

VTT Technical Research Centre of Finland

How do large corporations manage disruption? The perspective of manufacturing executives in Finland

Wallin, Arto; Pihlajamaa, Matti; Malmelin, Nando

Published in:
European Journal of Innovation Management

DOI:
[10.1108/EJIM-09-2020-0383](https://doi.org/10.1108/EJIM-09-2020-0383)

E-pub ahead of print: 16/02/2021

Document Version
Publisher's final version

License
CC BY

[Link to publication](#)

Please cite the original version:
Wallin, A., Pihlajamaa, M., & Malmelin, N. (2021). How do large corporations manage disruption? The perspective of manufacturing executives in Finland. *European Journal of Innovation Management*.
<https://doi.org/10.1108/EJIM-09-2020-0383>



VTT
<http://www.vtt.fi>
P.O. box 1000FI-02044 VTT
Finland

By using VTT's Research Information Portal you are bound by the following Terms & Conditions.

I have read and I understand the following statement:

This document is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of this document is not permitted, except duplication for research use or educational purposes in electronic or print form. You must obtain permission for any other use. Electronic or print copies may not be offered for sale.

How do large corporations manage disruption? The perspective of manufacturing executives in Finland

Disruption and
manufacturing
executives

Arto Wallin, Matti Pihlajamaa and Nando Malmelin
VTT Technical Research Centre of Finland Ltd, Espoo, Finland

Received 30 September 2020
Revised 29 December 2020
Accepted 14 January 2021

Abstract

Purpose – The article explores what forms of disruption are prioritized by top executives of large manufacturing companies in Finland and what strategies they consider appropriate for the management of disruptive threats and opportunities.

Design/methodology/approach – The empirical study was based on interviews with top executives in some of Finland's largest manufacturing companies.

Findings – Based on the data, we identify exploitative and explorative strategies in four dimensions that executives consider important in anticipating and responding to disruptions: internal development efforts, stance on new entrants, ecosystems and institutional change. Due to the presence of multiple potential disruptions, which often generate conflicting demands, executives have to consider them simultaneously and balance between them when making strategic decisions. They therefore do not necessarily have a specific response strategy, but their aim is to develop their companies' capabilities so that they are well-placed to face the future with confidence.

Originality/value – The findings indicate that the executives envision a disruption landscape that is more complex than typically described in the literature. In addition, it answers the call for a more systematic understanding of incumbents' response strategies by linking different disciplinary views with well-grounded empirical data.

Keywords Manufacturing industries, Top executives, Management, Strategies, Incumbents, Disruption, Disruptive innovation

Paper type Research paper

1. Introduction

The recent turbulence in the world economy has highlighted the complex interplay between various disruptive forces, particularly in the manufacturing industry. Already in the midst of substantial transformation due to digitalization and increasing sustainability demands, the industry suddenly seemed to be looking at multiple possible paths of evolution. Some of these disruptive forces may accelerate the adoption of radical innovations and the breakdown of traditional value creation patterns, while others may favour market leaders who have deep pockets and a strong foothold in the market.

Before the COVID-19 pandemic, it seemed that incumbents were leading the transformation of manufacturing industry in incremental steps, properly sized for the change of their organizations. Nevertheless, there is substantial evidence from other industries that when incumbents focus heavily on incremental innovations that protect their existing businesses and improve their performance, they are likely to miss “disruptive



opportunities” (e.g. Hagel *et al.*, 2008). These opportunities offer the chance to diverge from the current sustaining innovation trajectory, which is maintained by industry incumbents and the institutionalized rules for creating value within the industry. Hence, seizing disruptive opportunities would require radical renewal of their business and often renewal capability on the part of business partners and customers as well.

Traditionally disruptive innovation theory (Christensen, 1997, 2006; Christensen *et al.*, 2018) has focused mainly on technology-driven disruptions, which follow a few particular disruption patterns (mainly low-end disruption). As a result, the response strategies are limited and insufficient to proposing solutions in the context of complex management practice. Although there are numerous other streams of research interested in complementary disruption patterns, disruption theories are missing a clear ability to link different mechanism or articulate boundary conditions (Eggers and Park, 2017).

