

Digital Innovation and Changing Identities

Investigating Organizational Implications of Digitalization

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Department of Informatics
Doctoral Dissertation
Umeå University
Umeå 2015

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ISBN: ISBN 978-91-7601-278-9

ISSN 1401-4572, RR-15.01

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Printed by: Print & Media, Umeå University

Umeå, Sweden 2015

In Memory of Sven Nylén
1923-2015

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Abstract

The emergence of digital technology represents a paradigmatic historical shift. As a process transforming sociotechnical structures, digitalization has had pervasive effects on organizing structures and business logics, as well as contemporary society as a whole. In recent years, these effects have been particularly salient in the content-based (e.g. music and imaging), and most recently the print-media (e.g. newspapers and magazines) industries. Facing dramatically declining sales of print media products, publishers have sought to leverage digital technology for innovation. However, the digital revenues still do not yet typically compensate for the decline in print media sales. This thesis explores the organizational implications of digitalization in the media domain. Scholars have increasingly stressed that digital technology has some distinct characteristics that have fundamental implications for innovation. This thesis examines aspects of these implications that have been far from fully explored, including the roles of digital technologies as enablers of process innovation (new methods, procedures or responsibilities), product innovation outcomes (which shift or expand an organization's domain) and associated changes in organizational cognition and identity. The thesis is based on four empirical investigations, reported in appended papers, of the evolution of digital platforms, the new content creation practices they enable, and how traditional print media firms have sought to innovate and reorient themselves in relation to these novel phenomena. The composite analysis illustrates how the distinct characteristics of digital technologies are complicit in transitions from stable to fragile product categories, highlights the need for a dynamic approach to identity orientation, and discusses and proposes key concerns in scholarly studies of digital innovation in organizations based on insights generated by the underlying studies.

Acknowledgements

First, I would like to express my sincere appreciation to my supervisor, professor Jonny Holmström. Thank you for believing in me, and thank you for your encouragement and support throughout this process. I would also like to thank my second supervisor Per Levén for getting me started and being instrumental in setting up the collaborative projects that allowed me to get a head start in collecting data.

I am also very grateful to my co-authors. I want to extend my warmest thanks to Professor Kalle Lyytinen at Case Western Reserve University. I cannot stress enough how important your input and devotion has been. You have served as a great source of inspiration throughout my doctoral studies and your mentorship has been key in my development as a scholar. I also want to thank co-authors Viktor Arvidsson, Daniel A. Skog, and Youngjin Yoo. Thank you all for inspiring and fun collaborations! I also want to thank the IT Management Group for always being there and supporting me. Thanks also to Veeresh Thummadi and Aron Lindberg, and the Information Systems Department at CWRU for taking care of me during my time as a visiting scholar.

I would also like to extend my thanks to Ulrika H. Westergren, Vasili Mankevich, and Johan Sandberg for your constructive feedback during and after the pre-seminar.

I also gratefully acknowledge financial support from Vinnova and the program "Vinnande tjänstearbete", the MIT research school, and the Kempe foundation. Further, without admission from the organizations examined in the case studies, and all the informants that contributed with their time, this research would not have been possible.

To all of my family, thank you for always supporting me and believing in me.

Most importantly, thank you Matilda. This would not have been possible without your endless support and patience.

Umeå, April 2015

Daniel Nylén

Preface

This thesis is based on research described in the following appended papers, which are referred to in the text by the corresponding numbers. For convenience, the studies reported in Papers 1-5 are sometimes referred to as Studies 1-5, respectively.

Paper 1: Nylén, D., Holmström, J., & Lyytinen, K. (2014). Oscillating Between Four Orders of Design: The Case of Digital Magazines, *Design Issues*, 30(3): 53-68.

Paper 2: Nylén, D., Skog, D.A., Holmström, J., & Lyytinen, K. (2015). Cascading Digital Innovation: An Analysis of Cognitive Change and Identity Collapse in a Newspaper Organization. (Manuscript)

Paper 3: Nylén, D., Arvidsson, V., Holmström, J., & Yoo, Y. (2015). Digital Platform Evolution: Theorizing Configurations of Innovation and Control in the Case of Facebook. (Manuscript)

Paper 4: Nylén, D. (2015). Tracing Emergent Structure in Self-organized Citizen Journalism, Proceedings of the *48th Hawaii International Conference on System Science (HICSS 48)* (Kauai, HI).

Paper 5: Nylén, D & Holmström, J. (2015). Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation, *Business Horizons*, 58(1): 57-67.

1. Introduction

Digitalization has had pervasive effects on organizations, industry structures, the economy, and contemporary society as a whole (Brynjolfsson and McAfee 2014). Over the last 15 years, the content-based industries have experienced major disruptions of established structures and business models as low-cost and easy-to-use networked digital technologies have enabled novel usage patterns. While these effects are well documented with regards to the music industry (e.g. Graham et al. 2004; Liebowitz 2006; Wikström 2013) and the photographic imaging industry (e.g. Lucas and Goh 2009; Tripsas 2009; Tripsas and Gavetti 2000), more recently the legacies of a number of iconic newspapers and magazines started to crumble.

A number of historic structural transformations occurred in the traditional media industry even during the course of the research reported here, notably Newsweek magazine (founded in 1933) was merged with opinion website The Daily Beast in 2010 after facing radically declining sales. The printed edition was discontinued in 2012¹, but another change in ownership saw an unexpected re-launch of the print-issue in the spring of 2014. The Washington Post (founded in 1877) was acquired by Amazon founder Jeff Bezos for \$250 million in cash in 2013 (Sandoval 2013), and in May 2014 BuzzFeed published a leaked version of an internal New York Times policy document (see Tanzer 2014) provided an insight into the firm's relatively limited digital innovation efforts. At the same time, podcasts became an established product category that increasingly challenged FM radio, while streaming of film and TV-content exploded, with Netflix boasting more than 50 million subscribers worldwide in July 2014 (O'Toole 2014). Facing dramatically declining sales of print media products, rather than issuing copyright lawsuits, publishers sought to leverage digital technology for innovation. However, despite positioning themselves in increasingly diverse digital arenas, their digital revenues typically do not yet compensate for the decline in print media sales². Taking these developments into account, it is timely to study the role of digital technology and its associated innovation dynamics in the media domain.

A long legacy of research on technological innovation has generated valuable insights that can help explain observed changes associated with digital technology in the media domain. This research has, for example, highlighted the nature of technology trajectories (Dosi 1982; Nelson and Winter 1982) and how organizational strategies are related to differential forms of process and product innovation outcomes during the emergence of

¹ <http://en.wikipedia.org/wiki/Newsweek>

² In the U.S., print advertising revenues decreased by around 60% (25 Billion USD) between 2007 and 2013, while online ad revenues only increased by around 8% (250 million USD) during the same period ("Newspapers: Print and Online Ad Revenue", News Media Indicators Database, Pew Research Center), <http://www.journalism.org/media-indicators/newspaper-print-and-online-ad-revenue/>

discontinuous technologies (e.g. Abernathy and Utterback 1978; Henderson and Clark 1990; Tushman and Anderson 1986). More recently, the theory of disruptive innovation has emerged, postulating that instead of sustaining existing product categories through incremental or radical improvements, certain novel technologies are *disruptive* – they interrupt the normal trajectory of an industry, thus causing marketplace disorder. It is argued that disruptive technologies enable the creation of cheaper products that bring novel values to the market, however their with an inferior performance (Christensen and Bower 1996). Such products tend to appeal to new customer groups, and invite new entrants into the marketplace, while incumbent firms typically underperform in the new business logic (Bower and Christensen 1995; Christensen 1997).

The theory of disruptive innovation has also been specifically applied to analyze digitalization in the media domain. Indeed, the authors of the New York Times innovation report drew upon such ideas when suggesting ways forward for the parent firm in a digital landscape. In another prominent example, Christensen et al. (2012) applied the theory to the news industry in a Nieman labs report. These authors advised newspaper organizations should seek to develop new products that target a problem that consumers encounter during their downtime (e.g. boredom). However, Christensen's work on disruptive innovation was recently criticized by business journalist Jill Lepore (in an article in the New Yorker, see Lepore 2014) and economist Paul Krugman (2014). One of the key criticisms involves the distinction (if any) between the disruptive innovation concept and the 70-year-old concept of *creative destruction*. According to this theory some technological innovations can destroy established economic structure while creating new ones, rendering extant businesses and professions obsolete while making place for novel alternatives (Schumpeter 1942). Recent arguments hold that due to digitalization, the destructive component has become more dominant (see Komlos 2014). To this end, Information Systems (IS) research has a long tradition of investigating the relationship between digital technologies and organizing (e.g. Bostrom and Heinen 1977; Markus and Robey 1988; Orlikowski 1992). However, this research has been criticized for black-boxing technology. Notably, in a seminal research commentary in the journal Information Systems Research entitled "Desperately Seeking the "IT" in IT Research—A Call to Theorizing the IT Artifact", Orlikowski and Iacono (2001, p. 121) highlighted ways in which the digital artifact "tends to disappear from view, be taken for granted, or is presumed to be unproblematic once it is built and installed". To overcome these shortcomings, the authors suggested that scholars should put more effort into theorizing the digital artifact, and incorporating the resulting conceptualizations into their empirical investigations in social contexts. Twelve years later, a review by Akhlaghpour et al. (2013 , p. 151) showed that

little progress had been made regarding this issue. While related to a broader trend in organizational scholarship, where arguments have been made for including tangible artifacts and spaces in analyses of organizing processes (Leonardi and Barley 2008; Orlikowski 2007; Orlikowski and Scott 2008); studying the material aspects of digital artifacts has been highlighted as a promising avenue to pursue when seeking to further theorize the digital artifact (Akhlaghpour et al. 2013; Robey 2003).

A major objective of the investigations and analyses presented in this thesis has been to generate new knowledge that contributes to IS research. However, the pervasiveness of digital technology has attracted interest from scholars in various neighbouring fields: For example, digital technology is explored in interesting and relevant ways in communications, science and technology, sociology and psychology research. However, like any thesis in Information Systems, this thesis has to balance the act of focusing on contributing to IS research, while staying open to insights from neighboring disciplines, and ultimately seek to contribute back to them as well (Robey and Zmud 1992). In order to delimit the scope of the thesis, and since its core subject matter is digital innovation, I also reviewed relevant literature from the fields of Technology and Innovation management (TIM), and organizational theory.

Building on a review of the literature on digital innovation, the lens applied in the thesis highlights the *layered modularity* of digital artifacts (Yoo et al. 2010a), is sensitive to their distinct *material* aspects (Leonardi 2010; Yoo 2012), and highlights differential discontinuities in their long-term evolution. It also adopts a perspective of digital innovation that includes views of digital technologies as enablers of *process innovation* (new methods, procedures or responsibilities), and as *product innovation* outcomes (that shift or expand an organization's domain) (Fichman et al. 2014; Zmud 1982). In addition, it acknowledges that cumulative effects of digital innovation outcomes are associated with deep sociotechnical changes (Yoo 2013; Yoo et al. 2010a) concerning organizational *cognition* (Glynn and Navis 2013; Orlikowski and Gash 1994) and *identity* (Alvarez 2008; Tripsas 2009). In applying this lens to investigate the observed changes in the media domain, the thesis is guided by the following research question:

How do the distinct characteristics of digital technologies affect innovation in media production, distribution, and consumption?

Answering this question is important for several reasons. The media has long been a key component in Western democracies. However, incumbent media firms are struggling to find viable business models for the digital age. At the same time, digital technology has enabled citizen-driven journalistic efforts that involve more inclusive and “democratic” modes of media content

production. A feature shared by traditional and emerging modes of journalism is that they are increasingly distributed on digital platforms and services that are often “free” and easy to master. However control over, and advertising revenues associated with, such platforms and services typically reside remotely from the actors producing the contents. Thus, robustly addressing the research issues could help both scholars and practitioners engaged in digital innovation in the media domain.

The composite analysis presented here draws on investigations, presented in five research papers, of the evolution of digital platforms, the new content creation practices they enable, and how traditional print media firms seek to innovate and reorient themselves in relation to these novel phenomena. The thesis as a whole consists of this cover paper and the five appended research papers. Following this introduction, the remainder of the cover paper is structured as follows. Section two provides an introduction to relevant research on technological innovation and organizing. Section four outlines the overall research design. Section five summarizes the five research papers. Section six discusses the findings and key contributions of the thesis, its practical implications and limitations, and then suggests directions for future research. Finally, section seven presents my conclusions.

2. Technological Innovation and Organizing

The emergence of digital technology was a historical paradigmatic shift. Digital technologies had, and continue to have, major effects on people, organizations, industries, and society at large. Bresnahan and Trajtenberg (1995) classify digital technology as a “general-purpose technology”, comparing it, for instance, to the steam engine. While the steam engine enabled the mechanization of commodity production processes in the late 19th century, as a technological innovation it is associated with *industrialization* as a wider societal transformation process (Rosenberg and Trajtenberg 2004). This process involved significant changes in sociotechnical structures, manifested for example in urbanization, higher living standards, and the emergence of trade unions (Beninger 1986; Landes 1969). Similarly, while digital technology allows any information to be represented in a digital format, *digitalization* as a wider phenomenon is associated with major changes in sociotechnical structures triggered by pervasive digital technologies of similar magnitude to those of late 19th century industrialization (Yoo 2013). These changes come in many shapes, not least radical shifts in job-skill demands. In this respect, digital technologies increasingly complement workers in the completion of complex problem-solving tasks while replacing humans performing rule-based manual labor (Autor et al. 2003; Levy and Murnane 2004). However, recent developments suggest that a wider range of jobs could become obsolete as pattern recognition capabilities are further developed and incorporated in robotic innovations (Brynjolfsson and McAfee 2014). To conceptually investigate the implications of the technological evolution in organizational settings, the following sections present an overview of relevant key literatures that hold potential for explaining changes in the media industry. In so doing, I first introduce established theories of technological innovation (2.1), and then I specifically discuss the concepts of disruptive innovation and creative destruction (2.2).

2.1 Theories of Technological Innovation

The word *innovation* (noun) refers to “the introduction of something new” or “a new idea, method, or device” (Merriam-Webster 1993). Early scholarly conceptualizations of innovation can be found in the field of economics, notably Schumpeter (1934, p. xix) defined *innovation* as “the commercial or industrial application of something new – a new product, process, or method of production; a new market or source of supply; a new form of commercial, business, or financial organization”. Theories of technological innovation typically distinguish between the terms *invention* and *innovation* (see, for

example, Schumpeter 1947). In this context, Ruttan (1959, p. 596) notes that while exact definitions may vary, there seems to be a consensus that “invention in some manner is antecedent to innovation”. Drawing on Nelson and Winter (1982) and Schumpeter (1934) – West and Gallagher (2006, p. 83) distinguish between “invention (a scientific breakthrough) and innovation (commercialization of the invention).”

Rapid technological evolution during the mid 20th century sparked organizational scholars’ interest in the organizational challenges associated with technological innovation. While early organizational theorists had sought to identify universally optimal organizational designs, Lawrence and Lorsch (1967) argued that context is important, and that in the face of increasingly rapid technological development organizational structures are contingent on characteristics of a firm’s external competitive environment. Other influential contributors to the contingency perspective on technological innovation include Burns and Stalker (1961), who proposed that during the environmental turbulence associated with the emergence of a new technology organic structures (as opposed to mechanistic structures) facilitate innovative activity as they allow for a higher degree of individual experimentation and initiation. Subsequent research in technology and innovation management (TIM) applied a more dynamic view when investigating organization-environment interactions – such as how the occurrence of process and product innovations over time were related to the firm’s strategy and interacted with the industry segment’s development stage at a given time (Utterback and Abernathy 1975). In terms of innovation capability, Abernathy and Utterback (1978) argued that as incumbent firms focus on incremental innovation and specialization over extended periods in order to achieve economies of scale in mass markets, they are likely to reject ideas and technologies that present potential for radical innovation. While such innovations typically offer higher unit profit margins, they may require major reorientation of the firm’s strategy and production processes. Therefore, entrepreneurially oriented units or institutions are typically most likely to champion radical innovation (Abernathy and Utterback 1978).

