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The technology-mindset interactions: Leading to incremental, radical or revolutionary innovations

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ABSTRACT

Innovation is an integral part of the major transformation in modern business. Modern managers are increasingly pushed from both in- and outside the organization to innovate their processes including products and services. Research typically investigates innovative processes from either a technology perspective or managerial mindset perspective, but rarely both. We argue that technology and mindset should be analyzed in combination, as they are fundamentally co-constitutive albeit with different levels of interaction. We categorize the levels of interaction in a two-by-two model, with the Y-axis representing levels of innovative technology and the X-axis representing levels of innovative mindset. This categorization leads to a theoretical framework, a Technology-Mindset Matrix that consists of four typical technology-mindset interactions. We show how each type leads to unique innovative outcomes, and label the four types; incremental innovation, radical technological innovation, radical mindset innovation, and revolutionary innovation. We illustrate each square with case examples. Furthermore, we discuss core B2B issues managers face when transforming their organizations by moving up from incremental to higher ranked modes of innovation.

1. Introduction

Innovation is an integral part of the major transformation in modern business (e.g., Brynjolfsson & McAfee, 2014; Salonen, 2011; Schwab, 2017). This is echoed by Orlikowski & Scott (2008, p. 447) who argue that Western societies are on the verge of a transformation on a similar scale to the industrial revolution. Research into innovative processes is therefore increasingly important as it can provide important insights into the nature, challenges, and opportunities of transformation of companies before their raison d'être disappears. According to Cortez and Johnston (2017, p. 95), this is also mirrored in industrial marketing research as innovation and harnessing technology are among the six most representative topics in this area. In fact, one of the key tenets in Cortez and Johnston's (2017) historical overview and discussion of the future of B2B marketing is the development of strategies, tactics, and procedures for innovation that will help to close the gap between B2B marketers' challenges and scientific research. In particular, two areas influencing innovation have received significant attention, namely technology (e.g., Bower & Christensen, 1995; Lucas & Goh, 2009; Nagy, Schuessler, & Dubinsky, 2016; OECD, 2015) and sensemaking (e.g., Dougherty, 1992; Martins, Rindova, & Greenbaum, 2015; Rydén, Ringberg, & Wilke, 2015; Tripsas & Gavetti, 2000). Which of the two areas that is in the limelight has varied across time. Initially, technology was in vogue but that focus decreased significantly during the late 1980s and 1990s as it drew criticism for being associated with technological determinism and a positivist paradigm. An alternative, socio-culturally inspired approach to innovation based on managers' sensemaking replaced technological determinism and became the mainstream organizational focus in leading management journals (e.g., Griffith, 1999; Weick, 1989). Reflecting this evolution, Orlikowski and Scott (2008, p. 434) show that during a ten-year period (1997–2006) only 5% of articles in four leading management journals directly addressed the role and influence of technology in organizations. The increasing separation of technology and sensemaking was further perpetuated by the emergence of technology-oriented journals, such as the MIS Quarterly that almost exclusively focuses on the role of digital technology on managerial issues. Although it generated deeper levels of insights into each field, such specialized focus further isolated and insulated the two camps, and undermined an understanding of the mindset-technology interaction, i.e. their co-constitutive roles. Nonetheless, this interaction is addressed in other fields in the social sciences, such as in Giddens' (1984) structuration theory that highlights

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the ongoing and iterative processes of agency (sensemaking) and structure (regulations, norms, technologies) (see also Whittington, 1988) and the Actor-Network Theory (ANT) which locates agency neither in human "subjects" nor in non-human "objects" but in heterogeneous associations of humans and nonhumans (Latour, 2005). Nambisan et al. (2017, p. 6) also echo the concern of separating technology and mindset in innovation research. They advocate for an interaction between technology and socio-cognitive sensemaking because both are critical elements of theorizing about digital innovation management (see also Davidson, 2002, p. 352). Thus, dealing with the two determinisms independently is somewhat surprising given that disruptive innovation is deemed to be a key issue within B2B marketing (Cortez & Johnston, 2017). Consequently, in this paper we look at the interaction between technology and mindset to identify four types of innovation processes. Our stance is that technology and mindset are interconnected and co-constitutive, yet can still be semi-bracketed for analytical purposes enabling a description of how each contributes to innovative outcomes. This unifying perspective is also echoed by Nicholson, Brennan, and Midgley (2014) in their argument for a pluralist perspective that embraces and explains the interplay between agency (mindset) and technology (structure), and thereby overcomes paradigmatic blinders. This, we believe, will provide a better understanding of how to make sense of as well as optimize the interplay between management mindsets and new technologies in the market.

This leads to the main contributions of the paper. Firstly, the paper advances current theoretical accounts on the influence of technology and mindset determinism on technological and business model innovations. We do so by introducing a technology-mindset matrix that highlights the boundary conditions and origins of different types of innovation processes based on the interaction between mindset and technology (i.e., incremental, radical technology, radical mindset, and revolutionary innovations). This matrix provides a novel view into this important and largely overlooked interaction and is to our knowledge new to the literature. Secondly, we discuss how organizations might move from one position in the matrix to another based on particular interaction between high/low advancements in technology and/or mindsets. Our technology-mindset matrix helps frame the managerial focus when embarking on B2B innovative efforts.

Before starting, however, we need to define core concepts related to innovation. We rely on a slightly adjusted definition by Van de Ven (1986, p. 590). This states that innovation includes new technologies, transactions, institutions, and its stakeholders such as collaborators and customers. That is, innovation represents the development and implementation of new ideas by people within an institutional order, which lead to an enhancement of products, services, and existing business processes that potentially lead to increased financial gains, stronger competitive positioning, and improved value for stakeholders (e.g., collaborators, customers, end-users). This definition is sufficiently broad to embrace new ideas, mental/business models, technological processes, products and/or services that are located along the continuum from incremental to radical innovation. The third concept in the matrix, revolutionary innovation, is reached when radical innovation occurs within both the technological and the mindset fields. While a general categorical distinction between incremental and radical innovation is not possible as the lines of distinction are rather context specific, messy, and fuzzy (also see Griffin, Price, Vojak, & Hoffman, 2014), we suggest that in the extremes there are significant differences. For example, radical innovations typically require competence-destroying and creative construction processes (see Lawlor & Kavanagh, 2015), which lead to "unprecedented improvements" (see Story, O'Malley, & Hart, 2011). In contrast, incremental innovation typically follows a well-planned and structured process. It is worth highlighting that dominant socio-cultural and professional norms and values within a given business context also play a role in terms of distinguishing between incremental or radical innovations (see LaPlaca & Katrichis, 2009, p. 3).

Before fleshing out the technology–mindset matrix in more details below, we first highlight some of the key theoretical arguments raised in the innovation literature that argue in favor of technology and mindset determinism, respectively. We then discuss the four squares in more details, and subsequently discuss and illustrate the potential opportunities and dilemmas resulting from managers having to decide whether to stay put and compete within a particular square, or to move on toward another square in the matrix.