The recent global health and economic crisis has demonstrated that the narrow focus on disruptive innovation is insufficient to guide companies through the extremely complex systemic impacts that various disruptive forces may have. This article aims to build a more comprehensive understanding of the disruption process by describing disruptive forces, which were identifiable among top executives of the manufacturing industry before the pandemic. The aim is to shed light on how they perceived potential disruptions and how they prepared for the future by devising strategies to cope with challenging situations and seize disruptive opportunities. Since this management perspective represents a broad view on disruption, the following section summarizes various theoretical contributions which together can be viewed as building blocks for such a view.

2. Theoretical foundation

2.1 Disruptive innovation theory

Although the phenomenon of technological disruption has long roots in technological innovation studies, the interest of academics and practitioners only began to mount with the publication of Christensen’s (1997) book “The Innovator’s Dilemma” (Hopp *et al.*, 2018; Yu and Hang, 2010). The concept of disruptive technology, later redefined as disruptive innovation, became the basis for a specific theory focusing on how less-resourced smaller companies, i.e. entrants, are able to challenge established incumbents (Christensen, 1997, 2006; Christensen and Raynor, 2003; Christensen *et al.*, 2015).

Since Christensen’s original work, disruptive innovation theory has been the subject of intense discussion and development. Utterback and Acee (2005) proposed that, in addition to low-end disruption, there is a *high-end disruptive innovation* pattern in which “a higher performing and higher-priced innovation is introduced into the most demanding established market segments and later moves towards the mass market”. Although innovation is initially attractive to a high-end niche, incumbents either overlook it or stumble to respond. Further, two other types of extension, business model innovation and radical (new-to-the-world) product innovations (Markides, 2006), have been proposed. Business model innovation states that disruptive innovation is not only about technological innovation, but business model innovation is an integral part of the phenomenon. New-to-the-world product innovation was accepted as a new type of disruptive innovation under the notion of *new market disruption* (Christensen, 2006).

Major confusion remains about the phenomenon of disruption and the concept of disruptive innovation (Sood and Tellis, 2011; Weeks, 2015). On the one hand, Christensen *et al.* (2015) claim that the concept is used too inaccurately. On the other hand, many practitioners and researchers find the original definition problematic, since many innovations that are widely thought to have dramatically disrupted the market (e.g. Uber or Tesla) are not disruptive innovations in Christensen’s meaning (Chase, 2016; Schmidt and Druehl, 2008; HBR, 2015).

Despite these differences, researchers agree that the theory will only be useful if the terminology is used correctly (Christensen *et al.*, 2015). The definitions frame how we perceive, analyse and respond to changes in the competitive environment (Gobble, 2016). Different kinds of innovations, competitors and threats require different strategic responses, and conceptual ambiguity makes it impossible to identify appropriate responses. Therefore, we need to find complementary perspectives that together can build a more holistic understanding of the disruption phenomenon.

2.2 Complementary perspectives on disruption

When disruption is viewed from a broader perspective, there are several scholarly streams and complementary views (see summary in Table 1) that may help to describe the overall phenomenon better and to devise strategies on how to cope with different situations.

2.2.1 Incumbents' failure to change as the main mechanism for disruption. In many industries the displacement of incumbent firms appears to be driven as much by the success of entrant firms as by the failure of established firms (Chesbrough, 2001). Henderson (2006) suggests that the failure of established firms to adopt new innovations and to renew themselves due to embedded organizational competencies is an important pattern of disruption. To address this issue, Gans (2016a) makes a distinction between demand-side and supply-side disruptions. *Demand-side disruption* follows largely the mainstream narrative on disruptive innovation, where new market entrants introduce disruptive innovations that target niche segments, which are initially unattractive to the incumbents. In *supply-side disruption*, the mechanisms of disruption are based on changes in organizational competencies and product architecture (cf. architectural innovation; see Henderson and Clark, 1990). A new product architecture is seen as a technological discontinuity (Tushman and Anderson, 1986), or more broadly as a discontinuous innovation requiring the renewal of organizational competencies, i.e. embedded organizational routines and structures (Henderson, 2006). However, as incumbents are bound by their established routines and focus on (incrementally) developing their existing competencies, they become incapable of sensing needed changes and developing new competencies (Gans, 2016b; Henderson, 2006). Therefore, the same competencies that may be an organization's most enduring source of competitive advantage may become competency traps (Leonard-Barton, 1992), which will hamper significant organizational change.