Applying an evolutionary lens when exploring the relationship between technological innovation and market competition, Nelson and Winter (1982) suggested that technology evolves along *natural trajectories*. Drawing on Kuhn’s (1962) notion of scientific paradigms, Dosi (1982) further elaborated on the concept (however, using the term *technological trajectories*). In seeking to account for *continuous* and *discontinuous* change in technological innovation, Dosi (1982) argued that technology evolves along a trajectory that is shaped by the current paradigm. Daily problem-solving activities and design decisions in organizations are based on the prevailing paradigm, and thus become focused on incremental innovation. This can result in a failure to see opportunities for *radical innovation* that do not comply with the

current paradigm and forecast trajectory. While new paradigms emerge as an outcome of complex interactions between changes at various societal levels they typically present major challenges to incumbent firms.

In seeking to link organizational traits to firm and industry competition, Abernathy and Clark (1985, p.4) argue that “innovation is not a unified phenomenon: some innovations *disrupt*, destroy and make obsolete established competence; others refine and improve” (emphasis added). Therefore, they offer a framework for categorizing innovations and their roles in environmental competition. First, *regular innovation* involves the ongoing implementation of minor changes using extant competences, seeking to entrench the established customer base rather than breaking into new markets. Second, while *revolutionary innovations* “*disrupt* and render established technical and production competence obsolete” (emphasis added), they target existing markets (Abernathy and Clark 1985, p. 12). Third, *niche creation* involves innovations that utilize existing technology to tap into emerging markets. Finally, *architectural innovations* occur when new technology emerges that “departs from established systems of production, and in turn opens up new linkages to markets and users” (Abernathy and Clark 1985, p. 7). Architectural innovations involve a new rationale for processes and products, and are associated with a reformulation of the logic within an existing industry, or the emergence of a new industry and “stand out as creative acts of adapting and applying latent technologies to previously unarticulated user needs” (Abernathy and Clark 1985, p. 10).

In investigating longitudinal patterns of technological innovation in the minicomputer, cement, and airline industries, Tushman and Anderson (1986) found that when extended periods of technology evolution, characterized by incremental changes, are punctuated by discontinuous innovations, these discontinuities are either *competence-destroying* (rendering extant skills and knowledge obsolete) or *competence enhancing* (build on extant skills and knowledge). While the former are typically triggered by new entrants, the latter are initiated by incumbent firms (Tushman and Anderson 1986). According to Tushman and Anderson (1986, p. 439), “these effects decrease over successive discontinuities. Those firms that initiate major technological changes grow more rapidly than other firms”. Hence, incumbent firms are likely to face fundamental challenges when faced with competence-destroying technological discontinuities.

Based on a study of the photo-lithographic alignment equipment industry, Henderson and Clark (1990) argue that since certain types of “seemingly minor improvements” in technological products have disruptive effects on industries, the traditional dichotomy between radical and incremental innovation can even be misleading. While further developing the notion of architectural innovation (see Abernathy and Clark 1985), they propose that it

should be contrasted with *modular innovation*. Henderson and Clark (1990, p. 12) state that while "the essence of an architectural innovation is the reconfiguration of an established system to link together existing components in a new way", modular innovations involve the component-level, and in the industrial age they were relatively straightforward for organizations to deal with since the organizations were traditionally organized around divisions that dealt with specific components. While changes relating to architectural innovations may seem subtle to managers, they destroy architectural knowledge and competencies, which are deeply embedded in organizational structures, processes, and routines. Thus, new entrants typically perform better than incumbents in a context of architectural innovations (Henderson and Clark 1990).

2.2 Disruptive Innovation and Creative Destruction

Drawing on studies by Christensen (1992), based on longitudinal data from the disk-drive industry, Bower and Christensen (1995) first introduced the term *disruptive technology*. Such technologies are characterized by an architecture that contributes to interrupting an industry's normal trajectory, causing disorder in the marketplace (Christensen and Bower 1996). Here, a key distinction lies between the terms *sustaining* and *disruptive* technologies (Bower and Christensen 1995; Christensen 1997). While sustaining technologies are used to incrementally improve the performance of established product categories, disruptive technologies enable the creation of disruptive product innovations that bring novel values to the market. However, a key property of these products is that they underperform their predecessors and competing products (Christensen 1997). The characteristics of disruptive innovations are typically valued by new groups of customers, and subsequently attract new competitors into the marketplace. Incumbent firms typically struggle to innovate with disruptive technologies: while traditional innovation methods such as listening to customer needs, keeping track of competition, and constantly designing products with a higher quality are viable in relation to sustaining technologies, applying these approaches to disruptive technologies may be counterproductive (Bower and Christensen 1995; Christensen 1997).

An important perspective in this context is resource dependence (Pfeffer and Salancik 1978), which holds that environmental actors (e.g. customers and investors) strongly influence firms' investments (hence managers have less control over firms' resources than they generally believe; Christensen 1997). This is particularly salient, and environmental factors may impose key barriers, when firms seek to invest in disruptive technology. When a disruptive technology emerges, the customers are not usually interested yet, but by the time they are it is too late to invest in it (Christensen 1997). While disruptive technologies tend to enable the opening up of new markets, there

is a lag phase until such markets are large enough to increase a firm's growth. Therefore, Christensen (1997) argues that traditional financial forecasting techniques do not apply. When a disruptive technology first emerges its market does not yet exist and (of course) markets that do not exist are difficult to analyze.

Arguably, Christensen's theory of disruptive innovation is one of the most pervasive models generated by management research. In the media domain, the term "disruption" constantly recurs as media executives, policy makers, academic scholars, and technology bloggers seek to describe the digitalization of the media industry. Indeed, Christensen and associates applied the theory of disruptive innovation to the news industry in "Be the Disruptor" (Nieman Report, Fall 2012). In an included article "Breaking news – mastering the art of disruptive innovation in journalism" (Christensen et al. 2012), the authors apply the *jobs-to-be-done* (JTBD) concept proposed by Christensen and Raynor (2003). Essentially, the JTBD-concept is a framing device designed to facilitate identification of innovation opportunities in a disruptive context. As such, it discards the idea that people are interested in buying products *per se*. Instead it encourages firms to consider how they offer a solution to a problem that people encounter in their daily lives (Christensen and Raynor 2003). Applying this notion to the news industry, Christensen et al. (2012) suggest that newspaper organizations should target people's downtime during the day, such as time when they are commuting or waiting in line in the store or at the doctor's office. They encourage firms to try to gain an understanding of people's daily habits and routines (rather than asking people upfront what new products they want), and then adjust their structures and processes in ways that support delivery of these JTBD. While these insights are useful, a limitation of the theory of disruptive innovation when seeking to understand changes in content-based industries is that it does not provide the tools required to fully theorize the unique aspects of digital technology.

Christensen's work has also recently received criticism in popular debate, sparked by "The disruption machine"; an article by business journalist Jill Lepore published in *The New Yorker* in June 2014. In the article – described as "a careful takedown" by economist Paul Krugman in a blog post (see Krugman 2014) – Lepore (2014) not only criticizes the overall "disrupt or be disrupted" rhetoric, calling disruptive innovation "a theory of history founded on a profound anxiety about financial collapse, an apocalyptic fear of global devastation, and shaky evidence", she systematically follows up and scrutinizes the evidence drawn upon in *The innovator's dilemma* (Christensen 1997). In so doing, she shows that many of the incumbent firms under study eventually landed on their feet, while several of the new entrants or "disruptors" highlighted in Christensen's studies are no longer around.

An alternative perspective to related concepts such as “big bang disruption” (Downes and Nunes 2013), and “Supremacy through disruption and dominance” (D'Aveni 1999), is provided by (Carter and Rogers 2014) in an analysis of the effects of P2P music sharing and music blogs on the economics of the recorded music industries. Placing Napster³ and Pitchfork⁴ in a historical context, the authors question the frequently-heralded democratizing effects of these entities, the authors argue:

Ultimately we argue that the emergence and popularity of both Napster and Pitchfork may still be perceived by many as transformative moments but with the passing of time the culture of music has travelled a long arc back to many of the same institutionalized power relations these platforms appeared to disassemble. (Carter and Rogers 2014)

One criticism of the theory of disruptive innovation put forward by Lepore (2014) is that it is not clear exactly how it adds new knowledge that is not already offered by Schumpeter's concept of *creative destruction*. This concept refers to a process whereby innovation “incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one.” Schumpeter (1942, p. 83). Previous conceptions of market dynamics had almost exclusively focused on price competition. Instead, Schumpeter considered how “fundamental upheavals are brought about by process and product innovations of existing firms and potential competitors” (Heertje 1987, p. 714). Thus, creative destruction is a concept utilized to explain the role of technological innovation in sweeping away firms, professions and structures, while new ones emerge (Heertje 1987). Although a key component in Schumpeter's argument was that creative destruction is welfare-enhancing in the long-term, in the short term it was recognized as causing hardship for certain societal actors (Schubert 2013; Witt 1996). In a recent working paper, economist John Komlos suggests that there are signs that digital technology has rendered creative destruction “more destructive” in that it does not deliver long-term welfare to the same extent as in the industrial era (Komlos 2014).

While these insights are useful, they are limited when seeking to generate rich insights on the changes unraveling in the content-based industries in general, and in the media domain in particular. To do so, we need tools that provide the support for fully theorizing the unique aspects of digital technology. Meanwhile, the question of how *digital* technologies shape organizing and innovation has been studied in some detail, and remains a key concern in Information Systems (IS) research (see, for example: Barley 1986; Bostrom and Heinen 1977; Markus and Robey 1988). While a main

³ Napster was a file-sharing site. <http://en.wikipedia.org/wiki/Napster>

⁴ Pitchfork is a music website. www.pitchfork.com

focus of this thesis is to contribute to IS research, digital technology is also increasingly explored in interesting and relevant ways in other fields. In particular research on Technology and Innovation management (TIM), as well as broader organizational theory have investigated the organizational implications of digital technology in ways that are highly relevant to the thesis. Therefore, in the next section, I present a review of the relevant literature on digital innovation, while proposing a theoretical lens that enables fine-tuned analysis of the particular role of digital technology and the dynamics of digital innovation, a lens that will be applied in the thesis.

3. Digital Technology, Innovation, and Sociotechnical Change

Digital innovation has received substantial scholarly attention recently (e.g. Austin et al. 2012; Gregory et al. 2014; Tumbas et al. 2015). This attention is motivated by the notion that digital technologies “possess some highly distinctive characteristics that have important practical and theoretical implications for innovation” (Fichman et al. 2014, p. 332). In a broad sense, Yoo et al. (2010v, p.6) defined digital innovation as “innovation enabled by digital technologies that leads to the creation of new forms of digitalization”. More specifically, and for purposes of this thesis, I include in the term digital innovation both *process* innovations, defined as “new methods, procedures or responsibilities”, (Zmud 1982, p. 1424) and *product* innovations – “new products or services that shift or expand an organization's domain” (Zmud 1982, p. 1424)⁵. To date, studies of digital innovation have tended to focus exclusively on one or other of these aspects. However, due to the cumulative effect of multiple process and product innovation outcomes over time, and the sociotechnical changes associated with ensuing digitalization (Yoo 2013), scholars have recently paid attention to *cognitive* changes regarding the *meaning* and *categorization* of digital technologies, and firms’ processes, and products (Navis and Glynn 2010; Orlikowski and Gash 1994), as well as related changes in organizational *identity* (Alvarez 2008; Tripsas 2009). In the following sections I present a review of the relevant research on digital innovation that will be used as a theoretical lens in the composite analysis presented in the thesis. The next section explores the distinct characteristics of digital technologies involving their layered modular architecture (Yoo et al. 2010a), and their distinct material aspects (Leonardi 2010; Yoo 2012).

3.1 Being Specific About Technology

Despite repeated calls to be “specific about technology” (Monteiro and Hanseth 1996), to “theorize the IT artifact” (Orlikowski and Iacono 2001), and “bring the IT artifact into the core of theory development” (Tiwana et al. 2010, p. 677), a recent review by Akhlaghpour et al. (2013 , p. 151) showed that IS scholars have made limited progress towards “incorporating more comprehensive and multi-faceted conceptualizations of the IT artifact”. In this section, as I outline the first dimension of the theoretical lens applied in the thesis, I seek to open up the black box of digital technology in order to facilitate an account that remains sensitive to distinct aspects of digital

⁵ It should be noted that building on classifications presented by Zmud (1982), I suggest a broader definition of *digital innovation* than (Yoo et al. 2010a), who defined it as “the carrying out of new combinations of digital and physical components to produce novel products”, a definition that rather resonates with ideas of Fichman et al. (2014.)

technology. Today, digital technology is highly ubiquitous (Yoo 2013); often being embedded and “invisible” (Tilson et al. 2010b), but easy to understand and adopt for broad audiences (Zittrain 2008). To understand the current state of digital innovation, we need to first gain insights into how it evolved to this point. Therefore, in the next section, I provide a brief overview of how digital technologies have evolved since the mid-20th century, highlighting key discontinuities.

3.1.1 Three Waves of Digital Technology

Since the mid-20th century, Moore’s law⁶ has resulted in increasingly potent basic computing capabilities at decreasing costs. During this time, combinatorial evolution of those capabilities spawned three waves of discontinuous digital technology classes that had paradigmatically differential organizational consequences (Tilson et al. 2010b). In the following section I discuss these three waves while adapting and extending Tilson et al. (2010b) account, including additional literature that highlights capabilities of digital artifacts that are particularly relevant for my investigation of the media domain.

The first wave was initiated by the emergence of *mainframe computers* in the 1950s. During the following decades, mainframe computers, including multi-user monochrome terminals, became widely diffused in large corporations. Their use, in conjunction with standardized data formats, enabled digital information processing within the confines of inter-organizational networks. In this first wave, digital components were embedded in some traditional products (e.g. phone switches). However, typically these components were not visible to users. Therefore, interaction modalities and usage patterns largely remained the same (King and Lyytinen 2005; Tilson et al. 2010a).

The second wave was initiated by the emergence of two key technologies: *PCs* and the *Internet*. Basic PC functionalities were introduced in the first Macintosh (1984). It included an operating system (OS) with a Graphical User Interface (GUI) modeled on the desktop metaphor, and the mouse as a novel input device allowing direct manipulation of on-screen objects (Ehn 1988). The first Macintosh computers were mainly used in universities and governmental organizations. However, standardized PCs with MS Windows soon emerged as affordable, easily reconfigurable, and multifunctional options, and rapidly diffused into business and home settings. Since MS Windows allowed users to install and run third-party software, PC functionality could be extended far beyond any original design intent (Zittrain 2006). Exponential increases in processing power, storage capacity, and graphic rendering capabilities, enabled creation and editing of rich

⁶ http://en.wikipedia.org/wiki/Moore%27s_law

digital information (e.g. photos, sound, video). In turn, the Internet enabled globally dispersed users to interact, publish, distribute, and retrieve information through packaged data transmission protocols, client-server logic, and the HTML-standard (Lyytinen and Rose 2003). As middleware allowed information from disparate sources to be “glued” together and displayed in browser software, commercial actors soon entered the Internet, utilizing it as a standardized platform for flexible service delivery (Lyytinen and Rose 2003). Characterized by openness and shared control (Kallinikos et al. 2013; Shapiro 1999), the Internet became a constantly evolving set of digital capabilities that new groups could utilize and augment over time (Hanseth and Lyytinen 2010). To this end (Zittrain 2006) argued that collectively, PCs and the Internet serve as a *generative grid* (Zittrain 2006). However, this openness and its resulting status as a channel for “free” content (Anderson 2009) has been challenged by major ISPs and service providers (Kourandi et al. 2014).