2. Technological determinism versus mindset determinism

2.1. Technological determinism

By technological determinism we follow Dafoe's (2015, p.1052) definition as outcomes "that follow inexorable functional logics and are driven by technological change that lead to an unanticipated shaping and governing of societal routines, norms, practices, consumption, etc." The position of "technological determinism" within the innovation research suggests that technology drives innovative solutions (e.g., Bogner & Barr, 2000). According to Leonardi and Barley (2010, p. 42), researchers who do not take technology into consideration neglect the issue of materiality and power. More generally, overlooking technology is of concern because according to Dafoe (2015, p. 1049), "most of the disciplines in social sciences, and business and the military, continue to take technology determinism seriously." In a recent article by Nagy et al. (2016) on innovation, the authors mirror Dafoe's viewpoint, as they argue that technology sets the outer limits to what can be dreamed up in terms of new ways to optimize operations and develop new products and services, and suggest that disruptive innovations should be grounded in technology standard, technology functionality, and technology ownership. Similarly, at the heart of Innovation Diffusion Theory (IDT) lies a functionalist, technology determinist assumption that is orchestrated by five factors: technology advantage, compatibility, complexity, trialability, and observability (Nagy et al., 2016, p. 121).

Leonardi and Barley (2010, p. 5) argue that the fields of technology and organizations have swung strongly away from technological determinism, and in so doing has neglected issues of materiality and power (in Dafoe, 2015). Dafoe (2015, p. 1049) discusses the field of technological determinism and argues that technological determinism should be resurrected. Interestingly, Latour (1992) refers to technology as the "missing mass" of sociology, since it invisibly holds together social order. That is, technology imposes frames as to what is possible and what is not on its users. Similarly, in a report by the US National Security Council it states that "as technologies emerge, people will lack full awareness of their wider economic, cultural, legal, and moral impacts …" (Dafoe, 2015, p. 1054). That is, an awareness of the implications stemming from the influence of new technologies on existing practices and social structures.

The technology determinism position regards technologies as primary drivers of continued developments and as an external force that both enables and confines managers' abilities to exploit new business models. From the perspective of a functionalist position new business opportunities emerge or already exist "out there" to be exploited by new technologies by a rational manager. This follows Nagy et al. (2016, pp. 120–121) who argue "that functionality, technical standards and ownership are three innate characteristics of innovation as well as disruptive innovation," and that these characteristics "dramatically alter or disrupt existing organizational structure, strategy, context, and use." For example, the emergence of the Internet represented a technology change that created new competitive conditions, driving businesses to transpose their existing business models upon the new technology, albeit often with disappointing results. This view resonates with the technology imperative model (Aldrich, 1972; Blau, Falbe, McKinley, & Tracy, 1976) according to which technology is a variable that can be discovered, applied, and used in an objective fashion. That is,

technology exists as an objective entity with inherent potentials. This viewpoint makes Kline (2015) state that, "technological changes determine social changes in a prescribed manner" (in Dafoe, 2015). Patrucco (2005, p. 38) observes that "localized technical knowledge can be understood in terms of technical and regional factors that co-define the peculiar, technological and institutional features affecting the progressive accumulation of the specific common pool of technological knowledge we finally observe"…which affect society in unforeseen ways.

A similar assumption underpins much of the innovation research. For example, radically new technology is typically referred to as the driver of change. Martin-de-Castro (Martin-de Castro, 2015, p. 143) argues that "it is also true that in knowledge–based and high-tech industrial markets, competitive success comes directly from continuous technological innovations." This echoes Ceruzzi (2005, p. 593) who states that historians of technology should "step back from a social constructionist view of technology" and consider that, in at least some cases, "raw technological determinism is at work." Some technological trends are so predictable and persistent that they appear to follow an internal logic of their own, such as the past forty years of exponential growth of chip density, which barely deviated from its slope, as captured by Moore's Law (Ceruzzi, 2005, p. 593). Ceruzzi (2005, p. 590) also argues that this is not "an indication of the social construction of computing [but] an indication of the reality of technological determinism." Dafoe (2015, p. 1047) argues in favor of a technological determinism (based on military-economic competition and adaptationism) that constrains sociotechnical evolution to follow objectively defined, deterministic paths that are (largely) independent of human will. A similar position is often asserted when discussing Big Data technology and how it affects societies in unanticipated ways. For example, Big Data technology has enabled law enforcement to anticipate potential criminal behavior and intervene preventatively, thereby paving the way for super surveillance and other related technological developments. One can look at technology as the accumulated knowledge and intentions of past initiatives that often lead to unforeseen consequences and new technology developments. In the words of Dafoe (2015, p. 1064): "A scholar who seeks to explain technological change using only the decisions, beliefs, values and ideologies of groups will fail to see the prior structural causes of these decisions, beliefs, values and ideologies." Researchers holding this position argue that technology has an objective existence with particular functionalities that can be identified by managers through logic and reason. From the applied world, the assumption is even more evident. In a recent workshop for practitioners by Michael Schrage, a research fellow at MIT, and Mark Forster, Vice President at IBM (2017), on how technology leaders become breakthrough innovators the importance of data governance and data wrangling in promoting data-driven innovation is emphasized alongside with how digital data, platforms, and tools should be at the center of organizational efforts to drive innovation.

2.2. Mindset determinism

In contrast to technology determinism, mindset determinism researchers suggest that the use of existing or new technologies is, first and foremost, driven by managerial mindsets. This camp argues from an agency perspective where "an actor" drives the choice of technology to enhance strategic opportunities. Mindset determinists view people as having a degree of interpretative flexibility (Bijker, Hughes, & Pinch, 1987), and suggests "that technology design is an open process that can produce different outcomes depending on the social circumstances of development" (Klein & Kleinman, 2002, p. 29). Business opportunities emerge from sensemaking by entrepreneurs as "technology is construed and re-construed as it is designed, built, sold, and used" (Orlikowski & Scott, 2008, p. 452). Barley (1988, p. 46) proposes the notion of technology as a "social object" to emphasize that the material aspect of technology (i.e., hardware) is embedded into a system of meaning. This system of meaning or mindset drives how people enact technology and put it into action (see Rydén et al., 2015). For constructionist researchers technology is socially enacted as managers make sense of technological assumptions and performativity in order to alter social and material conditions (Bijker et al., 1987).

From within a business perspective, the "mindset determinism" position suggests that innovations are primarily driven by managers' abilities to see new opportunities related to an organization's interaction with the market as well as how to optimize the use of existing technologies (Dougherty, 1992; Martins et al., 2015; Rydén et al., 2015). From this perspective, radical mindset innovation springs from managers' sensemaking of new business models and the creative use of existing artifacts, such as technology.

Within the mindset camp, there are two dominant positions, and both provide support for a mindset position that drives sensemaking of technology. One position views cognizing as categorical (automated) processing. Here, the cognitive processes are largely tacit, governed by subconscious, embodied mental models. This follows Hodgkinson's (2015, p. 17) empirical work that identifies an unrecognized divergence in managers' mental representations of the competitive environment, both within and between organizations in a given industrial sector. Similarly, Rydén et al. (2015) identify four dominant yet tacit managerial mindsets of the organization-customer interaction (i.e. Promote & Sell, Listen & Learn, Connect & Collaborate, and Empower & Engage) and show how each affects the use of Big Data technology differently. The latter study also shows how managers often carry very different managerial mindsets within the same company and even within the same management team, and that these tacit managerial mindsets affect how new technology is used organizations. While some research suggests that a disparity between strategic orientations among its managers can be detrimental to an organization, it might also enable the organization to introduce proactively new initiatives. For example, Hodgkinson (2015) argues that diversity of mindsets among managers helps preserve variation in structures and processing of environmental information, which is vital for learning and longer-term survival of organizations. Of course, for learning to take place it is important that such mindsets are both made explicit and transparent, which often is not the case.