Digital disruption can be seen as a modern version of architectural disruption, where innovation is driven by pervasive processes of digitalization (Yoo *et al.*, 2010). A digital disruption process starts from digital innovation, which changes the historical logics for value creation and capture by unbundling, decoupling and recombining linkages among resources and activities or by generating new ones (Skog *et al.*, 2018; Teixeira and Jamieson, 2014). Although the innovation that initiates disruption may be orchestrated by one or multiple firms, often involving firms (e.g. start-ups) external to the field, the impact on value creation is systemic (Skog *et al.*, 2018).

2.2.2 Disruptions in market demand and supply. Operations and supply-chain management research also make the distinction between demand-side (market-demand) and supply-side disruptions. However, their notion diverges notably from the views of management and strategy scholars, as it builds on the common use of the verb disrupt, which means "to prevent something, especially a system, process, or event, from continuing as usual or as expected" (Cambridge Online Dictionary, 2020). Accordingly, disruptions are caused by random events, which disrupt the operation of the supply chain/network. They are difficult to foresee and are not necessarily related to technology or innovation in any way (e.g. natural disasters or socio-economic crises) (Oke and Gopalakrishnan, 2009). Market-demand disruption describes a situation where a sudden drop in market demand creates a disruption.

What?	Cause of disruption	Description	Selected reference(s)
<i>Niche-demand disruption</i> (adapted from disruptive innovation)	Disruptive innovation (tech. and business model) + disruptive entrant	Successful firms focus on their main customers and underestimate market entrants with innovations that initially target niche demands	Gans (2016) Christensen (1997)
(1) Low-end disruptive innovation		Disruptive entrants enter at the bottom of the market and take hold within an existing value network before moving up-market and attacking incumbents	Christensen and Raynor (2003) Christensen (1997, 2006), Christensen <i>et al.</i> (2015, 2018)
(2) New market disruption (adapted from the concept of new-to-the-world product innovations)		Disruptive entrants start from completely new value networks whose initial customers have not used the prior generation of products and services ("non-consumers")	Christensen (2006) Markides (2006)
(3) High-end disruptive innovation		A higher performing and higher priced innovation is introduced into the most demanding established market segments and later moves towards the mass market	Utterback and Acee (2005)
<i>Disruption (supply-side)</i> due to incumbents' failure to change		New (technological) innovation requires major changes, e.g. in production processes, product development, value creation and capture, but incumbent fails to implement	
(1) Supply-side disruption (architectural innovation)	Architectural innovation combined with incapacity to change	Architectural innovation requires reorganizing processes and redeveloping competencies, but incumbent is unable to respond due to focus on developing existing competencies	Gans (2016) Henderson and Clark (1990), Henderson (2006)
(2) Digital disruption of value creation	Digital innovation	Digital innovation initiates systemic change in historically sustainable <i>logics for value creation and capture</i>	Skog <i>et al.</i> (2018) Texeira and Jamieson (2014)
<i>Demand shocks and supply failures</i>	Random events, e.g. natural disasters, intentional or unintentional human actions	Unplanned and unanticipated events, which influence the flow within a supply chain	Shen and Li (2017)
(1) Market demand disruption		Random events cause unexpected sudden change in market demand	Snyder <i>et al.</i> (2016)
(2) Supply (chain/network) disruption		Random events cause supply chain/network to stop functioning, either completely or partially, for a (typically random) amount of time	Snyder <i>et al.</i> (2016)
<i>Systemic socio-technical disruptions</i>		Disruption as a complex systemic process	

Table 1.
Disruption types reported in the literature

(continued)

What?	Cause of disruption	Description	Selected reference(s)
(1) Institutional disruption (adapted from institutional change)	Disruptive events (e.g. discontinuous tech)	Disruptive events as a catalyst for changing the “rules of the game”, i.e. initiating change in regulations, norms and/or cultural-cognitive patterns	Laurell and Sandström (2016) Hinings <i>et al.</i> (2018), Munir (2005), Oliver (1992)
(2) Regime shift (disruption)	Shifts in larger institutional and social regime	Macro-level trends destabilize prevailing regime, opening up opportunity for disruptive innovations to break through and create major regime shift	Geels (2004), Geels and Kemp (2007)
(3) Macro (landscape) disruptions	Long-term macro-level trends	Exogenous disruptions as a source for macro changes in wealth distribution, education, infrastructure, government, geopolitics, economy, public health, demographics, environment and media	(Webb, 2020)

Table 1.