The third wave was initiated by *web 2.0* – an umbrella term that seeks to capture a shift in website design and use (O'reilly 2007). The wave was initiated by three key improvements in web technologies: (1) Really Simple Syndication (RSS), allowing content subscription; (2) Asynchronous JavaScript and XML (AJAX), enabling more seamless, uninterrupted user interaction through efficient data exchange between web applications and servers; (3) Application Programming Interfaces (APIs), enabling content sharing between previously separate web-based services (Cormode and Krishnamurthy 2008; O'reilly 2007). Up to this point, the dominant website design was centered around HTML-coded content silos in which ownership equaled authorship. However, the novel capabilities of web 2.0 blurred boundaries between user and producer, and between previously discrete services. Through the diffusion of website features such as comment fields, ratings, tags, and blogs, users could actively generate and co-create content. New standards meant services could be extended by integrating information from external sources and novel services. For example, so-called *mash-ups* could be created by simply combining information from different sources (Cormode and Krishnamurthy 2008; Lessig 2008). Overall, the emergence of web 2.0 initiated shifts towards perception of the user as an active and engaged co-creator and the web as a platform spanning all digital devices and services (O'reilly 2007).

The technologies, capabilities, and changes in behavior introduced, induced or fostered by the advent of web 2.0 provided fundamental components leveraged in easy-to-use *social media platforms* (e.g. Facebook and Twitter) that enabled both professionals and laymen to publish, consume, share, and interact with news content (Kane et al. 2014). Empowering the individual user, social media platforms displaced the locus of control in creation and configuration of content to the grassroots, peer

feedback being the key quality assurance mechanism (Parameswaran and Whinston 2007). As social media platforms evolved, they became increasingly interoperable, facilitating reusability, allowing content producers to cross-publish to several outlets simultaneously and for any external website to integrate social media functionalities (such as the Facebook “like” button) (Parameswaran and Whinston 2007). Finally, capabilities that had previously required separate devices (e.g. photo and video capture, editing and publishing; geographic positioning etc.) were integrated in *smart mobile devices* (phones and tablets) (Yoo 2010). Bluetooth, the ubiquity of wireless networks, and increasing 3G bandwidth enabled unbounded transferability and further erosion of space and time constraints in service accessibility (Lyytinen and Yoo 2002).

In summary, an understanding of how these waves of digital technology emerged is essential for digital technology theorizing. However, it is also important to understand the architectural logic that builds foundations for digital artifacts. The next section seeks to offer insights on this issue.

3.1.2 The Layered Modular Architecture

The term *artifact* refers to an object that is man-made, distinguishing it from natural objects (Simon 1996). Orlikowski and Iacono (2001, p. 121) define digital artifacts as “bundles of material and cultural properties packaged in some socially recognizable form such as hardware and/or software”. Following this definition, examples of digital artifacts include “digital files”, “executable software applications”, and “computer hardware components”. However, combinations of these three examples can also be classified as *a digital artifact* (e.g. an iPhone including iOS, apps, and music files). This has been held to reflect the greater complexity of digital artifacts relative to non-digital counterparts (Kallinikos 2012; Tilson et al. 2013), which arises according to Yoo et al. (2010a) from a “layered-modular architecture” (LMA), involving permutations of standardized components across four loosely coupled “layers”: *contents*, *services*, *networks*, and *devices* (see Figure 1).

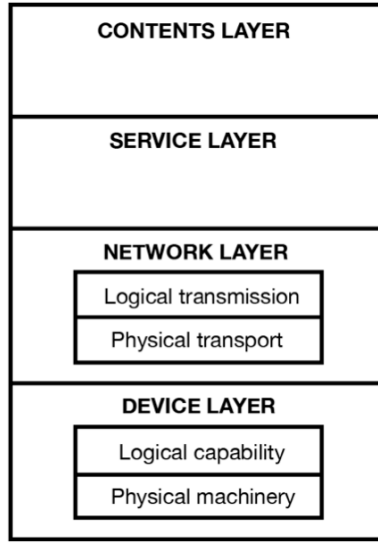


Figure 1. The Layered Modular Architecture of Digital Technology (Yoo et al. 2010a)

A fundamental conceptual element of LMA is von Neumann architecture (Yoo et al. 2010a), which enables separation of logical capability and representation from physical rendering and transmission (Kallinikos 2012; Von Neumann 1945). The four layers in the model (see Figure 1) are arranged as follows. Due to data homogenization, any *content* (1) (such as text, photos, audio or video) can be digitized (encoded into bits) (Brynjolfsson and Hitt 2000). Because standardized file-formats are used (e.g. jpg, mp3, avi), digital content is only loosely coupled to the remaining three layers⁷. Second, the *service* (2) layer “deals with application functionality that directly serves users as they create, manipulate, store, and consume contents” (Yoo et al. 2010a, p. 727). The authors cite smart phone apps and web-based services accessible through a browser as examples of services. Due to the decoupling of *contents* and *services*, digital artifacts display fundamentally different properties from non-digital artifacts. For example, unlike music on a vinyl record, digital music stored as an MP3 file can easily be made accessible and consumed through various services (e.g. iTunes, Soundcloud).

⁷ In contrast, analog content is *tightly coupled* to storage and distribution mechanisms (e.g. a vinyl record and a record player)

While the first two layers are fully digital, the *network* (3) and *device* (4) layers comprise both *logical* and *physical* elements. The physical elements of *networks* include fiber optic cables, routers, switches etc., while the logical elements include standards and protocols (e.g. TCP/IP and peer-to-peer) (Yoo et al. 2010a). Finally the physical and logical elements of *devices* include the hardware components and operating systems⁸ (Yoo et al. 2010a). Logical capabilities connect *networks* and *devices* to each other, and both networks and devices to *contents* and *services*. For example, digitized music can be stored in an MP3-file, and consumed via a wide array of devices (e.g. smartphones, tablets, PCs, smart TV's, and gaming consoles) and distributed through diverse networks (e.g. Wi-Fi, Bluetooth, Fiber, and 3G) (Yoo et al. 2010a).

Today, most digital artifacts are not delivered as final units with a fixed configuration across the four LMA layers (see Figure 1). Rather, digital artifacts are characterized by a *procrastination principle* (Zittrain 2008), holding that digital artifacts “should not be designed to do anything that can be taken care of by its users” (Zittrain 2008, p. 31). Thus: bindings across the four layers are temporary (Yoo 2012); and many digital artifacts are, by design, *intentionally incomplete* (Garud et al. 2008; Zittrain 2008).

3.1.3 Material Aspects of Digital Artifacts

Studying the material aspects of digital artifacts has been highlighted as a promising avenue to pursue when seeking to further theorize them (Akhlaghpour et al. 2013; Robey 2003). The recent interest in conceptualizing the materiality of digital artifacts is also related to broader arguments in organizational scholarship to include tangible objects, bodies, and physical spaces in analyses of organizing processes (Leonardi and Barley 2008; Orlikowski 2007; Orlikowski and Scott 2008). Indeed, *sociomateriality* has recently become a pervasive concept in IS research, as exemplified by the recently published MISQ Special Issue on the “Sociomateriality of IS & Organizing”⁹. However, the *sociomaterial perspective* or *sociomateriality theory* differs fundamentally from the concept *materiality* as used in this thesis. Leonardi (2012, p. 34) clarifies the distinction between the terms sociomateriality and materiality as follows:

Scholars who adopt the term ‘sociomateriality’ would likely argue that it is unique from the term ‘materiality’ in that it shifts the unit of analysis from materials and forms to the development or use of materials and forms. In other words, talking about sociomateriality is to recognize and always keep present to mind that materiality acts as a constitutive element of the social world, and vice versa. Thus,

⁸ Using vocabulary applied by Boudreau (2012, p. 1410), the logical dimension of Yoo et al. (2010a)’s device-layer involves “operating system platform software”, while the service-layer consists of, but is not limited to “application software”.

⁹ Management Information Systems Quarterly, Vol. 38 No. 3, pp. 849-871/September 2014

whereas materiality might be a property of a technology, sociomateriality represents that enactment of a particular set of activities that meld materiality with institutions, norms, discourses, and all other phenomena we typically define as 'social'.

When focusing instead on conceptualizing the materiality of digital artifacts, as in this thesis, a key assumption is that digital artifacts have certain properties that transcend space and time, and hence patterns of local use (Kallinikos 2004). Following Leonardi (2012), I use the term *materiality* when referring to aspects of digital artifacts that exist independently of human actors. While digital artifacts such as a file or an app are intangible (they cannot be touched) (Yoo et al. 2012), they are not purely conceptual, as they provide capabilities that afford or constrain human action. In turn, these capabilities shape the character of user interactions (Leonardi 2010). In making the case for studying digital materiality, Leonardi (2010) argues; “whereas objects, sites, and bodies, make it easy to define materiality as having some tangible character, software does not.” Further developing the discussion on the premises and consequences of theorizing materiality of digital artifacts, Leonardi (2012) argues that:

‘Materiality’ does not refer solely to the materials out of which a technology is created and it is not a synonym with “physicality.” Instead, when we say that we are focusing on a technology’s materiality, we are referring to the ways that its physical and/or digital materials are arranged into particular forms that endure across differences in place and time. Such a definition suggests that the usefulness of the term “materiality” is that it identifies those constituent features of a technology that are (in theory) available to all users in the same way. (Leonardi 2012, p. 29)

An assumption underlying any theorizing of digital materiality is that although digital artifacts are fluid, they can be temporarily fixed (Leonardi 2012). This assumption enables scholars to, for example, theorize ways in which iOS became more generative with the launch of the app store, and that the level of generativity of iOS is the same for all third-party developers at a specific point in time (Eaton et al. 2015). Therefore, Leonardi (2012) argues that the concept of materiality enables scholars to study intrinsic properties of digital artifacts, how they become fixed, and how this “fixedness” or “fixity” affects innovation.

Interest in theorizing the material aspects of digital artifacts has increased recently, but it was not completely ignored in earlier IS research. Notably, the malleable nature of digital artifacts has been a recurring topic. For example, Kling (1980, p. 100) described digital artifacts as “malleable, though not entirely plastic”. Similarly, in a study of local adaptation of electronic point of sale-systems, Smith (1988, p. 159) attributed the ability of local retail managers to deploy the systems in ways that reflected and sustained existing social relations to the “malleability” of their digital

components. In addition, Orlikowski (2000, p. 409) noted that while digital artifacts are not “infinitely malleable”, a software-based artifact is likely to be more malleable than a hard-wired machine, and that the degree of malleability depends on the type of digital artifact considered (“the use of a stand-alone personal computer in my home is likely to be more malleable than the use of a workstation by an air traffic controller”). In this context, Tiwana et al. (2010) highlighted the high degree of malleability in software platforms due to their extensible codebase.

In scrutinizing this recurring notion of the malleability of digital artifacts, Kallinikos et al. (2013) stress that all artifacts (digital and non-digital) are malleable to some extent, i.e. they have some capacity for adaptive change that allows them to be shaped or altered by human beings. However, because of their physical materiality, most non-digital artifacts are inherently inert (e.g. a hammer or a wooden chair) (Yoo et al. 2012), and do not allow rapid reconfiguration. To explain shifting degrees of malleability, Kallinikos et al. (2013) distinguish between the *editability* and *reprogrammability* of digital artifacts. According to their conceptions, *editability* is a fundamental characteristic of digital media content. For example, video content stored as a .mov file can be edited much more readily than contents of a VHS cassette, as users can readily change narrative sequences in a film, replace soundtracks and splice clips etc. using cheap software (Kallinikos and Mariátegui 2011). Other examples include the ease with which social media posts can be edited (see Treem and Leonardi 2012). Furthermore, the network layer of the LMA enables such content to be easily and rapidly shared, distributed, and collaboratively manipulated (Yoo et al. 2010a). To Kallinikos et al. (2013, p. 358), the *editability* of digital artifacts means that “they are pliable and always possible, at least in principle, to modify or update continuously and systematically”. The cited authors arrive at the following definition of editability:

The simple reorganization, addition, or deletion of the content and items that make up the digital object or the updating of information (for instance, in a database) without interference on the logical structure (the respective database schema) that governs the object and the mechanisms of information production and processing. (Kallinikos et al. 2013, p. 360)

Consequently, editability operates at the contents-layer of the LMA. Meanwhile, *reprogrammability* operates at the service, network, and device layers and is defined as:

The ability of a digitalized artifact to accept new sets of logic (instructions) to modify its behaviors and functions. In the case of digitalized artifacts, it is done by embedded software. (Yoo 2010, p. 231)

While all digital artifacts are reprogrammable (Yoo 2010), in the early days of computing, programming was a task mainly conducted by computer engineers and the producers of digital artifacts. Most early digital artifacts were relatively tightly coupled across the LMA, such as mainframe computers and “dumb terminals” (see e.g. Evans et al. 2006). As the layers were successively decoupled during the last 30 years, reprogrammability increased. To distinguish between editability and reprogrammability in the latest wave of digital artifacts, I will use *Tumblr*¹⁰ and *Instagram*¹¹ as illustrative examples. Tumblr is highly reprogrammable (and consequently characterized by a higher degree of malleability) than *Instagram*, since a Tumblr-user can edit the CSS and HTML-code to change the appearance of their user profile page. This is not possible at all for an Instagram user, except through hacking. Indeed, all digital artifacts are reprogrammable through hacking. For example, Eaton et al. (2015) showed that while the first version of iOS displayed moderate levels of editability (*content* could be edited through the native apps installed), *service*-layer reprogrammability was extremely low (there was no app store at this point). However, as reprogrammability also operates at the logical dimension of the *device* layer, users soon hacked iOS to enable the execution of third-party apps.

Finally, to interact with digital materiality, humans need a rendering device, and to exploit the essential functionality of *services* such as Instagram and Tumblr, they also need access to the Internet as a *network*. Digital artifacts may exhibit either *digital* or *physical* materiality, or both. Key issues, on which IS research is virtually silent, are how that affects the degree of malleability, and the relationship between digital and physical materiality. One of the few exceptions is a study by Barrett et al. (2012), who found that a medical dispensing robot’s digital materiality was associated with a higher degree of malleability than its physical materiality, but the two were “tightly intertwined and interdependent”. The embedded digital components allowed local technicians to reconfigure the robot’s physical movement patterns; the physical components could only be changed by the vendor. Thus, *reprogrammability* made the digital components more malleable (Barrett et al. 2012).

This section has presented the first component the theoretical lens applied in the thesis. This involved exploration of the specific properties of digital technology. The next section considers these distinct aspects of digital technology are leveraged for innovation. .

¹⁰ www.tumblr.com

¹¹ www.instagram.com

3.2 Process and Product innovation

In organizations, digital artifacts were historically first leveraged for processes innovation (see e.g. Davenport 1993), that is; new ways of conducting work (e.g Sandberg et al. 2014; Swanson and Ramiller 1997). Here, changes to existing work processes often involved process automation and business streamlining (e.g. Fichman and Kemerer 1997; Swanson 1994; Zmud 1984). Therefore, from a managerial perspective, digital technologies were typically viewed as serving opportunities for controlling the firm's operations in more efficient ways through for example altering the hierarchical distribution of power in order to reduce coordination costs (Scott Morton 1991; Yates 1993; Zuboff 1988). However, previous research has also documented how process innovation can emerge in a bottom-up manner following the implementation of a new digital technology in an organization. For example, Fleck (1994) highlighted how innovation occurred locally as organizational members simply tried to get the new technology to function in order to be able to carry out their work, labeling this phenomenon the *learning-by-trying* approach. Studies have also drawn attention to how new organizational *routines* emerge as organizational members enact novel digital technologies in their micro-level practices (Barley 1986). For example, Orlikowski (1996) highlighted the improvisational manner by which organizational members appropriated novel digital technologies introduced as a source for process innovation.