The other position argues that managers are aware of their mindsets and use them rationally to distinguish between various potential opportunities that a given technology enables. Managers change their mindsets and innovate their companies' strategic orientation mindfully and proactively with or without the presence of exogenous influences. Obviously, it takes a special type of introspective cognition to proactively generate a new conceptual framework through which to evaluate a given market context. In accordance with Tripsas and Gavetti (2000), generative cognition emerges when managers overcome status quo beliefs, existing business models, and cognitive biases, and move from categorical to reflective thinking (see also Ringberg & Reihlen, 2008), and thereby "creatively combine concepts, and modify familiar knowledge and habits to produce novel representational syntheses or action sequences" (Deák, 2003, p. 272). As such, mindset determinism can be based both on tacit and explicit that is subconscious and conscious processing. Obviously, if it is tacit, organizations will have difficulties governing mindsets and orchestrating mindset shifts for obvious reasons. Managers who are unaware of their mindset might still undergo mindset shifts but will do so outside of their conscious control. On the other hand, managers who are aware of their mindset and how it biases their interpretations might proactively change this mindset or switch between mindsets to identify opportunities for resolving and/or exploiting new market conditions. Managers may also adopt dominant mindset from within another industry by combining it with preexisting knowledge and thereby create a distinct new and useful business (managerial) mindset. For example, in a paper on a cognitive approach to innovating business approaches to the market, Martins et al. (2015) discuss how proactive managers can become radically innovative by

relying on structured cognitive processes that engage with analogies from other industries, such as when Tesla framed its business undertaking as "Apple on wheels." Martins et al.'s (2015) work is useful for understanding how managers might proactively search for alternative ways to conceptualize their current situation. The challenge for managers is to know when they should stop the "generative cognition" process and instead work on implementing their ideas since there is no end to the "conceptual screw." From a mindset determinism perspective, radical changes to business strategies are reflected in such intended or designed systems of activities (Casadesus-Masanell & Ricart, 2010).

2.3. Technology-mindset matrix

The technology-mindset matrix provides a conceptualization of the underlying transformation processes through innovation, and leads to the four squares identified in the Figure below. It can be difficult to define when a boundary (between one square and the next) is transcended because that often depends on perspectives and particular dimensions in use (see also Story, Daniels, Zolkiewski, & Dainty, 2014, p. 1271). In our case we follow Story et al.'s (2014) proposition, which suggests that to move from one square to another requires a radical leap or change in technologies and/or managerial sensemaking (i.e., mindset). The only path that involves iterative and incremental processes is developments within Square 1. Within each of the four squares we identify the dominant practices, theoretical position, and case examples. The matrix provides a visual overview of the various innovative processes within the four squares (i.e., incremental, radical, revolutionary) as well as transformative processes required for moving between squares.

3. The impact of technology and mindset on innovations

The matrix (Fig. 1) offers a theoretical scheme that illustrates how organizations might be prioritizing different innovative paths depending on whether they follow a technology-governed, a mindset-governed, or a combined technology-mindset governed process to innovation or simply remain in the incremental square (where most companies are located) in their strategic orientation.

The particular location of an organization within one of the four squares in the matrix is necessarily based on relative measures, i.e., on standards within each industry as to what constitutes "radical innovation" and "revolutionary innovation" in the first place. What represents a radical innovation (technology or mindset) within one industry might be considered an incremental innovation within another. Within young and/or dynamic/competitive market places it is possible (if not highly likely) to find organizations located across all four squares. However, such a diversified distribution is less likely in well-established industries where organizations have come to share particular and accepted norms and ways to compete (Grant, 2016), and therefore will be located in the incremental innovation square. The matrix also identifies the need for dynamic and radical processes in order for an organization to move from one square to another (i.e., transforming its state of operation), and illustrates how the technology and mindset transformative processes, respectively, lead to different innovative outcomes and business models. We describe the four squares next.

3.1. Incremental innovations

Incremental innovation, while typically representing low-risk reward, is still the most dominant position within most industries. One important reason is that identifying new and interesting processes, services, and/or products is demanding. In their sobering statistics, Iyer, LaPlaca, and Sharma (2006) illustrate the high potential risks of engaging in innovative stewardship, and point to the fact that approximately 85% of new products fail. This raises serious concerns about the return on investment of radical innovative processes.

Thus, incremental innovative organizations innovate at a steady pace and invest in incremental improvements in either (or both) strategic mindsets and/or technologies. The incremental path is largely influenced by tight interlinks between competitive actions, and is only to a minor extent focused on consumer needs. Activities are typically quite reactive, and involve gradual, step-by-step developments of technology and managerial mindsets. The development processes are often so subtle and incremental that they are difficult to distinguish in the short term. Typically, it requires longitudinal studies to detect significant changes in the operations of these organizations. There are often constraining factors (e.g., organizational culture, leadership style, lack of know-how) at play that limit the nimbleness of these organizations yet also create relative stability (see Sandberg & Aarikka-Stenroos, 2014 for a review). For example, the iron mill industry operated within its modus operandi based on highly integrated mills for almost four decades before being upset by mini-mills that were more

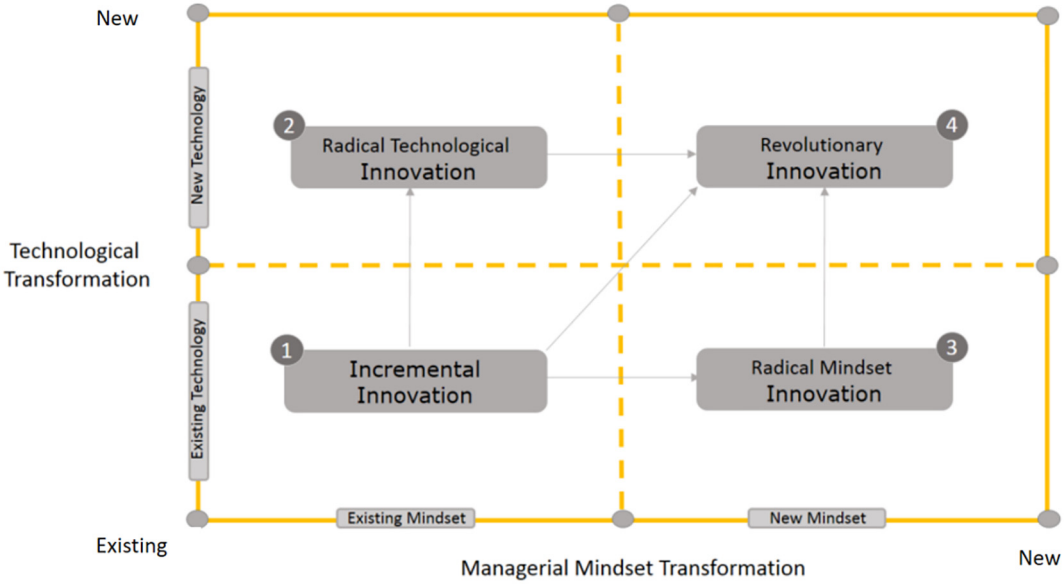

Fig. 1. The technology-mindset matrix.

nimble and offered a 20% cost advantage (Christensen & Raynor, 2013). In particular, strong adherence to accepted beliefs and technological choices prevent such organizations from differentiating themselves. In the words of Porac et al. (1989, p. 412), the mindset-technology interaction risks creating a mutual enactment process during which "the technical choices of organizations constrain the flow of information back to decision-makers, thereby limiting their vision of the marketplace." This cognitive inertia represents an obstacle to innovative efforts even in the presence of external innovative technological changes.