This demand-side disruption may be limited to a very specific segment or product category (e.g. the sudden drop in beef demand caused by the outbreak of mad cow disease), or it may have much broader implications, such as the global market disruptions caused by the 2008 financial crisis (Wang *et al.*, 2017). In the case of (*market*) *supply-side disruption*, “random events cause the supply chain/network to stop functioning, either completely or partially, for a (typically random) amount of time” (Snyder *et al.*, 2016). The negative impact of quarantines caused by the Covid-19 outbreak on manufacturing supply chains is a recent example of this kind of disruption (Haren and Simchi-Levi, 2020). Since market disruptions may have a severe impact on company operations and the entire supply network, market disruption management has received notable attention from both academics and practitioners (e.g. Snyder *et al.*, 2016).

2.2.3 Institutional and systems perspective on disruption. In contrast to technological, managerial and market-driven approaches, the research streams of organizational institutionalism and socio-technical systems have taken a broader view to studying disruption. Although institutional scholars consider *disruptive events* (e.g. technological discontinuity) catalysts of change (e.g. Hardy and Maguire, 2008), they argue that attributing the change to a single event or “jolt” leads to a flawed and simplified understanding of the process (Munir, 2005). Institutions are defined as complex social structures comparable to “rules of the game providing stability and meaning to social behaviour” (Scott, 1995, p. 33). For example, the disruption resulting from Uber’s digital platform is caused not only by disruptive technology, but first and foremost by institutional change, which is referred to as *institutional disruption* (Laurell and Sandström, 2016). It is argued that platform-based disruptions are a specific pattern of disruption, which fundamentally alter the industry’s institutionalized value creation logic. This perspective has recently become increasingly important as its effects often extend well-beyond industry boundaries, thereby enabling deep societal change (Sampere, 2016; Skog *et al.*, 2018).

The research stream of socio-technical transitions (e.g. Geels, 2004; Geels and Schot, 2007) focuses on the interplay between disruptive (niche) innovation, institutions and macro-level disruptive forces (Urbinati *et al.*, 2018). It explains how many potentially disruptive innovations

fail by introducing path-breaking value propositions that are in conflict with the prevailing rules of the game that are sustained by incumbents (e.g. [Walrave et al., 2018](#)). Sometimes, however, major landscape (macro) level trends (e.g. demographic or geopolitical) and/or exogenous shocks (e.g. wars or economic crises) destabilize the prevailing institutional setting and open up a window of opportunity for niche innovations to breakthrough ([Geels, 2018](#)). Thereby, disruption is seen as a complex process that cannot be controlled by a single actor. From this perspective, disruptive innovation theory relies on too narrow a conception of both disruption and innovation for it to help thinking about major societal disruptions such as low-carbon transitions ([McDowall, 2018](#)) or autonomous vehicles ([Skeete, 2018](#)).

2.3 Theoretical perspectives on strategies to manage disruptions

Although incumbent responses to disruptions have attracted scholarly interest for decades, the body of knowledge is still fragmented. This section aims to describe and summarize (see [Table 2](#)) discussions about disruption management strategies under different research streams.

Repositioning strategies can be seen as a classic incumbent response to disruptions. The early disruptive innovation literature focused extensively on how incumbents (should) respond to a threat posed by disruptive entrants who introduce technological innovations mainly to the low-end market or by establishing a new market (e.g. [Christensen, 1997](#)). Incumbents are forced to reposition themselves in the market when they are faced with disruption, often by surprise. [Kilkki et al. \(2018\)](#) observe that the incumbent has a strategic choice to reposition itself in the market by (1) moving upwards to high-end customers in order to avoid low-end disruptors (which is what the original disruption theory actually predicts); (2) moving downwards to low-end customers in order to avoid high-end disruptors with superior quality and (3) completely retreating from the market.