Extant research has also shown how digital technology can enable inter-firm level process innovation. To this end, a vast amount of studies has drawn attention to the ways in which digital technology enables new forms of collaboration across supply chains (e.g. Henderson and Venkatraman 1993; Malhotra et al. 2005; Rai et al. 2006) while giving rise to new forms of interorganizational networks (e.g. Im and Rai 2014; Sandberg et al. 2015; Zhu et al. 2006), and enable rapid, heterogeneous, and distributed engineering design collaborations (Argyres 1999; Boland et al. 2007). In terms of inter-firm level process innovation, digital technology reported to enable forms of value creation beyond the traditional value chain (see Porter 1985). To this end, (Jonsson et al. 2008) showed how digital technology enabled manufacturing firms to collaborate in temporary constellations while creating value collectively.

Due to pervasive digitalization, firms across a wide range of industries are becoming increasingly engaged in digital product innovation (Yoo 2013). With digital product innovation, organizations change or expand their previous offerings by introducing digital technology as a component in their new products (Yoo et al. 2010a; Zmud 1982) – products that are novel to a particular community or market (Fichman et al. 2014). As discussed in Chapter 2, traditional technological product innovations typically involve novel combinations of components or a reconfiguration of the architecture

that specifies their relationships (Anderson and Tushman 1990). While traditional non-digital technological product innovations either had an integral or modular architecture (Ulrich 1995), Section 3.1.2 discussed how digital artifacts are based on a layered modular architecture (Yoo et al. 2010a). In formulating the LMA, Yoo et al. (2010a) stated that they specifically focused on product innovation, arguing that it was understudied area in IS research (in contrast to process innovation).

According to Yoo et al. (2010a), one of the key implications of the LMA for digital product innovation is that it facilitates “unprecedented levels of generativity” (Yoo et al. 2010a, p. 727). Here, generativity is defined as a digital artifact’s “overall capacity to produce unprompted change, driven by large, varied, and uncoordinated audiences” (Zittrain 2006, p. 1977). As mentioned in Section 3.3.1, Zittrain (2006) argued that the second wave of digital technologies (PC’s and the Internet) came to serve as a *generative grid*. While these components formed a open and dynamic infrastructure (Hanseth and Lyytinen 2010), scholars have argued that the more constrained space for innovation provided by digital platform owners via for example “app stores” (the third wave) further stimulates generativity when appropriate levels of control are exercised by the platform owner (Eaton et al. 2015; Tilson et al. 2010b; Yoo et al. 2012). Indeed, the generativity of digital artifacts has profound implications for the locus of product innovation: the loosely coupled layers of the LMA and the emergence of low cost easy-to-use digital artifacts has opened up for novel actors to engage in digital product innovation, for example through designing apps for iOS and Android (Boudreau 2012). Here, platform owners such as Apple and Facebook have powerful actors that seek to reap the benefits of generativity by offering boundary resources (e.g. API’s) to facilitate third-party innovation (Eaton et al. 2015; Ghazawneh and Henfridsson 2013), which in turn can create network-effects as the platform becomes increasingly attractive to end-users (see e.g. Parker and Van Alstyne 2005).

Taken together, platforms and their complementary products created by third-parties, together with end-users that co-create contents, form ecosystems in which innovation unfolds in an heterogeneous and distributed manner (Wareham et al. 2014; Yoo et al. 2012). The emergence of such powerful digital platform-ecosystems has profound consequences for the distribution of power among actors in the content-based industries (Pagani 2013). Here, traditional incumbent media firms are both faced with commission fees of app stores, and run the risk of simply becoming providers of free content on for example Facebook. In both cases, the valuable consumer data generated resides with the platform owners. As noted in the beginning of this section, organizations first leveraged digital technologies for process innovation. However, the pervasive effects associated with digital product innovation outcomes are increasingly

challenging firms to reconsider the configuration of their internal processes. While Yoo et al. (2010a) argued that LMA calls for new organizing logics, less is known about how they are, or could, be implemented in practice.

3.3 Changes in Cognition and Identity

Cognitive theory holds that humans perceive reality in a selective manner, whereby it is “cognitively rearranged, and interpersonally negotiated” (Garud and Rappa 1994, p. 345). Cognition concerns “belief[s] about action-outcome linkages” (Gavetti and Levinthal 2000, p. 114). Therefore cognitive assessments can be done “off-line” without hand-on interaction with a particular artifact (Galvetti & Levinthal, 2000). In this thesis, I use cognition as a construct to investigate the ways in which individuals perceive novel digital artifacts introduced and digitally enabled work processes and products in a context of organizing. When making sense of, and assigning meaning to, such processes and products, humans use *frames* (mental models, knowledge structures, repertoires, schemes)(Orlikowski and Gash 1994). Such frames help social actors to imposing structure on ambiguous events and changes involving digital technology. Consequently these frames shape their successive decisions and behaviors (Orlikowski and Gash 1994). Frames exist an individual level but are shaped over time by interactions and experiences (Bingham and Kahl 2013; Watkiss and Glynn 2013). In an organizational context, multiple individual members share cognitive elements. These elements can also be in conflict. Orlikowski and Gash (1994) refers to the former as *congruent frames* and the latter as *incongruent frames*. To this end, IS scholars have drawn attention to the ways in which incongruent frames emerge and become articulated on a surface-level as radically new digital technologies enter organizational contexts (Davidson 2002).

In the broader organizational literature, the notion of frames has also been utilized to explores the linkages between producers and consumers (see Rosa et al. 1999). Here, linkages between the two are established via relatively stable product categories that facilitate sensemaking and informed decisions in terms of both producers and consumers (Rosa et al. 2005). Frames can cause inertia with both of these groups. Therefore, firms have to carefully explore how to launch a product innovation that is hard to categorize using established frames. On the other, hand such inertia can also reside with producers, whereby their failure to reframe can impede them from recognizing innovation opportunities in novel digital artifacts (Kaplan and Tripsas 2008). In the photographic imaging industry, scholarly work has documented how both Polaroid (see, for example Tripsas and Gavetti 2000) and Kodak (Lucas and Goh 2009) engineers has developed digital camera prototypes early on. Still managers’ failures to *reframe* meant that they evaluated these artifacts using previous frames dictating what a camera

is and means. As digital cameras did not represent relevant opportunities to exploit according to their framing, the prototypes were discarded. This is an example of the importance of *managerial cognition* as incumbent firms respond to discontinuous digital technologies. Although Christensen (1997) does not explicitly use the term, the arguments regarding managerial cognition resonate with his conceptualizations of the *innovator's dilemma*. Recent studies in TIM research have however paid increasing attention to *digital* technologies in this context (e.g. Eggers and Kaplan 2009). This research has explored the differential firm-level implications of various managerial responses at different levels, such as opportunity vs. threat framing (Gilbert 2006; Grégoire et al. 2010; Kaplan 2008; Taylor and Helfat 2009). While these insights are valuable, research has still to explore the role of cognition in relation to material aspects of the most recent wave of digital technologies and how it is affected by the complexity of the ascribed to the loosely coupled layers of the LMA.

The word *identity* refers to “the qualities, beliefs, etc., that make a particular person or group different from others” (Merriam-Webster 1993). Organizational identity refers to what is perceived as *core* or *central* characteristics of a particular organization (Dutton et al. 1994; Tripsas 2009), and is traditionally conceptualized as something *enduring* (Albert and Whetten 1985), allowing for various competing and incongruent frames to co-exist over time. However, if established meaning linkages between organizations and their environment collapse it can prompt a change in organizational identity. Consequently, I view significant cognitive change as a necessary but insufficient condition for organizational identity change. In such situations, organizational members are likely to collectively reflect on *who* they are as an entity, and *why* they are an entity (Albert et al. 2000; Brickson 2005).

Organizational identity encompasses both insider (i.e. organizational members) and outsider (i.e. customers, suppliers) perceptions how an organization associated with a particular identity should behave (Tripsas, 2009). Therefore, if a particular organization starts to drift from its established identity, specifically outsider actors are likely to be confused (Tripsas 2009). However, organizational identities do change, and viewing identities as socially constructed, identity construction is “a process never completed – always “in process” (Hall 1996, p. 2). In terms of insider perceptions about organizations core characteristics, Dutton et al (1994) stress that the extent to which organizational members identify with their organization varies heavily.

Organizational identity emerges through reciprocal dynamics between different individual insider actors and groups, as well as outsider perceptions of an organization (Gioia et al. 2000; Hsu and Hannan 2005). Therefore, viewing organizational identity as a dynamic construct, changes

in organizational identity can be initiated by various stakeholders (Merali 2002) in organizations. To this end, Giddens (1991) argued that the disembedded relations characterizing modern institutions and an increasingly fragile trust in artificial systems can lead to an undermined self-identity and diminished sense of moral meaning for organizational members. To this end, extant research has generated rich insights into the relationship between digital technology and changing professional identities (e.g. Lamb and Kling 2003; Walsham 1998; Yates 2005). For example, Barrett and Walsham (1999) found how insurance brokers pondered whether the digital technologies introduced would lead to deskilling or empowerment for their occupational group. Meanwhile Lamb and Davidson (2005) found that in a natural science research environment, scientific digital technologies enhanced scientists' professional identities while administrative and communications related technologies challenged the expertise of other occupational groups involved in the research project under study. Studies have also shown how digital technology can facilitate boundary-spanning (Gal et al. 2008; Speier and Venkatesh 2002) blurring boundaries between previously distinct professional identities (Burri 2008; Doolin 2002; Kimble et al. 2010).

While I have discussed that changes in organizational identity can be initiated from inside the organization, it often happens as a consequence of fundamental changes in the firm's environment (Albert and Whetten 1985). In such change there are two key options: completely abandoning the current identity and creating a new one, or diverging into multiple identities (Foreman and Whetten 2002). While an increasingly central component in such environmental changes, few studies have paid specific attention to the distinct characteristics of digital technology in such processes exploring such changes (Whitley et al. 2014). A recent exception is Gal et al. (2014) draw on Brickson's (2005; 2007) concept of organizational identity *orientation*, the authors argued that defined the term as "an organization's self-perceptions that derive from its relationships with external stakeholders" (Gal et al. 2014, p. 1372). In a study of the transition from computer-based 2D to 3D in a metal fabrication firm involved in the construction of architecturally advanced buildings, the authors show how digital technology affordances enabled new forms of interorganizational relationships that varied across projects in which the firm participated.

4. Research Design

In this section, I detail and discuss the research design. In so doing, I first position the thesis by providing a brief introduction to the field of IS, seeking to place the thesis in a cumulative tradition (4.1). Next, I discuss the philosophical foundations of the research the thesis is based upon (4.2). Then, I describe the qualitative case study method applied (4.3), including both the data collection procedures applied in each case study (4.3.1), and the evolution of the data analysis process throughout the research (4.3.2). Finally, I highlight a number of publications that are not appended, but encapsulated evolving concepts and/or other aspects of the research that were subsequently presented in more detail or refinement in the appended papers and/or thesis (4.4).

4.1 Information Systems Research

The history of the IS field has been extensively documented (see, for example: Davis 2006; Hirschheim and Klein 2012; Iivari and Lyytinen 1999). While I do not aspire to write a detailed historical account of the discipline here, it is appropriate to briefly discuss how my thesis is positioned in relation to the field.

IS research investigates the relationships between digital artifacts and organizing processes (Bostrom and Heinen 1977). I have shared this overarching concern during both the writing of this thesis and while engaged in the underlying research, as I have sought to add new knowledge in accordance with the cumulative tradition of IS research (Keen 1980). The IS field of study emerged in the 1970s, and is therefore a relatively young discipline. Like most other disciplines in the social sciences, IS is dynamic and evolving (Gieryn 1999). Indeed, due to the rapid evolution of digital artifacts during the last 30 years, social implications of digital artifacts are being explored in research rooted in expanding elements of neighboring disciplines (e.g. communications research, science and technology studies, sociology and psychology). Hence, the IS field has evolved in ways that complicate attempts to delimit it strictly.

Swedish Professor Börje Langefors is considered one of the founders of the IS discipline (for a discussion, see Hirschheim and Klein, 2012). His *infological equation* (Langefors 1966), describing the relationships between data, knowledge, and information, had a major intellectual impact on the field in the early days and laid some of the key foundations for IS research. According to this equation, information is generated by interpreting data, using prior knowledge (Langefors 1966). Langefors' hermeneutic perspective continued to evolve in his subsequent work. For example, he explored

relationships between data, knowledge, information, and additional phenomena such as language (see, for example: Langefors 1978; Langefors 1995). In the early days of the field, the literature tended to view digital artifacts as facilitators of *managerial rationalism*, utilized to fulfill organizations' information processing requirements as efficiently as possible (see e.g. Scott 1973; Whisler 1970). While Langefors' early work on IS development to some extent took human relationships and user participation into account, it has been criticized for viewing organizations as rational, machine-like entities (Iivari and Lyytinen 1999).

Two key alternative views of IS emerged in the 1980s. In the USA, Rob Kling and colleagues emphasized the importance of social context and human needs and participation in design (e.g. Kling 1980; Kling and Iacono 1984; Kling and Scacchi 1982). In Scandinavia, IS research was characterized by trade union collaborations, where scholars designed digital artifacts with and for workers in manufacturing settings (e.g. Kyng and Mathiassen 1980; Nygaard and Bergo 1975; Sandberg 1985). Both views were, by and large, reactions to the aforementioned managerial rationalism. Notable elements of Scandinavian IS research at the time included the pioneering DEMOS and UTOPIA projects, which entailed user-participation in action design research processes (Ehn 1988). In the early 1990s, Scandinavian IS research increasingly theorized the roles of IS designers and developers (e.g. Dahlbom and Mathiassen 1993; Stolterman 1991). At this point, the societal challenges and opportunities associated with digital technologies increasingly entered the policy-making discourse.

In 1994 the Swedish discipline *Administrative Data Processing* changed name to *Informatics*. Two of the most prolific Scandinavian scholars at the time – Pelle Ehn and Bo Dahlbom – were directly involved in the name change. In reflecting on the process, Dahlbom (1996, p. 31) writes:

In the discussions preceding the name change, initiated by Pelle Ehn, one obvious alternative was suggested, but rejected. In referring to our discipline in English, we have long used the term “information systems,” and what would have been more natural than to choose that as a name? When the name “information systems” was discarded, this marked an important decision regarding the identity of our discipline.

In the Scandinavian context, it was argued that the identity of the discipline should encourage investigations of the role of pervasive digital technologies throughout society, rather than limiting the discipline to studies of the development of organizational IS (Dahlbom 1996; Goldkuhl 1996). While international IS researchers eventually engaged in such investigations, it seems reasonable to speculate that Ehn and Dahlbom's approach enabled exploration of diverse aspects of relevant phenomena in Swedish Informatics departments that may otherwise have been neglected.

However, it can also be argued that over the years the diversity ended up in fragmentation. Therefore, the pendulum swung back, as illustrated by formation of the Swedish Association of Information Systems (SISA)¹² and its efforts to articulate IS as synonymous with Informatics. Nevertheless, a rich diversity in research efforts is evident in the “Umeå School of Informatics”, which (Holmström et al. 2010, p.3) argue is historically rooted in the Langeforsian view, while exploring “the ways in which information technology and people interact”.

An early focus of the Umeå School of Informatics was systems development, and since 1994 doctoral studies rooted in the school have investigated the role of digital technology in enabling new forms of organizational practices and collaboration (e.g. Henfridsson 1999; Holmström 2000) and the design challenges involved in pervasive digital environments (e.g. Fällman 2003; Lund 2003). More recent projects have explored digital innovation in industrial settings, such as industrial platforms (Sandberg 2014), mining and shipping (Jonsson 2010; Westergren 2011), and the automobile industry (Svahn 2012). This thesis is influenced by the diversity that characterizes the Umeå School of Informatics. It should also be viewed as a cumulative addition to a number of recent Swedish theses that have presented empirical analyses of media digitalization (e.g. Larsson 2012; Thorén 2013; Åkesson 2009), and emerging platform-ecosystems (e.g. Ghazawneh 2012; Mansour 2013).