Incremental innovation is expressed by Popper (1957) when he refers to it as "piecemeal" engineering, and Lindblom (1959) who viewed it as "a muddling through technology." Inherent in Popper and Lindblom's positions is the perspective that radical innovations are illusionary because the learning process itself always is incremental and follows a trial and error path. The assumption is that insights build on previous insights in a linear fashion, rather than emerging in quantum leaps (Wheelwright & Clark, 1992). Repetitive, ongoing interactions within the market create a sense of similarity in beliefs, taken for granted assumptions, and shared interlocking metaphors or worldviews (Bogner & Barr, 2000, p. 214). Spender's (1989) "industry recipes" is a useful term for framing this generative process that leads to competitive convergence and incremental innovation. This also follows Levinthal and March's (1993) observations that existing behavioral routines and procedures become codified into organizational capabilities that persist in the face of external changes, and result in suboptimal responses to radical innovative opportunities. That this is still the case, in spite of the increased competitive pressures experienced within almost all industries, is illustrated by Polites and Karahana's (2013) study in which they empirically document the inhibiting effects of existing technological system, habits, transition and sunk costs, and how these lead to inertia and the rejection of new technologies. Embedded routines in organizations lead to a deep psychological unwillingness among managers to abandon the status quo and explore alternatives. Oreg (2003) conceptualizes individual propensity to resist change based on psychological dimensions, such as routine seeking, negative emotional reaction to imposed changes, and cognitive rigidity. The status quo perspective posits that individual decision-makers are biased to maintain the status quo, that is, toward "doing nothing or maintaining one's current or previous decision" (Samuelson & Zeckhauser, 1988, p. 7). The status quo bias might also be a result of risk aversion and overly rational decision-making (see March, 2006) that emphasizes known short-term gains versus unknown long-term risks. Finally, limited knowledge of new technologies often leads organizations to stick to the incumbent system as a "known quantity." A recent report by Kane, Palmer, Phillips, Kiron, and Buckley (2015) shows that only 25% of organizations are engaged in transformative actions.

From within the incrementalist position competitors keep each other in check by dynamically reacting to each other's moves, which typically are gradual and follow well-established incremental technological development and deeply anchored mindsets (e.g. Porac et al., 1989). However, this reactive position also means incumbent players are late to adopt, or might even actively resist adopting radical innovative processes. Other reasons for why organizations remain within this square are: a lack of access to new resources; strong internal cultures and traditions; imposed standards by legal requirements; managers being resistant to change (status quo bias), and managers' competing mindsets might confine initiatives and prevent them from seeing new ideas (Hodgkinson & Healey, 2011).

In an almost paradoxical sense, it is particularly difficult for well-established and successful organizations to adopt competence-destroying technologies as these require the often difficult adjustments to fundamentally new technological practices, opportunities, and mindsets. For instance, Swiss watch manufacturers were devastated by the transition from mechanical to quartz movements in watches (Glasmeier, 1991). Other examples include Blackberry that was unable to appreciate the potential usefulness of touchscreens, and Nokia that was unable to envision the dramatic change from mobile telephones serving primarily as communication devices to serving as mobile computers with embedded telephony (e.g., Habersang, Küberling-Jost, Reihlen, & Seckler, 2018). According to Martins et al. (2015, p. 102) it is incremental or "piecemeal" innovations that prevent organizations from moving radically in any one direction. For example, banks are increasingly moving their transactions to online portals. This move is hardly revolutionizing. Moreover, it decreases the relational interaction with and loyalty from customers who now are merely a click away from online competitors (van Bommel & Edelman, 2015).

Still, well-established companies might be able to survive competitive pressures through incremental development processes. For example, Patrucco (2005, p. 39) provides a historical overview of the incremental development of the Italian plastic industry between 1951 and 1998. He describes how the long-term development of local plastic production incrementally evolved into high levels of specialization. The case illustrates the incremental (evolutionary) development of mindset and technology through "the systemic recombination of the diverse of human capital (technological knowledge) and technologies [that are] driven by inter-industrial complementaries between production processes and product components (see also Carlsson, 1997)." Patrucco (2005) emphasizes how changes were primarily driven by imposed (external) "quality standards and changes in suppliers' and users' requirements."

In a contrasting case, based on a longitudinal study of residential estate agents, Hodgkinson (1997) shows how dominant, industry-wide accepted mental models and social constructions of the competitive landscape cognitively restricted managers to a point where they were out of step with the changing circumstances confronting the industry. The Scottish knitwear industry displayed similar disregard for technological developments – a move that led to its dramatic decline. According to Porac, Thomas, and Baden-Fuller (2011), the "incrementalism" that is experienced within an industry is the result of technology traditionalism and mindset conservatism that are particularly dominant in industries where tight interactions between industrialized, institutional, and technological players are required. Another example comes from the freight and shipping industry, which represents one of the largest and oldest industries which in many ways are still characterized by incremental developments, although containerization did revolutionize liner shipping in the 1960s and early 1970s (Poulsen, 2007). For instance, Maersk, the largest container carrier in the world has only incrementally improved its fleet's fuel efficiency throughout the last decades by 20%. Its managerial mindset states, "first and foremost focusing on our existing businesses, meaning we are not suddenly jumping into the pharmaceutical industry."[1] Tellingly of its traditional mindset, in 2007 Maersk invested the less than impressive amount of U$10 million to improve services, reduce costs or develop new businesses.[2] However, more recently, Maersk's board of directors employed a leading international IT technology person as its new CEO to thoroughly revamp its business model in a long overdue reaction to the heavy competition from much more agile platform driven freight businesses such as DSV.[3] The first initiative is to develop a blockchain-based freight platform.[4] This latest move partially exemplifies what we talk about in the next section, namely radical technological innovation, the "partiality" is because this initiative represents a reactive rather than a proactive innovation.

[1] http://www.maersk.com/en.

[2] http://finans.dk/finans/okonomi/ECE7994968/Mærsk-skal-tænke-nyt-og-poster-millioner-i-innovation/?ctxref=ext

[3] DSV Global Transport and Logistics, www.dsv.com

[4] http://www.ibm.com/blogs/blockchain/2018/01/digitizing-global-trade-maersk-ibm/.

3.2. Radical technological innovation

Contrary to incremental innovations, in the radical technological innovation camp disruptive innovations happen based on technological breakthroughs that are discontinuous and radical in nature (Florida & Kenney, 1990; Iyer et al., 2006; Utterback, 1994). Radical technological innovation represents the development and implementation of new products, services or processes that lead to fundamental improvements in operational efficiencies, interactions with the market, and/or the fulfillment of "new" needs among stakeholders (e.g., Dewar & Dutton, 1986; Gopalakrishnan & Damanpour, 1997). Here, the dominant perspective is that managers are able to make sense of, assimilate, and use logic and reason to build new knowledge related to the use of breakthrough technologies (Kim, 1998, p. 507). To engage in divergent thinking is, according to Reid et al. (2014, p.1351), "to link advanced technologies to market opportunities of the future." It assumes a sophisticated ability to link "breakthrough technologies" with unarticulated needs of the future. Yet, this position overlooks research that suggests managers often apply existing mindsets to new technologies (see Rydén et al., 2015) and/or are simply restrained by limiting organizational factors. Obal (2017) outlines a range of such negative (and positive) antecedents of managers' continuous adoption intentions of disruptive technology. Thus, it is likely that radical new technologies are only explored to the extent that their capabilities can be made sense of within existing managerial mindsets and market business models, including having the potential to optimize production, logistics, outperform competitors and/or attract more customers. This follows Miller and Ireland (2005) who caution that when firms explore new technologies, prior expertise can be detrimental. In this way the absorption of new technology risks being mediated by existing mindsets and consequently an underutilization of new technologies within existing operations (Cruz-González, López-Sáez, & Navas-López, 2015; Kim, 1997, 1998).