Incumbents may also respond to unexpected innovation by a new entrant by *improving, redefining or extending their existing business*. This can be done by investing in existing capabilities to extend performance on the current trajectory ([Adner and Snow, 2010](#)), redefining the meanings and values associated with legacy technology ([Raffaelli, 2019](#)) or acquiring entrants to prevent competition ([Christensen et al., 2015](#)). Incumbents may try to protect their business from innovations that break traditional value chains by regulating or penalizing attempts to bypass part of the value chain, for instance ([Teixeira and Jamieson, 2014](#)). When protection is not an option, they may adapt their business models in response either to a specific entrant or to the overall industry transformation ([Cuzzolino et al., 2018](#)). Eventually, if an incumbent's position regarding new innovation is disadvantageous, it is also considered a strategic option not to respond to disruption at all. Incumbents may thereby continue in the old way for as long as possible before winding down the business in a controlled way ([Gans, 2016b; Kilkki et al., 2018](#)).

Strategies building on radical innovation have been extensively researched, especially in the stream of innovation management research. Radical innovation can be viewed through various complementary lenses such as technology, business model, value creation network or institutions and incumbents may pursue radical change even if it may cannibalize their own business. However, [Gilbert \(2001\)](#) emphasizes the importance of cognitive framing in decoupling the threat of core business from opportunity of the innovation. Radical innovations may be developed within an integrated internal innovation unit ([Iansiti et al., 2003](#)), an autonomous unit that is integrated later if successful ([Christensen, 1997; Christensen et al., 2015](#)), by partnering with start-up companies that are developing potentially disruptive innovations ([Ansari and Krop, 2012; Kumaraswamy et al., 2018](#)) or in active co-operation with partners in innovation ecosystems ([Beltagui et al., 2020; Kumaraswamy et al., 2018](#)).

Category	Strategy	Description	Selected reference(s)
Repositioning	High-end strategy ^a	Move upwards to high-end customers who demand higher quality	Kilkki <i>et al.</i> (2018)
	Low-end strategy	Move downwards to battle with lower price and quality	Kilkki <i>et al.</i> (2018)
	Retreat	Reposition old technology / solution to new demand environment	Adner and Snow (2010) Kilkki <i>et al.</i> (2018)
Extending the trajectory	Continue as-is (wait and give up)	Continue in old way as long as possible	Kilkki <i>et al.</i> (2018) Gans (2016)
	Incremental innovation	Aggressively invest in <i>existing capabilities</i> to extend current performance-improvement trajectory	Adner and Kapoor (2016), Utterback (1994)
	Technology re-emergence	Redefining the meanings and values associated with the legacy technology and redefining the boundaries of the market	Raffaelli (2019)
	Business model adaptation	Business model adaption of incumbent by finding new ways of creating and capturing value (after disruption in the industry)	Cozzolino <i>et al.</i> (2018)
	Gluing back the value chain	Protecting or preventing entrants from breaking the value chain (e.g. cutting out the middle-man)	Teixeira and Jamieson (2014)
	Institutional maintenance	Reproduction and strengthening of prevailing institutions that are beneficial for dominant stakeholders	Blanc and Huault (2014)
	Building or leveraging radical innovations	Innovate better than the disruptor (integrated follower)	Wait until (disruptive) technology converges on a dominant feature and then respond with an internal innovation effort to develop an even better solution
Internal innovation units, teams and spin-offs		Radical innovations developed within integrated innovation unit, autonomous innovation unit (within organization) or in spin-off tasked to develop and commercialize new innovations	Iansiti <i>et al.</i> (2003), Christensen (1997) Christensen <i>et al.</i> (2018), O'Reilly and Tushman (2008, 2016), Gilbert (2001)
Business model innovation		Radical (pre-emptive) renewal of the business model and/or decoupling of the value chain	Markides (2006), Teixeira and Jamieson (2014)
Institutional entrepreneurship		Envision change and devise strategies to break the rules of the game (often linked to business model innovation)	Battilana <i>et al.</i> (2009)
Co-operating with disruptive entrants		Active co-operation with a number of potential entrants (e.g. partnering or technology licensing)	Christensen <i>et al.</i> (2018)
Co-operating with disruptive entrants – wait and buy up		Wait for the disruptive events/ technologies to take shape and then acquire the entrant if it proves itself valuable	Christensen <i>et al.</i> (2015), Gans (2016)
Leveraging innovation ecosystem		Active co-operation with partners in innovation ecosystems	Beltagui <i>et al.</i> (2020), Kumaraswamy <i>et al.</i> (2018), Kaltenecker <i>et al.</i> (2015)

(continued)