Discussions involving fragmentation versus diversity often surface with the emergence of new academic disciplines (Whitley 2000). Being a relatively novel discipline, IS research is no exception. As it tends to borrow theory from reference disciplines (Culnan 1986), a recurring debate in the IS community concerns how, why, and quantity of theory that should be borrowed; how the IS field contributes back to reference disciplines, and whether it is a problem or not that IS research has not generated a substantial amount of endogenous theories that have significant impact in other fields (King and Lyytinen 2006). Dubbing this phenomenon the “anxiety discourse”, King and Lyytinen (2004, p. 221) problematized the ways in which the field “continues to be haunted by feelings of inadequacy”. The cited authors traced this phenomenon back to the emergence of the field in the 1970s, but the continuing discourse in the 2000’s has mainly concerned *core theories*. Orlikowski and Iacono (2001)’s research commentary (discussed in Chapter 1 and 3 of this thesis) played a key role in sparking the debate. The authors called for deeper theorizing of the IT artifact as a core subject matter. In heeding the call, Benbasat and Zmud (2003) argued that developing core theories involving the IT artifact was the optimal way for the field to gain legitimacy. In contrast, Weber (2003)

¹² SISA website: <http://sisa-net.se>

argued that if there is a core, it is the *information system*, not the *IT-artifact*. Meanwhile, other IS scholars criticized the idea of core theories as such, arguing that diversity should be encouraged (e.g. Lyytinen and King 2004; Robey 2003), and that trying to draw strict boundaries around the IS field is pointless (Galliers 2003). While I agree that IS research benefits from diversity and cross-fertilization with other fields, I also believe that further theorizations of the digital artifact is an exciting avenue for IS research. In this regard, it should be noted that Orlikowski and Iacono (2001) use the term “IT research”. Thus, in principle, I agree with Weber (2003) – an information system does not necessarily include IT artifacts *per se*. While I view information systems as a field I seek to contribute to, the core subject matter of the thesis is digital innovation, and as part of my theorizing efforts I pay specific attention to the unique properties of digital artifacts involved.

4.2 Philosophical Foundations

The thesis builds on a set of underlying philosophical assumptions. It applies an interpretive stance, which has a number of fundamental differences from a positivist stance (see e.g. Orlikowski and Baroudi 1991; Walsham 2006). According to Lee (1999, p. 29), social science scholars who apply a positivistic stance build on the assumption that their research “should emulate how research is done in the natural sciences”. Consequently, scholars with a positivist stance use formal propositions about *the truth* as they seek to produce knowledge about what the world is (Lee 1999). Adopting an interpretive stance has a number of implications that makes it fundamentally different from the positivist stance (Klein and Myers 1999; Walsham 1995). The first is *ontological* – the position from which researchers view the nature of the social reality surrounding them (Van de Ven 2007), particularly the “slice of reality” they choose to study (Hirschheim 1985, p. 13). Ontological assumptions describe the “nature of the being or of the existence of the phenomena under investigation” (Mason et al. 1997, p. 308). Essentially, ontology deals with the question “What is reality?” (Porra et al. 2014, p. 542). The subject matter of this thesis, and the underlying research, is digital innovation – a phenomenon that emerges from interactions between human actors and digital artifacts (non-human actors). Therefore, I do not view digital artifacts as independent variables with predictable, causal effects on human behavior and organization. Rather, I apply an emergent perspective, which assumes that “organizational change emerges from an unpredictable interaction between information technology and its human and organizational user” (Markus and Robey 1988, p. 585). Thus, I view digital innovation as phenomena that emerge as outcomes of mutual shaping of human actors and digital artifacts (see, for example: Markus and Robey 1988; Orlikowski 1992; Yoo 2012). This stance is broadly

referred to as a *constructivist ontology* (Berger and Luckmann 1967; Leonardi and Barley 2010).

The second implication of adopting an interpretive stance is *epistemological*, concerning the researcher's paradigmatic assumptions regarding how knowledge about ontology can be acquired (Porra et al. 2014), and the validity of that knowledge (Hirschheim 1985). Drawing on an interpretive epistemology (Klein and Myers 1999; Walsham 1995), I "assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them" (Orlikowski and Baroudi 1991, p. 5). Consequently, in my empirical investigations I have sought to understand digital innovation by "accessing the meanings" (ibid.) that the human actors involved assign to it. Therefore, I have not pursued "an "objective" or "factual" account of events and situations" (ibid). Rather, I have sought relativistic and shared understandings. In the next section I further address epistemological concerns as I discuss the approach applied in the research underlying the thesis.

As I have investigated material aspects of digital artifacts, I have adopted a perspective where the term *materiality* refers to "the ways that its physical and/or digital materials are arranged into particular forms that endure across differences in place and time" (Leonardi 2012, p. 29) (for further discussion, see Section 3.1.3). The term *material agency* on the other hand, refers to how an artifact behaves, once a human actor has provoked it (Leonardi 2012):

"Material Agency: Ways in which a technology's materiality acts. Material agency is activated as humans approach technology with particular intentions and decide which elements of its materiality to use at a given time." (Leonardi 2012, p. 42)

Consequently, "material agency is defined as the capacity for non-human entities to act absent sustained human intervention" (Leonardi 2012, p. 35). While digital artifacts lack intentionality (Taylor 2001), they exercise agency through performativity (Robey et al. 2012). However, human actors have to exercise their (human) agency to initiate the process (Boudreau and Robey 2005; Orlikowski and Robey 1991; Orlikowski 1992).

4.3 Qualitative Case Studies

The composite analysis and contributions presented in this cover chapter draw on the five appended papers. The papers all include sections that describe in detail the specific methodological approach applied, findings and contributions of the reported studies. However, since the papers were conceived through iterative stages during five years of doctoral studies, I will take this opportunity to discuss and reflect upon my overall research approach, and how it evolved during the course of my studies. In so doing, I

aspire to achieve transparency as I place the empirical investigations into context detailing the process of analysis and theorizing (see e.g. Eisenhardt 1989; Mason 2002).

My philosophical underpinnings and choice of methodology are intimately related and emerged in relation to the aims of my research (see Robey 1996). While specifically applying an interpretive stance (as discussed in the previous section), in a broad sense the research underpinning this thesis can be characterized as qualitative (e.g. Myers 1997; Sarker et al. 2013). In contrast to quantitative research, where understanding of a phenomenon is gained through numerical measurements and formulation of theoretical constructs based on interpretation of the acquired numbers (see e.g. Bryman 2003), qualitative research enables scholars to:

Explore a wide array of dimensions of the social world, including the texture and weave of everyday life, the understandings, experiences and imaginings of our research participants, the ways that social processes, institutions, discourses or relationships work, and the significance of the meanings that they generate.
(Mason 2002, p. 1)

As qualitative research “celebrate[s] richness, depth, nuance, context, multi-dimensionality and complexity” (Mason 2002, p. 1), I perceived this approach to be appropriate for studying the complex organizational phenomena of digital innovation. Qualitative research stresses the importance of exploring the particular, and the importance of context in generating understandings of the social world. Since qualitative methods are flexible and context-sensitive and enable the collection of rich and detailed data (Mason 2002), I judged that the approach provided “appropriate tools for accomplishing research aims” (Robey 1996, p. 406). More specifically, the empirical investigations underlying the thesis were conducted using a *qualitative case study methodology* (e.g. Eisenhardt 1989; Yin 2003). Yin (2003, p. 13) defines the case study method as:

An empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.

One of the key strengths of the case study approach is that it supports the collection and analysis of data on a contemporary phenomenon, when seeking to answer questions such as “how” and “why” (Yin 2003). To this end, this thesis addresses a “how” question: “How do the distinct characteristics of digital technologies affect innovation in media production, distribution, and consumption?” A further reason for choosing the case study approach is that it supports the combination and triangulation of multiple data sources (Eisenhardt 1989). This was particularly important in

Study 2, in which we used a combination of interviews, workshops and both public and confidential documents in an analysis of the adoption of digital technologies by Västerbottens-Kuriren (VK) (see section 5.2). Similarly, triangulation of data drawn from multiple web-based sources on Facebook was a key analytical technique in Study 4 (see section 5.4). A typical criticism of the case study method is that it depends on small samples, thus it is not well equipped to satisfy statistical generalizing. In response, Yin (2003, p. 37) notes that:

Such critics are implicitly contrasting the situation to survey research, in which a sample (if selected correctly) readily generalizes to a larger universe. This analogy to samples and universes is incorrect when dealing with case studies. Survey research relies on statistical generalization, whereas case studies (as with experiments) rely on analytical generalization. In analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory.

In other words, qualitative scholars do not discuss the concept of generalization in terms of statistical power but rather in terms of analytical generalization. In terms of qualitative case study research, there are also additional types of generalizability, depending on the researcher's epistemological stance (Lee and Baskerville 2003). Scholars with varying epistemological and ontological stances use qualitative case studies as a methodological approach. To this end, both Yin (2003) and Eisenhardt (1989) lean towards a positivist stance in discussing how qualitative case study results can be generalized. In my case, the interpretive stance (discussed in section 3.2) has particular consequences, primarily regarding my perception of the generalizability of my findings. When employing an interpretive stance, generalizations "should be carefully related to the field study details as they were experienced and/or collected by the researcher" (Klein and Myers 1999, p. 75). I conclude this section by providing examples of, and discussing more extensively, ways in which the thesis and underlying research meet criteria relevant to the types of generalization associated with my interpretive stance. Before doing so, the next sections describe the contexts in which the research reported in the thesis was conducted and how data were collected (3.3.1). I also describe how the overall data analysis process evolved (3.3.2).

4.3.1 Research Contexts and Data Collection

Before my PhD studies started (in January 2010) I participated in an industry-academia collaborative project focused on IT-enabled open innovation in a forestry industry context. Through this project I had the opportunity to collect rich data, which in turn resulted in a number of publications (see section 3.4). My PhD position was subsequently partly

funded by the Swedish innovation agency Vinnova, through another collaborative research program called “Organizing for innovation”, with participants including Umeå University and a number of industry partners. As my second Bachelor’s degree was in communication studies I perceived two of the partners in the program – media firms Västerbottens-Kuriren and Bonnier – as particularly attractive empirical contexts. The program allowed my advisor Jonny Holmström and me to gain access to these two organizations, and collaborate actively with them during and after the three years of the mentioned research program (January 2010-December 2012) gaining access to collect the data interpreted in Studies 1 and 2. The main sources of data in these studies were qualitative interviews with organizational members, but they also draw on data collected through participation in meetings and workshops, presentations. We also gained access to internal policy documents. For the studies specifically reported in Papers 1 and 2, a total of 38 interviews were conducted in Sweden and in the USA.

While Västerbottens-Kuriren (hereafter VK) and Bonnier served as excellent empirical settings in which to investigate digital innovation in contexts of incumbent media firms, I also wanted to gain deeper insights into the new digitally driven contexts for content creation and distribution that they were both challenged by, and increasingly embedded in. In conversations with VK and Bonnier staff, Facebook was one of the key digital actors that they recurrently mentioned in terms of both trying to make sense of and comparing to their own operations. Partly for this reason, I perceived Facebook as a highly attractive object for empirical investigation that offered an opportunity to theorize the specific role of digital technology in enabling these novel competing and overlapping content production and distribution practices (Paper 3). Obtaining opportunities to interview Facebook staff seemed impossible, but the second author of Paper 3 (Viktor Arvidsson) and I found vast amounts of rich communication made available by Facebook itself. Inspired by a number of recent studies presented at IS conferences that utilized web-based qualitative data (e.g. Ghazawneh and Henfridsson 2010; Selander et al. 2010), we decided to pursue the use of secondary data based on the approach outlined by Romano et al. (2003). In turn, this research approach also revealed opportunities to investigate how these new types of content production and distribution practices unfolded online, which is the focus of Paper 4.

Having discussed how case selection decisions emerged as the research progressed, in the following sections I turn to introducing the four research contexts in more detail, while providing a detailed account of how data were collected in each empirical investigation.

Bonnier (Paper 1)

Bonnier was founded as a family owned publishing house in 1804 and is today the largest media firm in Sweden. In 2012, it comprised 175 firms operating in 16 countries. Bonnier's historical roster of authors includes several Swedish Nobel Prize winners. However, over the years it has evolved into a multi-channel media company. In Sweden, for example, it owns the largest daily newspaper, the second-largest evening paper, the largest daily business paper, and the largest privately owned TV channel. In 2008, the newly appointed CEO established a centralized R&D department, and externally recruited a manager to head it. The R&D department launched a number of digital products. Out of these products, *Mag+* gained most attention. The department reported directly to the CEO, which was perceived as a bold and somewhat controversial move: for the preceding 10-15 years Bonnier had maintained a geographically distributed divisional structure in which innovation was managed locally in each division and coordination of these efforts was highly limited.

Starting out as a book publisher, then venturing into newspapers, Bonnier entered the magazine business in the late 1920's through acquisition of Sweden's largest magazine publishing firm at the time. In the following years, Bonnier came to heavily influence the overall emergence and evolution of the modern magazine market in Sweden. Bonnier also created a U.S. subsidiary more than a century ago (in 1911), but its international operations remained modest for decades, characterized by gradual expansion into the Nordic countries and Eastern Europe (Larsson 2001). However, in 2006-2007, the firm made major investments in the U.S. magazine market, adding around 40 well-established magazines to its portfolio, including titles such as *Popular Science*, *TransWorld Snowboarding*, and *Skiing*.

When the "Organizing for innovation" project started, Bonnier's R&D department had recently uploaded a video on Vimeo illustrating a prototype for a digital magazine concept¹³ that would later be launched as a digital publishing platform. While establishing contact with key respondents, we followed rumors online that were somewhat straightened out as the iPad was released in April 2010, and Bonnier-owned *Popular Science* was one of the first magazines available on the iPad from day one. At this point, we agreed that the R&D department in general, and this project in particular, provided an excellent opportunity for an empirical investigation of digital innovation in context. The first round of data collection comprising ten interviews was carried out in October 2010-December 2011 when I interviewed the R&D manager and key members of the Swedish R&D team. As *Mag+* was spun off into a separate firm shortly after launch, I also interviewed its Swedish and

¹³ <https://vimeo.com/8217311>

U.S. CEO's. Except for two interviews conducted via Skype, all interviews were carried out in Stockholm, at three Bonnier sites. Four interviews were conducted in the second round (March-May 2012). This involved a site visit to Bonnier's head office in New York, where one interview was carried out. The site visit also involved an informal group interview with three graphic designers of the *Popular Science* editorial team. This round also included interviews with two members of the *Popular Science* editorial management team (formal members of the Mag+ design team) and the project manager at the external consultancy firm Berg. These three interviews were done via Skype.

VK (Paper 2)

Västerbottens-Kuriren (VK) is a Swedish newspaper organization founded in 1900. It is located in Umeå, the largest city in the county of Västerbotten, which has 260 867 citizens (SCB). In 2014, the printed newspaper edition was 30 700 (Mediefakta 2015). Aside from regional news coverage, VK also purchases domestic and international news from news agencies. In Study 2 we explore VK's transformation from a company fully focused on printed newspaper production to being engaged in the acquisition and distribution of news content through various digital services and platforms.

Data were collected in three phases. The first phase of data collection took place in 2010 and involved a series of meetings (7) and workshops (4) where we sought to gain an initial understanding of the organizational context. Seeking to identify key actors in the organization, in this round, we conducted five interviews that were of an open and unstructured character. Following initial analysis of data from the first round of interviews, a second round (seven interviews) was conducted in 2011 where we aimed at covering a wide range of professional roles. These interviews were of a semi-structured character (Myers and Newman 2007) and focused on issues related to digital innovation. A third round comprising eight interviews was subsequently conducted late 2011 to early 2012, with a theory-informed interview guide, focusing on the introduction of digital technologies throughout the firm's history. Therefore, in this phase, we sampled senior and former long-standing employees. We also subsequently conducted four additional interviews, and participated in one workshop in 2013. This study also drew on multiple secondary data sources, including both publically available (e.g. books about the company and annual reports) and confidential documentation (e.g. policy documents and internal presentational material). The third author and I managed the overall data collection process in this study. Other project members carried out the interviews in the first round; the second author and another project member carried out the interviews in the second round, and I carried out all

interviews in the third round. I participated in all of the workshops together with additional project members, students, and faculty members.