Kim (1997) reports an illustrative case of radical technological innovations on Samsung's learnings related to semiconductors. Within a decade, Samsung Electronics successfully leapfrogged from being a mere manufacturer of microelectronic devices to becoming a serious competitor in the dynamic random access memory (DRAM) chip market. Samsung's experience of catching up with advanced industry technology was achieved by upgrading prior technological knowledge by assimilating new technology 'out there'. Samsung used two important measures to improve its absorptive capacity in a highly dynamic technological field. First, and like other Korean semiconductor producers, it developed close networks to US-Korean scientists and engineers as a source of up-to-date knowledge. Yet, contrary to other producers like LG and Hyundai, it pioneered the recruitment of "more overseas-trained scientists and engineers, and invested more heavily in R&D than other competitors" (Kim, 1998, p. 98). Through technological learning Samsung's managers upgraded their technological skills to advanced industry standards allowing it to assimilate knowledge within a highly innovative technological field. Yet, at the time, the firm was primarily an imitator, not a pioneer of radical technological innovations, as it kept following its traditional managerial mindset.

Tripsas (2009) argues that companies that engage in radical technological innovation often end up investing in new technologies that preserve existing managerial routines and orientations. Tripsas (2009, p. 443) provides an illustrative example of how newspapers that viewed the Internet as a threat invested in the Internet but offered few novel features on their website, perceiving the Internet primarily as another outlet for distributing the newspaper rather than rethinking the core content and its interaction with customers. Thus, core competencies can turn into core rigidities or competency traps that constrain the organization from exploring new ways to interact with the market. Initially, computer development and usage also followed an incremental path. It was only when another new technology emerged, the Internet, that heavy investments were made into the upgrading and development of new technologies (hardware, software, infrastructure, etc.). Yet the prevailing mindset of computer producers remained intact for decades, preventing the industry from anticipating the disruption caused by the mobile telephone industry. Many computer producers, like Compaq, were unable to fathom and imagine such a shift in the market and eventually went bankrupt.[5]

There are, of course, also strategic reasons for relying on technologies as a way for organizations to evolve. Staying within a company's dominant managerial mindset and technological competences makes it possible to draw on existing processes, norms, and internal work relations and responsibilities. In fact, Davis (1989) developed the Technology Acceptance Model (TAM), which is further elaborated by Benbasat and Barki (2007). Davis (1989) describes how managers' salient behavioral and normative beliefs and intentions are guided by these technological systems' usefulness, perceived ease of use, and usage intention as well as subjective norms. Thus, the empirically supported model (see reviews in Lee, Kozar, & Larsen, 2003; Venkatesh, Morris, Davis, & Davis, 2003) illustrates the interaction of salient behavioral aspects and normative beliefs and radical technological innovation (see also Dosi, 1982).

3.3. Radical mindset innovation

The other disruptive innovation process is driven by mindset change among managers. Martins et al. (2015) argue that a business model is represented by a cognitive scheme (mindset) that reflects the manager's "theory" on how different actors, activities, and resources are interrelated for value creation. Markides (2006, p. 20) suggests: "… business model innovators do not discover new products or services; they simply redefine what an existing product or service is and how it is provided to the customer." A study by Barr, Stimpert, and Huff (1992) of two railroad companies facing very similar initial conditions show how top managers at the declining firm suffered from inertia and cognitive constraints and followed a conservative path. By contrast, top managers at the prospering firm engaged in mindset change associated with business model innovations, which led to strategic renewal. Hodgkinson and Healey (2011) argue that it is a combination of sensing, seizing and reconfiguring assets and structures, which ensures that companies stay competitive (see also Helfat & Peteraf, 2015; Hodgkinson, 2015; Sund, Bogers, Villarroel, & Foss, 2016; Teece, 2007). Bogner and Barr (2000), in their article on hypercompetitive environments, suggest that it is the extensive use of *adaptive* sensemaking processes that results in the development of new cognitive frameworks. This is echoed by Smith and Tushman (2005) who argue that top managers need to build a paradoxical cognition in order to both pursue exploration and exploitation—a process that requires a reflective mindset in order to seize opportunities and/or new ideas in the market. This is what Helfat and Peteraf (2015) refer to as dynamic managerial capabilities, which is an extension of Teece's (2007) focus on managers' ability to sense, seize, and reconfigure opportunities. In other words, from this perspective radical new developments stem from the innovation of business models (interactions within the value chain and/or with end-users) rather than technological progress, per se. New mindsets enable managers to identify and proactively adopt technologies from other fields and apply these to facilitate and further strengthen existing business models. Again, the technology is not viewed as the cause of such changes. Instead, disruptive approaches within this square refer to how existing technologies are creatively reapplied based on radical new mindsets that forge new business models and disrupt existing services and/or interactions with customers. Basically, managers reframe aspects of an existing reality construction and come up with new constructions and ideas. Sharma and

[5] https://channels.theinnovationenterprise.com/articles/8831-5-major-tech-companies-that-failed-and-why-they-did

LaPlaca's (2005) article on the (then) emerging era of build-to-order manufacturing shows how managers in B2B were able to change the production paradigm under which this market operated through a creative application of logistics and operational efficiencies. Another example of a new mindset orientation in the production industry is Volvo's team-based manufacturing process of trucks where teams rotate across various tasks and in the process gain skills, reduce boredom and mistakes, and become much more flexible and adaptable to changing customer demands for low volume variants. This move led to average assembly time per vehicle being cut by nearly 50% (Thompson & Wallace, 1996).

Some research on innovation and entrepreneurship identifies a number of underlying reasons for creating new mindsets (e.g., Mitchell et al., 2007) such as heuristic-based logic (Baron, 1998; Busenitz & Barney, 1997), specific perceptual processes and entrepreneurial alertness (Gaglio & Katz, 2001; Kirzner, 1979, 1985), expertise (Gustavsson, 2004; Mitchell et al., 2002), passion and unique talents (O'Connor & McDermott, 2004), and effectuation (Sarasvathy, 2001), a search for unique knowledge, as well as inspiration *from* and openness (i.e. open innovation) *to* lead/end users (Baldwin & von Hippel, 2011) whereas other researchers argue that user-centric, open innovation can affect performance negatively (see Hopkins, Tidd, Nightingale, & Miller, 2011). More generally, it is unclear to what extent these findings apply to business managers who are consumed with daily routines and incentives that often limit their cognitive agility and reduce motives to adopt new mindsets and engage (and listen to) end users.

