 2016; Wu et al., 2011; Zott et al., 2011; Zwass, 1996

Long Tail (Short Tail)
The long tail refers to a large amount of niched low-volume products. For example, a physical bookstore needs to select high-volume authors (referred to as head or short tail) due to physical space limitations, in contrast with space online which is not limited.

Anderson, 2008; Lyubareva et al., 2014; Swan, 2017; Zhang et al., 2012

Pure (Full) and partial e-commerce
Pure e-commerce refers to when an agent (merchant), product/service, and delivery channel all coincide within the digital domain (carried out online). Partial e-commerce refers to the fact that some of them (but not all three) are carried out in the physical domain. For example, when clothes are ordered online, but delivered by traditional mail, the agent belongs to the digital domain, while the product and delivery belong to the physical domain. If all three are carried out in the physical domain it becomes traditional commerce within the physical world.

Choi et al., 1997; Dey & Nath, 2012; Yang et al., 2017; Yayla & Hu, 2011

Web 2.0 (Consumer centric)
Web 2.0 (popularized by Tim O'Reilly and Dale Dougherty in 2004) is seen as an enhancement of Web 1.0 by utilizing new technologies, such as asynchronous JavaScript and Extensible Markup Language (XML), together referred to as AJAX. The tools made the web more dynamic, gave rise to platforms, and facilitated users' interactions. As the business-centric Web 1.0 was about providing information, the consumer-centric Web 2.0 is focused on participation. Concepts of Web 2.0 are, for instance, platforms, user-generated content, content creators, social commerce, and social media.

Hajli, 2013; Harrison & Barthel, 2009; Singh et al., 2008

Blockchains (DLT, DAO)
Blockchains consist of network software protocols that manage transactions of value and ownership over the Internet in a decentralized manner, without the need of any third parties (intermediaries). The technology is mainly based on peer-to-peer (P2P) technology, cryptography, and an immutable ledger (file that keeps track of the transactions) by which a user may transfer values (for example, digital tokens and assets) to other parties on the same blockchain. There are two types of blockchains, public and private, where bitcoin represents a public blockchain (where the user's real identity is not known), in contrast to private blockchains, the latter which mainly are managed as business consortia or by governments and where user identities are known. Distributed ledger technology (DLT) is a more general form of the technology based on a ledger, consensus update, cryptographic signatures, and tamper-proof auditable history, without necessarily being updated by sequences of blocks such as a blockchain. Some blockchains may also encompass possibilities of handling decentralized autonomous organizations (DAOs), which may be seen as organizations represented by rules encoded as a computer program.

McConaghy et al., 2017; Mehar et al., 2019; Nowiński & Kozma, 2017; Ryan, 2017; Swan, 2017; Tapscott, 2017

Business Model Innovation
Business model innovation mainly refers to when a

business changes one or multiple components in their business model, such as introducing a novel way to create or capture value (for example, licensing instead of selling products).

Amit & Zott, 2012; Björkdahl & Holmén, 2013; Frankenberger et al., 2013

Consumer-to-Business (C2B)
In social commerce the relation refers to group buying (a group of consumers who get together) in order to obtain volume discounts. In intellectual commerce the relation may refer to creators (for instance bloggers) making money by promoting business products.

Chen et al., 2008; Vanmeter et al., 2015; Wang et al., 2002; Yrjölä et al., 2017

Platforms
Platforms facilitate users to upload or develop content and can be seen as organizations which serve and create value for two or more distinct types of customers: application developers, manufacturers, advertisers, and consumers. An early stage problem that platforms must overcome is referred to as the chicken-and-egg problem. For example, YouTube needed to have many content creators to be able to attract viewers, but at the same time content creators require many viewers in order to incentivize their efforts into producing and sharing creative works. After accomplishing a critical mass, platforms may have the ability to utilize network effects (NE), which may trigger self-reinforcing feedback loops that can magnify incumbents' early advantages, and thus lead the platform to a winner-takes-all outcome. The purpose of a platform is to facilitate the exchange of products or information but also to provide greater accessibility, speed, efficiency, user experience, and convenience. Marketplaces usually comprise of e-auctions (for example, C2C trading), but also e-malls that utilize the long-tail concept.