Collectively, the interviewees represent a wide variety of respondents in terms of professional roles, employment duration, professional experience and gender. We sound recorded all 24 interviews and transcribed them. With the exception of three telephone interviews, all interviews were conducted in offices and meeting rooms at the client's premises, and public spaces. The duration of the interviews varied from 30 min to 1 h 45 min, totaling more than 23 hours. In order to protect their privacy, we fictionalized all names of respondents, and additional individuals participating or mentioned, as well as the names of external firms that are mentioned.

Facebook (Paper 3)

Facebook was launched in 2004 and is the world's largest social networking site. In Study 3 we sought to understand key features of this evolution and how the unique aspects of digital technology enabled such evolutionary patterns. To meet these objectives, the second author and I collected data spanning a 7-year period. The first step of our data collection involved reviewing content in a section of the Facebook website that comprises corporate blogs, press releases, and various additional forms of corporate information. We elicited data from three particular sub-sections. One was the *Announcements* section, which contains all of Facebook's press releases. These releases cover diverse topics, ranging from new features, through integrity issues, to business partnerships. We captured all 55 press releases that were published from April 2006 to December 2011. Another was the *Timeline* section, which contains brief facts on numbers of users, major investments and global expansion at different points in time. This section contains entries from 41 time points from the launch of the site in 2004 to December 2011. The third section was the *Blog* section, which contains a number of blogs focused on various topics. Facebook staff mainly writes the posts published in these blogs. *The Facebook blog* is one of them. In December 2011, it contained 455 posts by 254 different Facebook employees. We chose this particular blog as it encompassed the same wide variety of content as the *Announcements* section, while also often providing discussion and reflections about those announcements. This data was then triangulated with data from additional sources, including documentation from Facebook annual developer conference (F8), Facebook's official IPO-filing, and an additional Facebook blog called *the developer blog*.

Alpha Forum (Paper 4)

The Alpha Forum is one of the most frequently visited Swedish websites. It was founded in 2000 and covers a wide range of general interest topics.

When data were collected in Study 4 Alpha had more than 800 000 registered users and over 40 million messages had been posted and compiled in threads. The forum has been surrounded by controversies; for example, the exposure of personal records and aggressive debate climate had raised discussions in the mainstream media about both ethical and legal aspects of the published content. Server hosting was moved abroad in 2002 when a Swedish court ruled that Alpha violated Swedish privacy and integrity legislation. On the other hand mainstream media has awarded particular investigative journalism efforts conducted on the forum. In this study, I analyze in detail a particular forum thread where citizen journalism was conducted. The thread contains a discussion of a local Swedish murder case that occurred in August 2011. 240 users posted a total of 1198 messages in the thread. Data collection involved exporting and merging the entire HTML-formatted contents of the thread into a single 300-page PDF-file. This file was then imported into Atlas.ti Qualitative Data Analysis (QDA) software.

Information posted on the Alpha forum is available to the public and as a researcher I did not have any access to additional data other than that available to anyone visiting the forum. Nevertheless, as is stressed in the appended paper, but should also be highlighted here – conducting and reporting this study gave rise to some important ethical considerations. Although the Alpha Forum enables its users to post their messages anonymously, Internet researchers have stressed that it is essential to remember that real people are posting them (Markham 2011). To support my decisions regarding ethical aspects of this study, I consulted guidelines for Internet research proposed by Ess (2002). As result, I decided to fictionalize both the name of the online forum, all user names involved in order to protect users' privacy. Key information mentioned in the thread, such as addresses, persons and organizations were also fictionalized.

4.3.2 Data Analysis

The role of theory and the process of theorizing are continuously debated in both organizational scholarship (e.g. Pfeffer 1993; Suddaby 2014; Sutton and Staw 1995) and the IS literature (e.g. Avison and Malaurent 2014; Gregor 2006; King and Lyytinen 2006). In section 3.1, I introduced and discussed some of these matters in my overview of the IS field. However, given that “...every theory and every technique highlights certain topics, downplays others, and totally ignores many others.” (Holmström and Truex 2011, p. 284), I return to this issue, seeking to specifically elaborate on the role of theory in the research underlying the thesis. I particularly want to stress that it was not guided by a singular theoretical lens from the start (see Walsham 1995). Rather, choices of theoretical perspectives emerged through parallel processes of grounded empirical investigations and analysis (Klein and

Myers 1999). In this way, I grounded my empirical investigations, allowing them to be reflected against theory in approximating to knowledge (see Weick 1996). Multiple activities were undertaken concurrently during the overall theorizing process – in particular the literature review, construction of theory-induction from empirical bases, and the extension of theory-deduction into propositions (see Bourgeois 1979; Weick 1989).

Heeding advice by Weick (1989), I deliberately designed the theorizing process “to highlight relationships, connections, and interdependencies in the phenomenon of interest”. Since organizational phenomena are determined by their context, and emerge through complex relationships (Weick 1995), using abstract concepts helped me to reflect details of digital innovation as phenomena into “systems of thought” (Weick 1996, p. 302). I agree with Weick (1989), that improving the theorizing process is critical for constructing better theories, and an essential step (albeit insufficient in isolation) is to describe the process more explicitly and implement it more self-consciously. Thus, this section seeks to provide explicit descriptions and discuss how I conducted the theorizing process in a self-conscious manner.

When starting the doctoral project, my previous theoretical underpinnings included a general familiarity with IS research as well as parts of Technology Innovation Management (TIM) research (particularly in the subfields of open innovation; Chesbrough et al. 2006) and disruptive innovation (e.g. Christensen 1997). A number of IS papers published during 2010 caught my attention and increasingly fostered an area of concern that my research both draws on and seeks to add to (see e.g. Mathiassen et al. 2012). These studies included: “The Next Wave of Digital Innovation: Opportunities and Challenges: A Report on the Research Workshop Digital Challenges in Innovation Research” by Yoo, Lyytinen, Boland, and Berente; Youngjin Yoo’s MISQ Issues and Opinions article “Computing in everyday life: A call for research on experiential computing”, and the ISR research commentary by Yoo, Henfridsson, and Lyytinen called “The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research”. Taken together, these papers introduced me to a new perspective on digital technology and innovation that resonated well with the challenges faced by the media firms considered in the “Organizing for innovation” project. They also collectively challenged some of the dominant theoretical assumptions underpinning the contemporary TIM literature (Alvesson and Sandberg 2011; Sandberg and Alvesson 2010).

Thus, these theorizations of digital innovation presented me with my first challenge to “drop my tools” (Weick 1996). The act of “theory abandonment” (Holmström and Truex 2011) was discussed by Weick (1996) in his re-analysis of his seminal paper on the firefighters who tragically died in the Mann Gulch forest fire (Weick 1993) partly because they did not follow orders to leave their heavy (and expensive) equipment behind. Weick argued

that organizational scholars need to develop an analogous tool-dropping capability. In arguing for the need for IS scholars to follow Weick (1996)'s advice, Holmström and Truex (2011, p. 283) summarized his key recommendations as “drop your tools—hold your concepts lightly and update them frequently”. Inspired by this approach, I made a determined effort to remain flexible and adaptive, ready to revise my assumptions throughout the iterative rounds of data collection and analysis carried out during the doctoral project (cf. Walsham 1995; Weick 1996). When searching for appropriate theoretical constructs to apply and develop, this approach enabled me to adapt the elements that were “relevant to the task at hand” (Holmström and Truex 2011, p. 284).

When coding and analyzing the data from the four empirical investigations, I applied both grounded and theory-driven approaches (see, for example, Boyatzis 1998; Corbin and Strauss 2008). All coding and analysis were done in Atlas.ti Qualitative Data Analysis (QDA) software. While I adopted an iterative approach in all of my PhD studies (including those discretely described here as Studies 1-5 and reported in Papers 1-5, respectively) some recurrent procedural patterns emerged that were intimately related to the evolution of the overall analysis and (hence) concepts that form the foundations of the thesis as a whole. In the following text I elaborate on this process. It should be noted that a process perspective on digital technology and organizing (see e.g. George and Bennett 2005; Langley et al. 2013) was applied in all the analytical efforts involved in Studies 1-4. As theory construction is, essentially, a sense-making process (Astley 1985), the number and sequences of analytical stages in Studies 1-4 differed, so discussing the data analysis process applied in them collectively rather than individually is challenging. In an attempt to meet this challenge productively, I discuss the overall data analysis process in relation to the relevant sense-making strategies for process study theorizing outlined by Langley (1999).

The first stage in all four empirical investigations involved a *grounded theory strategy* (Langley 1999). For example, in the first stage of analysis in Study 2 this approach emerged somewhat spontaneously as it was judged the most appropriate approach given the character of the data collected. Grounded coding (Corbin and Strauss 2008) generated insights on the key challenges the organization was facing and served as a valuable input that helped to guide us in pursuing relevant issues in further data collection activities. When data analysis commenced in Studies 3 and 4, we aimed to follow what Langley (1999, p. 699) calls the “by the book” approach outlined by Corbin and Strauss (2008). Consequently, a five-stage process was followed in these studies: (1) initial coding, (2) merging of visibly similar codes, (3) the creation of definitions for each code, and additional merging due to overlapping meanings, (4) renaming and subsuming of codes that did

not make sense individually, and (5) construction of code categories through reviewing codes and code definitions (Corbin and Strauss 2008). In Study 3, five main categories were identified in the transcripts, three of which were particularly relevant to the focal concerns. Taken together, they encompassed descriptions of specific features and information about when apps or features were introduced, which third-party actors (organizations) Facebook engaged with over time, how Facebook engaged with them, and the company's responses to privacy and integrity issues arising due to platform changes (user information). In Study 4 the corresponding process resulted in the identification of five main categories: place, identity, relations, chain of events, and biography. In a subsequent stage of analysis, these categories were conceptualized as "interaction themes" and comprised a key component of the analysis presented in Paper 4.

Secondly, a *visual mapping strategy* (Langley 1999) was applied. In Study 2, this strategy supported us as we sought to structure and interpret the detailed longitudinal data collected in the first round. We started by placing key events involving introduction of digital technology in a timeline-model. When starting to also place organizational changes in the timeline, we realized the need for a multi-layered model to guide our further analysis. Adopting a four-layered model of firm-level digitalization, we next developed a theory-informed coding scheme. Through theory-driven coding we were able to trace individual events of digital technology introduction, and visually connect events of change in our four-layered model. The analysis presented in Paper 1 built on a similar theory-driven coding approach: items in interview transcripts were coded in terms of both the time point in the design process being discussed, and the order of design involved. In Study 3, visual mapping was applied in the first stage after having selected the (three) key categories. Having revisited the coded segments in these three categories, visually mapping the identified key events and processes facilitated our sense-making of their role in shaping Facebook's evolution over time (Langley 1999). As in Study 2, while this first visual mapping enabled us to develop and verify our theoretical ideas, it was refined throughout the research process and the final version is included in the paper. In Study 4, visually mapping the emergent interaction themes identified, based on their intensity over time, contributed to foundations of the analysis finally presented in Paper 4.

Finally, a *temporal bracketing strategy* was utilized (Langley 1999). In Study 2, we coded the time points for each relevant event of change identified over the 30-year period under study. As we discontinued events in the *technology*-layer were possible to identify, temporal bracketing enabled us to identify phases involving changes in deeper dimensions based on these discontinuities. In Study 3, theory-driven coding in the second stage of analysis (drawing on an evolutionary perspective) was facilitated by a

temporal bracketing strategy that allowed us to conceptualize and clearly delineate three patterns as three distinct, but cumulative stages. Furthermore, it also revealed how the transitions between these stages occurred.

It should be explicitly recognized that theorizing processes are full of conflicts and contradictions, involving “tradeoffs between generality, simplicity, and accuracy” (Sutton and Staw 1995, p. 372). Rather than a full-blown *theory*, my theoretical contributions in this thesis should be seen as *approximations* that are grounded in empirical investigations (conducted by myself and co-authors of the appended papers) and generated through my theorizing efforts (Kaplan 1964; Weick 1989; Weick 1995). In the appended papers, the data are presented to the reader in a format that is intended to be transparent and readily comprehensible, to illustrate observed empirical patterns. On the other hand, I use theory to explain why (I believe) these patterns were observed, and/or why they can be expected to occur in the future (Kaplan 1964; Sutton and Staw 1995).

As illustrated in this and the previous section, the act of theorizing was an ongoing venture throughout the research underlying my thesis. To this end, I have highlighted how theory has played key roles in different parts of the process – both in early rounds of data collection and iteratively during later rounds of data collection and multiple stages of analysis (Eisenhardt 1989; Henfridsson 2014). A guiding principle for my choices, validations and generation of theory throughout the research was assessment of its strength in relation to the real world problems I was investigating (Robey and Zmud 1992). When drawing on frameworks from reference disciplines, such as design theory (Buchanan 2001), complexity theory (e.g. Gell-Mann 1995), and evolutionary theory (e.g. Nelson and Winter 1982; Simon 1996) a key concern was to gain an understanding of their ontological and epistemological assumptions (Truex et al. 2006). An important criterion in evaluating interpretive research is assessing whether the reader is able to follow how the researcher reached and drew abstract *theorizations* (Klein and Myers 1999). I have sought to meet this criterion by relating abstractions (reported in this section) to my own experiences of detailed aspects of the research contexts (reported in the previous section) (Klein and Myers 1999).

Ultimately, IS theorizing should also produce outcomes that contribute to practice. According to (Benbasat and Zmud 1999, p. 4), most published IS research lacks practical relevance, although “articles that address enduring (or current) organizational problems, challenges, and dilemmas as well as articles that address timely business issues tend to be well received by practice”. I assess this thesis as being consistent with this description. However, Benbasat and Zmud (1999) also set out more specific criteria, arguing that IS research should address problems that are of concern to

practitioners, produce knowledge that they can apply in their daily work, focus on contemporary technological and business issues, and publish their work in outlets that are accessible to professionals. As pointed out by Applegate and King (1999), meeting the last criterion will be problematic as long as quality IS journals do not allow fully open access, under current arrangements for the publication and quality control of IS scholarship. I have, however, made efforts to make my work available through open access channels and various platforms as far as possible within copyright agreements. Another criticism of Benbasat and Zmud (1999) concerns their definition of *practice*. For example, students are a key audience for scholarly publications, and as most of them will launch a career in practice, our work will have an impact (Davenport and Markus 1999; Lyytinen 1999; Straub and Ang 2008). While all five papers appended to this thesis articulate concrete practical implications, such attempts are strongest in Paper 5, which meets two of the key guidelines suggested by Benbasat and Zmud (1999): the implications are concrete and prescriptive, aimed at resolving problems, and the paper is written in a pragmatic style and tone (Benbasat and Zmud 1999).

My objective for this research design section has been to describe my research approach clearly and transparently, allowing the reader to follow and receive my theorizing, in terms of both process and outcome (Eisenhardt 1989). To conclude, I want to return to the issue of generalization introduced in the beginning of section 3.2. Building on such a rationale, Walsham (1995, p. 79) views generalizations in interpretive case studies as “explanations of particular phenomena derived from empirical interpretive research in specific IS settings”. Walsham (1993) argues that in interpretive research, knowledge claims are based on *understanding* rather than *causality*. Consequently, when claiming generalizability of one’s knowledge claims, interpretive researchers need to provide the reader with reports of results and conclusions drawn that are logically coherent and cogent. It is then up to the reader to assess whether the researcher has produced a piece of research that generates new understanding (Walsham 1993). Walsham (1995) suggests that in interpretive research that applies a case study methodology, there are four possible types of generalization: development of concepts, generation of theory, drawing of specific implications, and contribution of rich insight. The cited author stresses that these four types of generalizations should be seen as:

“Explanations of particular phenomena derived from empirical interpretive research in specific IS settings, which may be valuable in the future in other organizations and contexts.” (Walsham 1995, p. 79)

Thus, of course, it is up to the reader to judge the generalizability of results I have presented. However, based on the types of generalization mentioned above, I deem that apart from an overall generation of *rich insight* into digital innovation in the media domain, the research has led to the development of a couple of *concepts* that may be more generally applicable, “digitalization rifts” (Paper 2), and “digital platform evolution” (Paper 3). It has also *generated theoretical constructs*, e.g. the four-layered model presented in Paper 2, and *articulated specific practical implications*: notably Paper 5 presents a tool for practitioners seeking to manage digital innovation.