While the causes for the creation of new managerial mindsets differ (and are always relative to current thinking within an industry/organization) the outcome should result in radical shifts in how organizations market their products, services and/or interact with customers and other stakeholders. The determining factor is that these changes are initiated by modifications in managerial mindsets and not by technological breakthroughs. It is relevant to note here that although the management literature on sensemaking is heavily slanted toward exploring managers' perception of their competitors, such a focus underestimates the importance of understanding how managers frame the organization-customer interaction both within the B2B and B2C fields. Hodgkinson (2015, p. 20) critiques this when stating: "the proliferation of techniques for revealing and comparing actors' mental representations" has been done "in a piecemeal fashion, from one study to the other..."

In short, strategy researchers and organizational scientists have focused far too much on explicit cognition-behavior links at the expense of affective, subconscious/implicit processes that would be able to identify radical shifts in managerial mindsets. To address this shortfall, more recent work is modifying extant cognitive mapping techniques and related procedures for mapping actors' cognitive-affective representations of strategic knowledge (Hodgkinson, 2015, p. 22, also see Hodgkinson, Wright, & Anderson, 2015; Rydén et al., 2015). Hodgkinson (2015) argues: "we should find meaningful divergence in actors' mental representations of the competitive environment within and between organizations in a given industrial sector."

The reason why the viewpoint of multiple mindsets has not been raised earlier and applied to business model innovation (i.e., mindshift) is, according to Hodgkinson (2015), that theory development outpaced the required empirical scrutiny, small-scale, cross sectional, and single informant multi-organizational research. The aforementioned commentary stems from earlier work by Hodgkinson and Johnson (1987, 1994) that based on a series of interviews with representative groups of managers, marked variations were uncovered in their mental representations of the competitive arena. This follows Dougherty's (1992) research where she shows how different organizational units (i.e., R&D, accounting, sales etc.) embraced different "thought worlds" where individuals not only knew different things, but also knew things differently. That is, each professional group would have a different system of sensemaking with which its members interpreted technology-market issues (Dougherty, 1992, p. 187). The aforementioned findings challenge Porac et al.'s (1989, 2011) and Peteraf and Shanley's (1997) assumptions of intra-organizational homogeneity and Spender's industry recipes. This insight also illustrates the ongoing struggle in many organizations about agreeing on a shared strategic positioning and, more specifically, how (and if) such marked differences should be reconciled or mediated, including whose mindsets ought ultimately to prevail in determining the organizational directions and actions.

An example of the radical reframing of an existing mindset is illustrated by Chef René Redzepi, the renowned co-innovator of Noma, the Danish restaurant that won the "best in the world restaurant" prize four times in the recent four out of five consecutive years. Redzepi realized that rather than having customers spend time and resources to come visit Noma from around the world, he could bring Noma to the world as a pop-up restaurant, which utilizes local products and still applies unusually high culinary standards. The concept is that the pop-up restaurant stays for seven weeks at a chosen location somewhere in the world. Most recently, it was located in the Mexican jungle. Reservations for the entire seven-week period for tables at this exotic location were made within 4 h of it being posted on the Internet, in spite of a price of US$750 per person![6] Stjernqvist, when CEO of Volvo Trucks, came up with a similar idea when realizing that logistics and transportation costs could be greatly reduced and service improved by developing a sophisticated service facility on wheels (see Rydén, Ringberg, & Jacobsen, 2017, pp. 149–152). In bringing the business to the customers, literally speaking, both of aforementioned entrepreneurs used existing technologies but applied radical new thinking that resulted in dramatic improvement in how to conduct their businesses more effectively and in entirely new ways. A similar innovative mindset is exemplified by Cirque du Soleil that reframed circus services by developing it to be more akin to a theater performance within the entertainment industry. Underlying these innovative approaches is a "quantum leap in buyer value" that creates new markets where value innovators far exceed companies focusing on merely matching or beating their competitors" (Kim & Mauborgne, 1999, p. 43). In this case value innovation happens without technology innovation, meaning that value innovators are not necessarily first entrants to their markets in technological terms, and much value innovation is therefore not patentable, yet such products and services succeed because they satisfy needs in new, stimulating and useful ways (see Kim & Mauborgne, 1999, 2015).

3.4. Revolutionary innovation

Revolutionary innovation refers to the co-occurrence of a radical new mindset and radical new technology. These "new to the world" or game-changing innovations move organizations into uncharted technological and cognitive waters. The only certainty of this square is uncertainty, ambiguity, and lack of proper sensemaking. This implies that organizations aiming for revolutionary innovation have to break away from existing technological assumptions and normal sensemaking, and create new mental models of how to approach the market while at the same time reinventing existing technological solutions. This demands agility and efficiency, which in turn require the right knowledge [mindset] and capabilities [technology]. These skillsets are not only scarce, but also often difficult to imitate and "their astute orchestration requires entrepreneurial capabilities that many management teams don't have" (Teece, Peteraf, & Leith, 2016, p. 19). These skillsets are also what Teece et al. (2016) refer to as "dynamic capabilities" and point to Elon Musk's Tesla and SpaceX revolutionary innovations as an example of the latter. Revolutionary innovations are typically characterized by a long timeframe because of the radical changes to both technology and organizational processes and interaction with the market. For instance, the heavy-duty vehicle ("truck")

[6] https://www.eater.com/2016/12/6/13854188/noma-mexico-reservations-sold-out

industry has been founded on the diesel engine as the core technology. As Tongur and Engwall (2014) suggest the industry will be challenged in the future by a new technological paradigm based on an electric road system (ERS). ERS are electrified roads that transmit power to the vehicle while it is in motion. The technological shift toward the ERS paradigm creates great uncertainties for truck manufacturers. Multiple technological challenges remain unresolved, and how technology should be adopted and used strategically is a "wicked" (i.e. mindset) issue (see Camillus, 2008). As Tongur and Engwall (2014, p. 532) state, "instead of buying trucks future customers might buy transportation solutions or subscribe to ERS services provided by one or several road system operators." As such, the future strategic value proposition remains highly ambiguous. Furthermore, organizations will face unintended consequences as well as opportunities stemming from the changes in the technology-mind interaction. A well-known example of the "wickedness" of moving into entirely new territories (mindset and technology) comes from the old Kodak case. Here, Kodak, that basically broke new technological territory with the digital camera, was unable to envision the full extent of its usefulness. Kodak was driven by technology and viewed the new technology as inadequate and inferior to its film (i.e., pixels per picture were much fewer). Kodak's engineers and managers were framed by the technology and overlooked how digital cameras offered users a more profound satisfaction of deeply held social needs by enabling consumers to instantly share precious moments with family and friends online, rather than waiting for film to be developed, and only share these occasionally at family gatherings (Lucas & Goh, 2009).

Another example is open-source software programming. Traditional computer programming of commercially packaged software took place within the boundaries of a commercial enterprise which employed/contracted software engineers and programmers to design new products and producing codes (see von Hippel & Krogh, 2003). Parhankangas et al. (2005, p. 440) suggest that the challenge with the commercial software development regime is "that it is founded on capitalist principles. Profits come from software companies restricting access to their intellectual property." However, the open software approach, as introduced by Linus Torvalds, the founder of Linux, is radically different. Instead of sharply restricting access to the source code, open source software development shares the source code and encourages participants to continuously develop and update the product. Instead of executing tight project management, open source development teams also follow a radically different mindset because they are distributed around the globe and are largely self-managed by volunteers. A new technology ownership structure combined with a distributed software development community largely composed of volunteers working for non-commercial ends radically differs from the traditional software development business.