Table 2.
Disruption
management strategies
reported in the
literature

Category	Strategy	Description	Selected reference(s)
Building future proof organization	Absorb and integrate	Building a thoroughly integrated, flexible organization which is able to absorb and integrate external resources and to quickly shift production and organization processes	Bergek <i>et al.</i> (2013); Cohen and Levinthal (1990), Gans (2016), Bockmühl <i>et al.</i> (2011)
	Owning key complementary assets	Owning complementary assets that are crucial for business no matter the product or architecture	Gans (2016)
	Introduce a platform	Utilize platform to maintain desired social order which serves as a “constitution” for entire ecosystem	Cusumano <i>et al.</i> (2020), Gawer and Cusumano (2014)
	Strong corporate identity	Build strong corporate identity, for example, in the form of a clear and abstract understanding of what the company is offering to its customers	Gans (2016)
	Robustness	Building a capability to mitigate potential disruptions and maintain performance level	Behzadi <i>et al.</i> (2018)
	Resilience	Building the firm’s capability to be alert to, adapt to and quickly respond to and recover from changes brought about by a market disruption	Ambulkar <i>et al.</i> (2015)

Table 2.

Note(s): ^aChristensen *et al.* (1997) considers this a strategy that leads to disruption

In addition to understanding available responses, there is also prominent research on why incumbents’ responses to disruptive innovations seem to vary significantly. Charitou and Markides (2003) claim that how a company responds depends on two main factors: *motivation to respond* and *ability to respond*. Motivation to respond is identified to be dependent, for example, on strategic and structural context, outside influences and perceived financial attractiveness of the opportunity (Madjdi and Hüsigg, 2011a, b). Bockmühl *et al.* (2011) analyse responses to disruption in dental lab industry and divide responses based on their intensity and timeliness. The intensity of the response is identified to be dependent mainly on, opportunity framing, openness of workforce and organizational flexibility, whereas the timeliness of response depends mostly on market sensitivity, opportunity framing and management flexibility (i.e. the ability of decision makers to modify their mental models on a timely basis). A study in the context of publishing houses by Kammerlander *et al.* (2018) proposes that domain and role identities are key determinants defining the response to disruption. These identities may define whether incumbent firms adopt disruption, how quickly they react to it and innovativeness of their response.

Strategies to “insure” companies against disruptions are very different from previously described strategies, and those can be seen as a way to improve the ability to respond to disruption. These strategies are often based on building a flexible and integrated company structure that can absorb and integrate new innovations into the company as effectively as possible (Gans, 2016b). They have been widely studied under several lines of theoretical discussion that look at the phenomenon from slightly different perspectives: absorptive capacity (Cohen and Levinthal, 1990), dynamic capabilities (Eisenhardt and Martin, 2000) and creative accumulation (Bergek *et al.*, 2013). Based on these theories, it is suggested that incumbents can manage disruptive innovations by taking advantage of external knowledge, resources and talent and by developing integrative capabilities (e.g. cross-functional teams) that can simultaneously handle both old and new technology (Gans, 2016).

Other insurance strategies include owning key complementary assets or a strong corporate brand (Gans, 2016b). These strategies are well aligned with platform leadership strategy (Gawer and Cusumano, 2002; Perrons, 2009), in which the incumbent controls the platform to maintain the desired social order which serves as a “constitution” for the entire ecosystem (Hinings *et al.*, 2018), thereby making it difficult to replace the ecosystem leader. However, Gans (2016a) argues that relying on complementary assets or brand should be seen only as a strategy to buy time – eventually the incumbent will have to be able to absorb the new innovations, or risk being erased by waves of disruptions.

Operations management scholars have extensively studied disruptions in the manufacturing industry. However, they take a different view from mainstream disruptive innovation research and mainly focus on *strategies for managing supply chain and market demand disruptions*. The major difference compared to managing disruptive innovations stems from the temporary nature of disruptions. Incumbents’ response strategies are based on building robustness to disruptions and so ensuring that they are able to mitigate realized risks and maintain their performance level under disruption (Behzadi *et al.*, 2018). Since it is not possible to mitigate all disruptions, the company will need the resilience to adapt or survive until the disruption is over and recover as quickly as possible (e.g. Ivanov *et al.*, 2016). The potential permanent impacts of market demand and supply disruptions are linked, for example, to shifts in customer preferences, breakthroughs of innovative production processes or shifts in market dynamics, but these are quite rarely discussed (e.g. Lin *et al.*, 2015).