4.4 Additional Publications

The papers appended to this thesis describe research and concepts that have developed over substantial time. Papers describing some aspects of the research, providing important stepping-stones towards the ideas expressed in the appended papers, have been published in other formats and outlets, as listed below.

Nylén, D., & Holmström, J (2013). Managing Digital Innovation in the News Industry, *Mercury Magazine*, Issue 4, 2013.

Appelgate, L., Nylén, D., Holmström, J., & Lyytinen, K (2012). Bonnier: Digitalizing the Media Business, *Harvard Business School Case 813-073*, November 2012.

Skog, D.A., Nylén, D., & Holmström, J. (2012). Digital convergence from within and without: Investigating digitalization and its implications for a local newspaper, *the 2012 International Symposium on Media Innovations*, Oslo, Norway.

Nylén, D., Holmström, J., & Levén, P. (2011). Digital convergence or digital clash? Exploring organizational adoption of social media in the newspaper industry, *21st NFF Conference (Nordic Academy of Management)*.

Nylén, D., & Holmström, J. (2011). From forestry machines to sociotechnical hybrids: Investigating the use of digitally enabled forestry machines, In: *Proceedings of the IFIP WG8.2 conference*, Turku, Finland.

Nylén, D. (2010). From closed to open: ICT as an enabler for creating open innovation systems in industrial settings. In Holmström et al. (eds), *Industrial Informatics: Design, Use and Innovation*, IGI Global. pp. 5-19.

While the five papers appended to the thesis represent the product(s) of my research, these other related papers played a part in the research process and the evolution of my thinking over the course of my studies.

5. Research Paper Summaries

This section provides summaries of the five appended papers, which are a mixture of publications in international journals or conference proceedings, and manuscripts currently under review. Presenting and publishing papers throughout the PhD project provided me with opportunities to engage with other academics in discussions around both empirical and theoretical concerns, and to receive important comments and feedback from reviewers, co-authors, and editors. The following summaries of the papers outline the aims and key contributions of each paper. This section, as well as the descriptions of the research contexts and data collection activities, contains both excerpts from the individual papers and text written specifically for this purpose. The papers are introduced in chronological order.

5.1 Paper 1

Nylén, D., Holmström, J. and Lyytinen, K. (2014). Oscillating between Four Orders of Design: The Case of Digital Magazines. *Design Issues*, 30(3): 53-68.

The first paper is based on the Bonnier case study. It focuses on the specific project that commenced as the firm's R&D department was commissioned to design a digital magazine concept. The outcome of the project was a tablet-focused digital publishing platform called Mag+. In analyzing the design process, we uncover how the global multi-disciplinary design team faced a broader set of design challenges than those experienced during the company's preceding 80-year history of publishing printed magazines. These design challenges expanded beyond traditional graphic design concerns such as typography and page layouts. Using the four orders of design-framework presented by Buchanan (2001) as a lens, we reveal how the design challenges that emerged in the Mag+ project ranged from device form factors (industrial design), to user experience (interaction design), and overall business logic (environmental design). This paper makes two key contributions: First, it illustrates the design challenges arising from the decoupling of form and content in digital content-based product innovation. Second, it highlights the relative absence of dominant designs in the digital media domain, and attributes it to the fragility and negotiability of digital product categories.

5.2 Paper 2

Nylén, D., Skog, D.A., Holmström, J., & Lyytinen, K. (2015). Cascading Digital Innovation: An Analysis of Cognitive Change and Identity Collapse in a Newspaper Organization. (Manuscript)

The second paper is based on the VK case study and focuses on how the organization adopted and leveraged multiple families of digital technologies for innovation over a 30-year period. In this paper, as we trace the changes associated with digital technology assimilation and process and product innovation outcomes, we identify three rifts that penetrated four organizational layers, differentially and with deepening effects: technology, structure, cognition, and identity. We note that the velocity of change increased as the newspaper's core business processes – news production, distribution, and acquisition – were consecutively digitized. While each rift generated extensive innovation outcomes, this experience failed to produce sufficient knowledge to prepare the firm for the next. Ultimately, cumulative effects of the firm's digital innovation efforts culminated in deep sociotechnical changes involved radical reconsideration of the firm's products and markets and generated firm-level disorientation as the CEO questioned the firm's identity. The paper contributes to the literature on digital innovation by sketching a theory of cascading digital innovation that explains path-dependent assimilation of digital technologies and related innovation outcomes at the firm level.

5.3 Paper 3

Nylén, D., Arvidsson, V., Holmström, J., & Yoo, Y. (2015). Digital Platform Evolution: Theorizing Configurations of Innovation and Control in the Case of Facebook (Manuscript)

The third paper is based on the Facebook case study, and addresses how digital platforms emerge and evolve to grow powerful ecosystems for innovation. While digital platforms are central to the creation and use of a vast array of contemporary digital products and services, little is yet known about how these networked uses of digital artifacts generate new forms of organizing over time. To tackle these uncertainties, this paper chronicles the development of Facebook from a local social network to a multifarious hub for distributed innovation across the globe between 2004 and 2011. By analyzing our archival web-data through a novel evolutionary lens sensitive to the unique properties of digital materiality on multiple levels, we were able to theorize three configurations of digital innovation and control: network, platform and system. In our chronicle, we illustrate the configurations as three different sets of co-evolutionary logics that delineated and tuned the Facebook-ecosystem: interaction, integration, and interconnection.

Through our evolutionary lens, we conceptualize these logics as distinct micro-evolutionary patterns of variation, selection, and retention. By understanding these logics as related to particular utilizations of digital

materiality, this paper builds on and extends IS theory on digital platforms as a generative infrastructure. To underscore the need for more fine-grained understanding of digital platforms, our discussion emphasizes the unique dynamic effects that separate digital platforms from their analog counterparts. Having stressed the need to critically examine the metaphors we adopt from other fields due to the distinct nature of digital platform evolution, we conclude this article by providing managers with insight into strategic challenges of platform-based competition within digital markets. This article is a testament to how nascent theorizing of digital materiality can provide IS research a distinct theoretical core.

5.4 Paper 4

Nylén, D. (2015). Tracing Emergent Structure in Self-organized Citizen Journalism, *Proceedings of the 48th Hawaii International Conference on System Science (HICSS 48) (Kauai, HI)*.

The fourth paper investigates the novel self-organized content creation practices enabled by digitalization. It particularly theorizes a topical issue – citizen journalism. This term refers to the ways in which the citizens who used to make up the mass audience utilize the most recent wave of digital technologies to inform each other about current events. Communications research has demonstrated how such citizen-generated journalistic content published on independent digital platforms can both substitute and complement traditional news publishing practices and outlets. It has also illuminated the challenges faced by traditional media firms that seek to integrate elements of citizen journalism into their processes and products. However, less is known about how self-organized citizen journalism processes emerge and evolve. This paper utilizes complexity theory as a lens for analyzing in detail the contents of an online forum thread in which users collaboratively investigated and published detailed information about a local murder case. The paper contributes by generating a deepened understanding of the self-organizing logic that incumbent firms in content-based industries face as consumers transformed into “prosumers” come together to produce and distribute content themselves without centralized control and monetary incentives. In particular the paper shows how order and structure emerged through frequent, distributed interactions around sequenced interaction themes and the triangulation of multiple online and offline information sources.

5.5 Paper 5

Nylén, D., and Holmström, J. (2015). Digital Innovation Strategy: A Framework for Diagnosing and Improving Digital Product and Service Innovation, *Business Horizons*, 58(1): 57-67.

The fifth paper provides concrete advice for practitioners who seek to manage digital innovation. The case studies presented in the thesis illustrated how digital technologies give rise to vast potential for product and service innovation, while at the same time fundamentally changing the process of innovation, rendering both processes and outcomes difficult to control and predict. In contrast to Papers 1-4, this paper is conceptual, addressing two practical questions: Can digital innovation be managed, and if so how? We offer a framework and a diagnostic tool that can support practitioners in managing digital innovation. The nature of digital innovation obliges firms to challenge prior assumptions about their product and service portfolio, their digital environment, and ways of organizing innovation work. The managerial framework presented is geared towards supporting continuous improvements in digital innovation management. It covers five key areas: user experience, value proposition, digital evolution scanning, skills, and improvisation. In turn, the diagnostic tool proposed can be utilized as firms begin the process of implementing the framework. The paper contributes to digital innovation practice by offering prescriptive advice to managers and strategists.

6. Discussion

In a recent MISQ Issues & Opinions piece, Lucas et al. (2013) urged IS scholars to focus their efforts on major business and societal transformations driven by digital technology. This thesis focuses on one of the major digital transformations occurring in its contemporary context – digitalization of media content production, distribution, and consumption. In so doing, it draws on empirical explorations of the nature of novel digital platforms, the new content creation practices they enable, and the responses of legacy print media publishers. Using concepts from the economics of innovation literature, it can be argued that mainstream media firms are facing a “perennial gale of creative destruction” (Schumpeter 1942, p. 84) as digital process and product innovations fundamentally challenge the fundamental structures of the traditional media industry as new forms of digital content creation practices emerge. Nevertheless, many of the established print media incumbents are still present, intensely striving to transform their operations in order to meet the challenges, and opportunities, presented by the digital age, whereas the final outcomes of these upheavals remain to be seen. Indeed, a reinstatement of the same institutionalized power-relationships, as observed in the music industry (see Carter and Rogers 2014), is still a potential outcome. The current state of the incumbent media industry is however having palpable effects on the status of many media professionals due to vast lay-offs of journalists¹⁴. Having said that, the unit of analysis in this thesis is not societal macrostructures, but organizational phenomena.

Another set of valuable concepts is offered by the technology and innovation management literature (e.g. Anderson and Tushman 1990; Christensen 1997; Tushman and Anderson 1986). From this perspective, it can be argued that digital technologies contribute to interruptions of the normal trajectory of print media firms, causing disorder of their centennial marketplace logics (cf. Christensen and Bower 1996; Christensen et al. 2012). More specifically, applying vocabulary introduced by (Bower and Christensen 1995), VK (Paper 2) had spent around a century improving their products by using *sustaining* technologies – first analog technologies such as printing presses, and later digital technologies such as desktop publishing software. In contrast, PCs, the Internet, and later smartphones and social media proved to be *disruptive* technologies in that they enabled distribution at a lower cost, although (to this day) they continue to be viewed as inferior carriers of quality journalism by parts of the established customer base. On

¹⁴ The U.S. Bureau of Labor statistics project a 13% decrease in numbers of “reporters, correspondents, and broadcast news analysts” during the period 2012-2022: <http://www.bls.gov/ooh/media-and-communication/reporters-correspondents-and-broadcast-news-analysts.htm>
In Sweden, 400 local journalists were reportedly laid off in 2013. During the first nine months of 2014, another 400 journalists were laid off: <http://www.journalisten.se/ledare/skams-ni-inte>

the other hand, my findings highlight the ways in which digitally published content is increasingly integrated in rich forms of social interactions inviting new actors to interactively discuss and co-create media content, thus opening up avenues for digital innovation that challenges established value propositions of media products *and* enables new forms of processes for content production, distribution and consumption. To support fine-tuned theorizing on the specific role of digital technology in these developments, I presented a theoretical lens based on key literature on digital innovation to support me in exploring my research question:

How do the distinct characteristics of digital technologies affect innovation in media production, distribution, and consumption?

In the following sections, I explore these issues in the light of my main empirical findings. I focus primarily on three key aspects: the transition from stable to fragile product categories (6.1); the need for a dynamic approach to identity orientation (6.2), and an evaluation of the approach for studying digital innovation and organizing applied in the thesis (6.3). Then finally I consider their limitations and suggest avenues for future research (6.4).

6.1 From Stable to Fragile Product Categories

The traditional mainstream media industry has historically been based on a handful of relatively stable product categories (i.e. Newspapers, Magazines Radio and TV). This thesis provides several examples of how digital product innovation extends beyond, and across, established product categories from the analog era. I have highlighted the longstanding interest of IS scholars to investigate the higher levels of malleability associated with digital artifacts, most recently directed towards the ways in which digital materiality enables product boundaries to become fluid (Yoo et al. 2010a). However, few empirical studies have investigated the practical consequences of these developments for the design process, how digital materiality affects product categorization in digital innovation, and the relationship between physical and digital materiality, a notable exception being Barrett et al. (2012).

The thesis shows how the physical materiality of print media products and its associated inertia provided stable boundaries between occupational groups within the organization as well as between media professionals and the customer base (Papers 1 and 2). In contrast, the malleability of digital materiality allows for rapid reconfiguration and thus renders digital product categories fragile and negotiable (as noted in Paper 1). The thesis also illuminates how tensions between *digital* and *physical* materiality occur in digital product innovation. Firstly, in terms of *digital materiality*, while both Bonnier and VK engaged in product innovation that was “fully digital”

(neither of them designed their own devices), the findings show how the degree of malleability in digital materiality differed depending on the types of digital product innovation they engaged in. For example, Study 1 showed that as the design process commenced, the Mag+ design team experienced an open and seemingly unbounded design space. However, as the design process evolved, digital materiality proved not to be “infinitely malleable” Orlikowski (2000, p. 409). This became particularly apparent as the design team decided to implement their product on iOS. To appreciate this difference in degree of malleability, we can utilize the distinction between the two terms *editability* and *reprogrammability*. Papers 3 and 4 illustrate the dynamics associated with the editability of digital contents in several ways. For example, the editability of digital contents was an important enabler of the practices associated with the Alpha forum (Paper 4). Here, a key activity was piecing together fragments of information from an array of online resources to publish succinct forum posts.

In terms of editability, Facebook’s dramatic growth has also generally been driven by the platform being filled with content by users who can continuously edit the content associated with their *profiles* or *pages* to reflect their current lifestyle, social relationships, and overall image they want to convey at any given moment (Paper 1). However, Facebook’s transition from a *social network* to a *platform* highlights the distinction between editability and reprogrammability. While the ability of users to update their profiles involved the basic manipulation of digital content that Kallinikos et al. (2013) referred to as *editability*. In contrast, providing openings for third-party applications enabled the modification of logical structures (reprogrammability) through by means of an *extensible codebase* (cf. Tiwana et al. 2010).

The findings show that while the loosely coupled layers of the LMA may suggest an open design space, any actor engaging in digital innovation will probably be constrained by a number of vested power relationships acting across these layers since they are likely to want to tap into the massive installed bases of (for example) Facebook (service-layer), and operating systems such as iOS and Android (the logical dimension of the device-layer). The latter supports findings by Barrett et al. (2012) that despite the loosely coupled layers of the LMA, when artifacts are enacted in practice, digital and physical materiality interdependent. In terms of *physical materiality*, Paper 1 shows how the physical materiality of the iPad further constrained the design space. This was exemplified by a number of innovative features in the prototype being scratched due to unclear and limited graphics-rendering capabilities of the device.