The rise of revolutionary innovation is commonly addressed in terms of serendipity or haphazard technological discoveries. In particular, serendipity, which is the interaction between discovery, observation, knowing, and chance has been proposed as a mechanism of profound innovation and change (Weisenfeld, 2009). However, in a study of twelve radical innovation projects in ten large established U.S. based organizations, O'Connor and McDermott (2004) found two very different radical innovation regimes, and introduced the concept of radical innovation maturity. While organizations that score low on radical innovation maturity "rely on a combination of serendipity and extraordinary individual effort" (O'Connor & McDermott, 2004, p. 27), organizations with a mature radical innovation capability cultivate broad support ecology for innovation. Radical innovation maturity resonates with a more recent stream in the innovation, strategy, and entrepreneurship literature that explains complex disruptive innovations as a collective learning process taking place in "innovation ecosystems" (Autio & Thomas, 2014; Reihlen, Seckler, & Werr, 2017).

Revolutionary innovations rarely emerge because of individuals, teams, or even organizations alone, but are based on ecologies of innovative networks. The ecosystem perspective, as proposed by Nambisan and Sawhney (2008), sees the embeddedness of the innovating mind as a key imperative for innovation. Ecosystems, such as open platforms, represent a new technological online frontier that can enable a productive and stimulating learning space, which in turn may lead to radical innovations. In the case of software programming commercial players in the industry mirror the Linux experience. For instance, Vishal Sikka, member of the SAP executive board, claims: "Open community-based development is at the very heart of who we are" (Kleinemeier, 2013). SAP started a number of different platform-based communities of innovations in 2003 that now have more than two million members composed of SAP employees, customers, and business partners (Iansiti & Lakhani, 2009). These platforms help to continuously improve existing products and services, but also the support environment for more radical innovations.

The more integrative approach to radical new mindsets and radical new technologies in Square 4 can be explained as an interaction between, on the one hand, objectively favorable, pre-existing and actor-independent technological opportunities resulting from new functionalities (i.e., the Internet of Things) and, on the other hand, creative approaches with which to reframe market perspectives (for example, by using data analytics) and create new dynamic exchanges and interactive business platforms. These creative approaches would be driven by new "sensemaking strategies" (Davidsson, 2015, p. 684) and require extraordinary accomplishments through radical innovative progresses across both technologies and managerial mindsets, and include amazing leadership, technological acumen, and likely some luck. The processes lead to major leaps forward and an improved competitive positioning. It resembles to some degree the scenario described by Bogner and Barr (2000) in their description of organizations facing hypercompetitive environments where managers are required to constantly evaluate new perspectives and question old ones. In larger organizations that span across multiple domains of product and service types, the transformative processes are likely to follow different paths, each of which depends on the particular market contexts. The successful managers must be active sensemakers and sensegivers willing to undertake proactive learning and experimental actions, and the CEO of large and complex organizations will often have to deal with multiple transformative paths occurring simultaneously across the organization.

4. Discussion

This article explores how the technology-mindset interactions affect innovation outcomes. We use the technology-mindset matrix to identify and categorize four unique interaction processes. Each type of interaction is driven by different cognitive-technological perspective. We therefore expect that particular B2B marketing approaches would also differ across the four quadrants. For instance, incremental B2B innovation requires a marketing approach that is largely based on an inside-out (resource-based) orientation that at best benchmarks against competitors' initiatives (Kim & Mauborgne, 1999), yet still largely represents cognitive conservatism and piecemeal advances. By contrast, revolutionary B2B innovations involves cognitive agility and nimbleness by managers as they apply new ways to conceptualize and interact with stakeholders in order to fully exploit new market opportunities afforded by new technology and mindsets—such process involves a more holistic market approach. Rather than institutionalizing B2B innovation processes, managers in organizations must actively seek discomfort, disruption, and uncertainty by regularly reframing how they view the organization, competitors as well as customers. The latter represents tantalizing tasks both internally (organizational processes and resources) and in the interaction with stakeholders. Based on our study we discuss how managers located within Squares 1, 2, or 3 might want to pursue paths that enhance their present position.

Each path illustrates how an organization or part of an organization may move from one type of innovation (square) to another in the

matrix—while undergoing a transformation of some sorts. Each path requires different triggering events as well as internal change processes (see Greenwood & Hinings, 1988, 1996; Langley, 1999). As already mentioned most organizations are progressing in an incremental way and remain within Square 1 with most of their offerings, even though this square resembles a red ocean where most companies would prefer not to be, but from which they do not know how to advance (Kim & Mauborgne, 2015). Of course, positioning the firm (or part of the firm) within a red ocean might also be a strategic decision (e.g., Ryanair in the airline industry), but more often it is a result of being blind to alternative possibilities (Zajac & Bazerman, 1991), managerial rigidity (McKinley, Latham, & Braun, 2014), and/or strategic paralysis (D'Aveni, 1989, 1990; Sneddon, Soutar, & Mazzarol, 2009) which leads to structural inertia (Hannan & Freeman, 1984). Obviously, this position is problematic when disruptive pressures increase and require unique responses to remain competitive. Consequently, if managers want to leave Square 1 they have to consider if it makes sense to initiate changes in managerial mindsets and/or the adoption of new technologies. Similarly, if CEOs want to optimize and potentially coordinate the competitive positions across varies product groups and/or services it would be beneficial to identify first in what square these are located and then to explore potential strategic moves needed to move toward either square 2, 3, or 4.

Organizational transformation processes have been studied across management literature and have more recently been inspired by the literature on process organization theories (e.g., Langley, Smallman, Tsoukas, & Van de Ven, 2013; Langley & Tsoukas, 2016) with applications on schema (mindset) emergence (Bingham & Kahl, 2013) institutional change (Greenwood & Hinings, 1996), industry change (Sneddon et al., 2009), consumer change (Giesler & Thompson, 2016), strategic change (MacKay & Chia, 2013), and organizational failure (Habersang et al., 2018). This literature is particular useful to explore more systematically under what conditions firms will move horizontally (i.e., keeping an existing technology and adopting a new mindset), vertically (i.e., keeping an existing mindset and adopting new technology), or diagonally (i.e., adopting both a new mindset and a new technology), and what transformation mechanisms may work for different moves in the technology-mindset matrix. Each type of move involves very different (sometimes foundational) challenges to the organization which would be important to be aware of before venturing ahead.

Next, we briefly illustrate with examples from the industry each type of transformative move. It is important to have in mind that while the examples intend to illustrate radical new ways, competitors might later have neutralized these positions. The location in the matrix is dynamic and always vulnerable to the catching-up by key competitors. As such, what justifies a position in Square 4 today might quickly become "old school" as competitors catch up, and thereby relegate the company (or part of it) back to Square 1! Finally, given the increased competition, especially from platform vendors it seems pertinent that businesses consider whether it makes sense to leave their existing square and move toward another square in the matrix—and, if so, which one that makes the most business sense.