Dufva et al., 2017; Garcia-Swartz & Garcia-Vicente, 2015; Hagiu & Wright, 2014; Holland & Gutiérrez-Leefmans, 2018; Korhonen et al., 2017; Rochet & Tirole, 2003; Stephen & Toubia, 2009

Social Commerce or s-commerce (SC)
Social commerce means commerce through social interactions by consumers. Social commerce is mainly seen as a subset of e-commerce or as utilizing Web 2.0 features in e-commerce. Traditional e-commerce is mainly seen as a one-directional business relationship where information rarely is sent back to the business compared to social commerce, which constitutes a multidimensional flow between businesses and consumers. The term social commerce was introduced in 2005 when Yahoo allowed consumers to create, share, and comment on product lists of a collaborative shopping feature on their platform.

Banks & Humphreys, 2008; Busalim & Hussin, 2016; Hajli, 2014; Huang & Benyoucef, 2013; Kane, 2007; Kim et al., 2008; Liang et al., 2011; Stephen & Toubia, 2010; Yadav et al., 2013; Zhang et al., 2012

Social Media (SM)
Social media mainly consist of online services which facilitate communication channels of information between different types of users in a multidirectional way. The information can consist of entertainment, news, education, discourse, or user-generated content.

Halliday, 2016; Kaplan & Haenlein, 2010; Liang et al., 2011; Saarijärvi et al., 2018; Vanmeter et al., 2015

Terms
The terms of service, which mainly are provided by a business, specify the rights and obligations which apply to the users of the service. Terms may also include a privacy policy which states how personal data will be protected and handled. There are different connotations for user terms, for instance, terms and conditions, terms of service, service agreements, or statements.

Lippi et al., 2019; Steinfeld, 2016

User-Generated Content (UGC, UCC)
User-generated content may be seen as publicly accessible creative works made by non-professionals. More specifically, the three parts may be addressed as: 1) it needs to be publicly accessible; 2) it needs to include some creative effort; and 3) it needs to be created outside of professional routines. The term became popular in 2004 and according to our trend analysis seems to have been referred to as user-created content (UCC) (Table 2). It may also be mentioned that in the early 1990s, its early users created all of its content. Some common terms of content creators applied on the Internet are, hobbyists, amateurs, unpaid labourers, and volunteers. The term perhaps should have a broader definition nowadays and not only cover creative contributions, as the boundary between amateurs and professionals has also become more dynamic. Normally, consumers or users contribute online by submitting text, image, sound, video, and combinations of them (multi-media). Such creative works are subject to copyright.

Angehrn et al., 2009; Banks & Humphreys, 2008; Barnes,

2002; Dye, 2006; Figallo & Rhine, 2001; Goh et al., 2013; Hajli & Sims, 2015; Harrison & Barthel, 2009; Kane, 2007; Kaplan & Haenlein, 2010; Lai & Turban, 2008; Postigo, 2016; Scarle et al., 2012; Van Dijck, 2009; Van Esch et al., 2018

Virtual Worlds

Virtual worlds are mainly characterized as virtual social worlds where users appear as avatars and interact as in real life, such as in Second Life, or as virtual gaming worlds where users behave according to stricter rules.

Kaplan & Haenlein, 2010

Word-of-Mouth (WOM)

Word-of-mouth mainly refers to the interconnections between consumers that may be used to strengthen a brand or trust in an online product or service. It mainly solves the problem of not having a salesperson whom you can ask and gain trust from as in physical stores. Reviews by consumers are also seen as word-of-mouth and can improve buying decisions, as well as saving time for other consumers. Word-of-mouth is seen as powerful and can easily change consumer preferences and purchase behaviour.

Figallo & Rhine, 2001; Gefen, 2000; Hajli, 2014; Hennig-Thurau & Walsh, 2003; Libai et al., 2010; Stephen & Toubia, 2010

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