In terms of cognitive frames and product categories, Paper 1 shows that while Mag+ introduced innovative forms of presenting editorial magazine content and novel paradigms for user interaction, the design team’s

cognitive anchoring in the *magazine* as a traditional established product category facilitated a somewhat literal translation. In seeking to move beyond established product categories design scholars have highlighted the importance of ‘stepping back’ (Kelley and Kelley 2013), and starting by defining novel *meaning* to guide product design (Verganti 2009). In the detailed study of the design process involved in *digital product innovation*, Paper 1 also effectively illustrated that as Bonnier faced tremendous challenges in “designing for the unknown” (the iPad had not yet been announced), digital tools were fundamental to the effort. For example, the decision to use video as a prototyping tool turned out to be critical, enabling rapid iterations between the distributed design team. Thus, Paper 1, in part also sheds some further light on effects of digital artifacts on the *process of innovation* (Lee and Berente 2012) and the self-referential nature of digital innovation (Kallinikos 2004; Yoo 2013). On the other hand, Paper 2 illustrates how VK’s printed newspaper had historically provided ample space for domestic and international news, but was delivered to subscribers’ homes well after news events had unfolded. The early strategic decision to focus the news website on ‘local breaking news’ thus infused the news website with novel meaning. However, it should be noted that in the case of Mag+, the outcome of the focal design process in Paper 1 was only one “temporary fixation” (Leonardi 2012) in a “virtually infinite product space” (Boudreau 2012). As Mag+ was updated, it soon supported both embedding of rich content (i.e. video and sound), and social media integration.

Previous research has mainly investigated categorization and meaning in relation to what constitutes the *service-layer* in the LMA, an issue that is also further explored in this thesis. For example, the study of VK involved how the firm introduced digital product innovations such as the iPhone app and the blog portal. However Paper 2 also highlights how the very *meaning* of news *content* has also been challenged. This is also illustrated in the case of citizen journalism (see, for example: Allan and Thorsen 2009; Fico et al. 2013) depicted in Paper 4; a highly content-driven incarnation of news production. In this case of *digital process innovation*, digital artifacts allowed a single news story to emerge as an entity through numerous complementary fragments contributed by more than 200 individuals. In contrast, at VK, each reporter typically crafted each news story individually.

This section has drawn attention to challenges involved in the transition from a stable set of analog product categories to a more unbounded digital design space with fragile product categories. I next turn to discussing the consequences of dissolving traditional product categories for organizing logics within and between firms in the media domain.

6.2 Dynamic Identity Orientation

The previous section discussed the consequences of digital materiality and layered modularity for how organizational members and consumers frame and categorize digital products in the media domain. I now turn attention to the associated consequences of transitions from stable to fragile product categories for organizational identity. A noted mechanism in identity construction is the ways is to define oneself in relation to the constitutive outside (i.e. what one is *not*) (see Hall 1996). Therefore organizations such as VK and Bonnier could historically define themselves not only in relation to competing newspapers and magazines, but also in relation to the limited set of actor identities within the media industry (e.g. TV and Radio organizations). Of course, this is still possible in the digital era. However, what now constitutes *the outside* is highly complex and fragmented. The thesis has illustrated how digital platforms and associated practices increasingly compete for engagement of the traditional print media customer base while new forms of relationships emerge between print-media firms, platform owners and consumers, which has particular implications for aspects linked to firms' organizational identities.

Print media firms are typically embedded in value chains (see Porter 1985) that emerged over 100 years ago (Papers 1 and 2). The thesis shows that these value chains were configured based on a logic derived from the very physical properties of the products (printed newspapers and magazines). In the analog era of print publishing, media content was highly constrained by physical materiality throughout the production process, which was time-consuming, paper-intensive, and expensive while advertisers, print shops, distributors, and readers each occupied a cemented position in unidirectional value chains. As products, printed magazines and newspapers were analog artifacts in which form and content were tightly coupled and physically materialized in a way that supported viable storage and distribution of units. In this value chain there were no ambiguities regarding each actor's organizational identity, and only limited boundary-spanning activities were required to coordinate links in the chain. Solid alignments between elements of technology, structure, cognition, and identity and clear demarcations between the links in the value chain provided clarity for all actors involved in optimizing their operations to according to their respective business strategies. In this way, the fit between material aspects of the firms' products and deep cultural aspects such as values and norms facilitated unambiguous and stable personal, professional, and organizational identities.

As print-media publishers have engaged in digital innovation they have become increasingly interconnected with digital ecosystems comprising new types of competitors and partners (as noted in Papers 1 and 2). At the same time, the malleability of digital artifacts has reduced the relevance of the

static value chain positions of the analog era based on the inherent inertia of physical materiality (i.e. paper). The new relationships in the digital media ecosystem have become increasingly critical to nurture. Thus, since their historical competitors were facing similar challenges, it became increasingly irrelevant for the case study companies VK and Bonnier to continue solely defining themselves in relation to those actors. As illustrated in the thesis, this shift did not occur through a 'Big Bang'. Rather, the process emerged over extensive periods of time. This is particularly illustrated in Paper 2: The introduction of several classes of digital technologies over a 30-year period was associated with changes that formed deepening effects through organizational dimensions of structure, cognition and identity. Furthermore, as shown in Paper 2, the pace of change has accelerated, due to novel characteristics of recent classes of digital technologies.

A cumulative effect on VK of the multiple interactive streams of digital process and product innovations over 30 years (examined in Paper 2) was summarized by the CEO's articulation of the need to reorient the organization's identity. In this respect, Bonnier and VK took different approaches to organizational identity change. For VK, as long as the printed newspaper remained the main source of income, the company could not fully transition to a new identity, rather it created an overarching meta-identity of a *media house*. Bonnier was based on multiple organizational identities from the start. In concert with this approach, Bonnier chose to spin-off the Mag+ into a separate firm. Both VK and Bonnier had to accept that, rather than being a local or domestic leader, they were highly peripheral actors in Apple's and Facebook's business ecosystems, in which new actors continuously reconfigured their identities. This is illustrated in Paper 3 – Facebook evolved from a social network, to a platform, and beyond. To this end, the thesis resonates with findings that digital technologies (in particular social media) facilitates rapid emergence of new entrants with novel organizational identities (cf. Vaast et al. 2013). In turn, such platforms opened up user-generated news content. This is for example illustrated in Paper 4, where for citizens engaged in rapid and effective self-organized reporting without monetary incentives, thus starting to challenge where news come from and if it matters whether a professional journalist produced them.

The case of VK confirms Tripsas (2009) claim that identity reorientation is a disruptive process. While this state of disruption affected VK after 100 years of a relatively stable organizational identity, the overall the findings reported in the thesis suggest that due to digitalization, organizational identity reorientation in the media domain is most likely not going to be rare one-off events. Rather, I agree with Gal et al. (2014) that digital technology accentuates the dynamic and malleable nature of organizational identity orientation. Due to the distinct aspects of digital artifacts (i.e. digital

materiality and layered modularity), the thesis suggests that actors that engage in digital media production and distribution need to continuously reorient their identities while balancing both short-term and long-term relationships with an array of external stakeholders.

6.3 Studying Digital Innovation and Organizing

Throughout the research underlying this thesis, and while writing it, I have shared a major longstanding concern of IS scholars: to elucidate relationships between digital artifacts and organizing processes (see e.g. Bostrom and Heinen 1977). In this context, the thesis demonstrates the value of adopting a longitudinal process perspective (George and Bennett 2005; Langley et al. 2013) when investigating digital innovation and organizing. Each of the appended papers presents an analysis of sequences of events and associated processes, over time-periods ranging from 6 days to 30 years. Covering the shortest timespan, Paper 4 focuses on fine-grained micro-level practices conducted on the Alpha forum. It reveals how connections and relationships between forum users and environmental resources emerged as frequent interactions around sequenced themes gave rise to spontaneous order and structure.

At the other end of the spectrum, Paper 2 examines phenomena over the most extended timespan, covering the 30 years from 1980 to 2010. During this period, following initial introduction of digital technology in organizations in the 1970's it evolved in numerous ways. As noted by El Sawy (2003, p. 592), "the changing nature of IT capabilities induces different views of IS". For example, in the 1970s it was characteristically perceived in the light of managerial rationalism, by both researchers and practitioners. While a challenging undertaking, this calls for re-examination of previous theorizing on different families of digital artifacts and the roles that they played (and play). Preliminary efforts to address these challenges have been made in both the thesis and the underlying research. For example, in section 3.1.1 I have attempted to provide such artifact-focused insights and perspectives. Meanwhile, in the investigations reported in Paper 2, my colleagues and I applied a historical case study approach to explore digital technology assimilation as a sociotechnical process. The perspective applied differed from technological determinism, but we did trace and analyze events involving digital artifacts and organizational change that occurred in an era when managerial rationalism strongly informed views of both researchers and practitioners. Therefore, we made a concerted effort to analyze those events using our current knowledge, without discarding the insights of previous research conducted at the time. Inspired by the thoughts expressed by El Sawy (2003) on the different views of IS, I argue that critically scrutinizing the evolution of digital artifacts to date using our current views, and contrasting them with previous views, can generate rich

new insights. Hopefully, this thesis has highlighted the urgency and rewarding nature of investigating how digital innovation emerges over extended periods of time and its associations with deep sociotechnical changes. While retrospectively studying digital technology assimilation events and connected changes that occurred in the 1970s and 1980s, I encourage scholars to seek ways to analyze them from current IS perspectives.

Further, it should be noted that the study of digital innovation and organizing is by no means only of interest for IS researchers. In my research and theorizing I have striven to obtain generalizable results through rich insight (cf. Walsham 1995), drawing in the process on both IS literature and literature from a broader innovation domain. In theorizing and empirically examining digital innovation I have deliberately applied a broad perspective, incorporating both process innovation (new methods, procedures or responsibilities), product innovation outcomes (which shift or expand an organization's domain) (see Zmud 1982) and associated changes in organizational cognition and identity. This contrasts with the narrow definition by Yoo et al. (2010a) of digital innovation as “the carrying out of new combinations of digital and physical components to produce novel products”. In applying the broader perspective, the thesis stresses the importance of viewing digital innovation not merely as the mass-market introduction and individual use of a novel product but as an organizational phenomenon that involves multilayered sociotechnical change processes. I opted for an approach that was grounded in contextual events where digital artifacts enabled the carrying out of a new process or practice or were utilized as parts of innovative products. Investigating these events, as they occurred in my cases, I aspired to develop “powerful stories of the digital age” (Henfridsson 2014, p. 357). In this way, the studies underlying this thesis both built on extant research on digital innovation and were grounded in my cases.

Applying the broad view of digital innovation adopted in the thesis, and approach adopted when studying associated phenomena, requires scholars to conduct context-sensitive empirical investigations, for which site access is needed that is not always easy to obtain. Nevertheless, I stress the importance of grounding investigations of digital innovation in practice as the phenomena are inevitably strongly influenced by the context, and emerge through complex social relationships (cf. Weick 1995). The interpretive approach enabled me to uncover how organizational members understand and experience digital innovation, as well as how meaning is generated through relationships between digital technology and social processes. The case study method was a rewarding approach as it enabled me to explore digital innovation in real-life contexts, particularly as the

boundaries between digital innovation and the media context are highly complex and difficult to distinguish (Yin 2003).

To summarize, the thesis promotes an approach to digital innovation scholarship that (1) employs a multi-level perspective, attending to changes in multiple organizational dimensions or layers (such as technology, structure, cognition, and identity), and (2) seeks to trace how patterns of multilayered change emerge and unfold over time.

6.4 Limitations and Future Research

Like all others, this thesis has a number of limitations that are related to the methodological approach applied and the theoretical framing (Robey 1996). In this section I discuss the nature and consequences of these limitations, and highlight some key ways in which they open up opportunities for future research.

Firstly, the empirical investigations drawn upon in this thesis were conducted using a qualitative methodology. In accordance with this approach, as described by Mason (2002), I sought to generate an understanding of digital innovation by exploring how it emerged in particular contexts, while paying attention to specific aspects of those contexts. While I do not claim that my findings have statistical generalizability, they have at least some generalizability at an analytical level (Yin 2003). That is, my explanations of how key processes evolved in the empirical settings can be generalized to theories of digital innovation (Walsham 1995). However, although I argue that the interpretive approach facilitated the generation of rich insights about digital innovation, the approach does have limitations. My analytical generalizations bounded by the particular theoretical framing (Walsham 1995). The theoretical lens applied (see Chapter 3) emerged through parallel iterative processes of data analysis and literature review, and is therefore solidly grounded in my empirical data. In this manner, I have used theory in attempts to explain why the empirical patterns presented in the attached papers occurred (see Kaplan 1964; Sutton and Staw 1995). I applied the particular theoretical lens as I considered it the most appropriate tool to support me in seeking to answer my research question. Still, as with any claims of analytical generalization, and the fact that the theoretical framing is a limitation in itself (Robey 1996). These limitations open up a number of opportunities for future research.

Recent studies have demonstrated the utility of applying institutional theory when studying digital innovation (e.g. Henfridsson and Yoo 2014; Tumbas et al. 2015). In terms of studying digital innovation in content-based industries I encourage future research to consider such perspectives. More research is needed into the transformation of professional identities in relation to digitalization and the layered modular architecture (Yoo 2013;

Yoo et al. 2010a). While this thesis attended to such changes, applying institutional theory (e.g DiMaggio and Powell 1983) as a lens enables deeper theorizations of dynamics involving professional and institutional fields. The thesis investigated relationships between established and novel forms of digital media production, distribution, and acquisition. However, did not involve industry-level analysis as such. Given the ongoing digitalization in the media industry, I argue that it provides a relevant empirical context for IS scholars that seek to investigate the role of identity in digital innovation.

The thesis demonstrated the enriching nature of utilizing qualitative web-data (Paper 3 and Paper 4). I encourage future studies that explore the potential of applying “quali-quantitative methods” when utilizing digital traces to study digital innovation (Venturini and Latour 2010). While such applications are highly limited in IS research so thus far, recent studies on for example self-organized online open source development also demonstrate the validity and enriching nature of the approach (Lindberg et al. 2013).

7. Conclusions

This thesis was conceived in proximity to, and grounded in, media practice. My experiences of participating in the collaborative industry-academia research program that included Bonnier and VK was that of a mutually rewarding collaborative venture that facilitated two-way knowledge sharing. In turn, these conversations, meetings, and workshops informed and motivated relevance of conducting the empirical investigations reported in Papers 3-4. As noted earlier, Paper 5 represents fruits of a deliberate effort to generate prescriptive advice that can be utilized and applied by practitioners in their day-to-day work as encouraged by (Benbasat and Zmud 1999), but I hope that, in the long-term, the thesis as a whole may helpfully inform the thinking and decisions of practitioners (see Lyytinen 1999) involved in digital innovation.

I have sought to unpack the dynamics of digital innovation by paying specific attention to how distinct material aspects of digital artifacts are leveraged for both process and product innovation, and the ways in which these outcomes were implicated in changes involving deeper sociotechnical dimensions involving cognition and identity. I discussed how the malleability of digital artifacts were associated with a shift from a limited set of relatively stable analog era product categories to fragile digital counterparts with ambiguous meaning that both called for new ways of organizing work while new types of relationships with customers and additional external stakeholders emerged. In turn, the thesis highlighted how such cognitive changes, under certain circumstances can lead to changes in both various professional identities within organizations and overall organizational identity. To this end, I argued that due to ongoing digitalization, when going forward, incumbent media firms likely to experience the need to continuously reorient their organizational identities as they venture into temporary constellations with external digital platform owners, and content creators.

In applying a longitudinal process perspective on digital innovation and organizing I argued for the utility of an approach that attends to multilevel changes in organizations. In so doing, I encouraged further accounts of digital innovation to pay attention to how patterns of change in digital technologies trigger sociotechnical changes across multiple levels in organizing contexts over time. In drawing attention to the increasingly distributed locus of control in digital artifacts, the thesis advised managers to not simply seek to utilize digital technology as tools for controlling their operations, but instead stay sensitive to how digital innovation initiatives emerge throughout organizations as well as outside of the organization's boundaries. In the latter case, firms need to investigate how they can provide

or utilize boundary resources to create novel integrations with external stakeholder in order to create and appropriate value.

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