4.1. Technology-driven transformation

The two vertical paths from Square 1 to Square 2 and Square 3 to Square 4 both involve the adoption of a radical new technology. These paths are explained by the technology-push literature arguing that managers' beliefs about opportunities are driven by new technologies (see Di Stefano, Gambardella, & Verona, 2012). Here, technology is typically conceptualized according to the "objective" performativity of machines or devices where technology is understood as a quasi-autonomous system that facilitates innovation (e.g. Dosi, 1982; Nemet, 2009). Extraordinary technological initiatives "emerge", as Dosi (1982, p. 157) argues, "either in relation to new opportunities opened-up by scientific developments or to the increasing difficulty in going forward on a given technological direction." An example of a move from Squares 1 to 2 comes from the recent initiative by Amazon.com to equip some of its grocery stores with sensors and face recognition equipment that enable shoppers to enter, pick-up groceries and exit without having either to stand in line or swipe their credit cards. When first organizations have entered Square 2 they might be further inspired (mindset) by experiencing the effects of a new technology, leading to an additional move from Square 2 to Square 4. One example is a Danish company Wisecon, which developed a first of a kind rattrap, Wisetrap that when having killed a rat (which then is automatically flushed out in the sewage system) sends time, GPS, and temperature signals to a server. This new technology not only removed the use of poison (a major contribution to the death of birds), but also killed the rat instantly (instead of having it suffer from internal bleeding first) and made it possible to monitor the number of killed rats, as well as the temperature and water level in the sewage pipes.[7] Thus, this new technology made it possible to identify a number of additional information such as burst heating pipes and the extent of a rat infestation in a given area. An unexpected new business models emerged from these insights and exemplifies the move from Square 2 to Square 4. Since Wisecon could now trace the origin of rat outbreaks to its source (based on timestamps and GPS) it was able to locate and investigate the source of the outbreak, and consequently work at eliminating future outbreaks. Thus, a new mindset and business model evolved from combatting rat infestations to now also preventing them. The recent start-up company was acquired for a considerable amount (DKK 200 million) by Anticimex, which now explores how to further capitalize on both the existing and new business models.

4.2. Mindset-driven transformation

Another transformative path goes from Square 1 to Square 3 (and a corresponding one from Square 2 to Square 4) and potentially onward to Square 4. The path from Square 1 to Square 3 requires a radical shift in mindset while relying on the same technology. According to Story et al. (2014, p. 1271) the "transitioning to a new mindset, or reframing, is both complex and problematic, especially for existing cognitive frames ...," which basically act as internal barriers or restrictors of dealing with the discontinuities that emerge from working outside an established cognitive frame (see Barr et al., 1992; Bessant, Öberg, & Trifilova, 2014; Hodgkinson & Healey, 2014; Rydén et al., 2015). Moreover, lower ranked organizational members often experience disruptions as cognitive and emotional tension, uncertainty, stress, anxiety, and often frustration as described by Putnam, Fairhurst, and Banghart (2016). Thus, the dilemma for managers is whether, how, and how fast to let go of a well-established mental anchoring spot and embark on an unchartered and discontinuous, and therefore potentially risky and uncertain journey in pursuit of a better business positioning. Story et al. (2014) devote a Special Issue in Industrial Marketing Management to the issue of radical innovation, and especially the significant hindrance created by frameworks among managers that tie their thinking down, even as their industries are experiencing increased competitive pressure. The mindset deterministic position, on the contrary, suggests that managers are in control and form and shape the use of technology (Di Stefano et al., 2012). When managers follow the market "demand-pull" as the driver of innovation they do not count on the firm's technological capabilities in bringing innovation to the market. That is, managers look for opportunities "to satisfy unmet needs" among customers (Nemet, 2009, p. 701). Obviously, not all organizations and managers are able to embrace, engage, and inspire

[7] It was not always easy to determine whether poison in the poison-based traps was eaten by rats, and moreover, if the poison still worked as rats would create resistance over time

radical disruptive mindsets. Yet, an example that illustrates this path is the online ordering and home delivery of groceries. A similar alternative mindset also propelled Netflix's success during its initial days as it offered DVDs delivered by U.S. Postal Services and competed with dominating video stores, such as Blockbuster and Hollywood Video, which rented out DVDs from their brick and mortar outlets. Moving from Square 3 to Square 4 involves the use of new technology, as well. Here, Netflix again made a dramatic move when it invested in and offered online streaming service in 2007.[8] While this move might be regarded as an obvious one, today, when Netflix announced it invested considerable amounts in developing this service it resulted in a strong negative reaction on Wall Street. The same was the case when Netflix, in an effort to stay ahead, used its understanding of customers' needs and explored a new mindset to create a new business model when investing in the production of its own original television series.[9]

4.3. Revolutionary transformation

The most challenging path is from square 1 directly to square 4 as this entails a quantum leap of a whole socio-technological system. Perhaps the Norwegian media group Schibsted is a good example (see Bradley & O'Toole, 2016), which made a dramatic move during the early days of the Internet era. It decided to post its bread and butter classified ads for free online. It used radical new technology and a radical new mindset to accomplish this task. Most other publishers did not react at the time. Bradley and O'Toole (2016, p. 6) write; "as this early stage of disruption, incumbents felt barely any impact on their core businesses except in the distant periphery. In short they do not need to act." This echoes de Jong and van Dijk's (2015) observation that incumbent organizations are locked in by their governing beliefs on the role of technology and strategic differentiation. Schibsted was able to challenge its own dominant logic as how to ensure future earnings by combining radically new technologies with a radical new business model (i.e., managerial mindset). In terms of the technology-mindset matrix Schibsted's move represented a radical move from Square 1 to Square 4 as both technology and mindset shifts took place in quick successions. A very similar story is the case of Axel Springer, the Germany media giant, which was referred to "as a mere Internet midget" by Financial Times Germany in 2005, but then went on a shopping spree and acquired numerous digital properties and launched even more digital and new business models initiatives in 2013. In 2016, digital media contributed to 70% of Axel Springer's earnings. Axel Springer was the imitator but was still able to move to Square 4 as it continued to adopt new technology and adapt new mindsets to run its media business. Another example is BGI (originally The Beijing Genomics Institute) that represents a whole new generation of international Chinese tech companies (Bai & Wang, 2016). This company gained success from combining a new mindset of executives, who had been trained abroad, thus mentally differentiating from traditional Chinese companies, with new technology. The e-commerce company Alibaba shares its data processing capabilities with BGI, which enables it to innovate its services and products by building a large DNA database of millions of people to be used as a stepping-stone for new drug discoveries, advanced genetic research, and a transformation of public health policy.[10]

For most organizations, the pursuit of any one of the three stipulated transformative paths typically involves a series of obstacles that might lead to organizational tensions, managerial discomfort, and contradictions between internal departments and processes. A range of intriguing questions comes to mind. Do the types and extent of tensions differ depending on which path (square) the organization pursues? Are certain organizations, or part of an organization, more prone to follow the mindset or technological paths and why? Are there intrinsic organizational processes that enable/prevent the exploration/exploitation of one path over another? This we will leave up to future research to explore. Finally, it is also important to be aware of that disruption is not a single discrete event that can be dealt with once and for all! It is a dynamic and ongoing process, and an organization's position in the matrix is always relative to competitors' actions and consumers' preferences as well as firm-specific capabilities.

From a managerial perspective the matrix might also be used as a monitoring device for scanning first movers among competitors and determine both the direction (i.e., horizontal, vertical, diagonal) and severity of such moves. In this way the matrix might help organizations detect and categorize both risks and opportunities, and respond accordingly.

[8] https://media.netflix.com/en/about-netflix

[9] http://knowledge.wharton.upenn.edu/article/on-wall-street-netflix-is-a-comeback-kid-but-can-it-stay-on-top/

[10] https://www.ft.com/content/9c2407f4-b5d9-11e4-a577-00144feab7de

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