Institutional and socio-technical perspectives provide lenses to explore disruption as a complex societal phenomenon. They help to understand the difficulties that incumbents face in responding to shifts in the institutional setting (see Chesbrough, 2001) and how to devise *strategies concerning institutional disruption*. The agency perspective on institutional change highlights the possibility that actors can take an active role either to maintain prevailing institutions (Blanc and Huault, 2014) or to initiate and enact institutional change (e.g. Battilana *et al.*, 2009). Accordingly, actors can envision change and devise strategies to break the rules of the game (e.g. regulations, norms and cultural-cognitive patterns) in order to give rise to market disruptions. The socio-technical transitions perspective, then, is concerned with how niche innovators (e.g. start-ups) build disruptive innovations within technological or market niches that are initially protected against mainstream market selection (Geels and Schot, 2007). Incumbents can also disrupt the market by developing novelties within niches that act as “incubation rooms”. Nevertheless, if innovation is not compatible with the prevailing socio-technical regime, incumbents will also require help from the landscape-level forces that destabilize institutional arrangements and create pressure for change.

2.4 Research gap

Although our review found quite an extensive amount of research related to disruption, it confirms previously identified research gaps. First, there is significant need to move from a siloed descriptive theories, which are relatively limited in scope, to a more broadly explanatory causal theory of innovation and competition (Ansari and Krop, 2012; Christensen *et al.*, 2018). Traditional disruptive innovation theory focuses mainly on low-end and new-market disruptions, even though digitalization is profoundly challenging old taken-for-granted rules, and several macro-level trends are shaping the landscape for innovations that enable major socio-technical transitions (Geels, 2018). As a result, many traditional businesses and sectors may be threatened (Hinings *et al.*, 2018a; Skog *et al.*, 2018). However, studies in the manufacturing sector often focus on a single source of disruption, and there is a lack of understanding of how separate disruptive forces overlap and interact with each other.

Second, our review is coherent with the argument that disruptive innovation theory offers detailed insights on how to respond to a few specific disruption patterns, but the theory is “mostly empty-handed when it comes to proposing solutions” (Christensen *et al.*, 2018). Most of the studies focus on incumbents’ adaptation to disruption or simply their survival, even though understanding a broader range of incumbent outcomes would be highly beneficial (Ansari and Krop, 2012; Cozzolino *et al.*, 2018). Furthermore, the boundary between competition and co-operation between incumbents and entrants has become increasingly blurry when business is conducted within multi-sided platforms and ecosystems. Hence, companies have to balance simultaneously between multiple strategic choices with conflicting demands (Ansari *et al.*, 2016; Rosli *et al.*, 2017).

This article aims to answer to the call for more careful empirical analysis and more in-depth exploration of response strategies (Christensen *et al.*, 2018) by shedding light on how top executives in manufacturing corporations perceive disruptions and what they consider appropriate responses to those disruptions. Specifically, we aim to answer to following research questions:

RQ1. What forms of disruption are the priority for top executives of large manufacturing companies?

RQ2. What strategies do they consider appropriate in managing potential disruptions?

3. Methodology

3.1 Perspective and research design

This research was conducted using the basic principles of abductive reasoning, a process of discovery based on the interaction of theory and practice, and of researcher and research objects (Dubois and Gadde, 2002). Qualitative research following the principles of abductive reasoning was deemed suitable for the study for the following reasons. First, while specific sources of disruption and strategic responses to them have been addressed in the literature, broader examinations that include multiple overlapping disruptive forces are lacking. To address this shortcoming, we prioritized exploratory qualitative inquiry that is open for emerging findings. Second, the abductive analytical strategy allows us to refine the data-driven observations with insights from existing theory and increase the theoretical relevance of the findings. This process enables reasoning the best explanations for how executives of manufacturing companies perceive disruptive opportunities and threats and how they manage them. Thereby, although the research was guided by disruptive innovation theory, the authors used an inductive approach to structure the data and combined the emerging findings with existing constructs from theory.

3.2 Research setting

To ensure a degree of transferability for the findings, we focused on large manufacturing companies in one country (Finland). At the time of the study, digital disruption, in particular, was an important topic in the manufacturing industry, and we saw large companies with a good overlook of disruptive forces within their industry. To sample companies, we consulted the Federation of Finnish Technology Industries. The companies were drawn from five subsectors of the biggest manufacturing sector in Finland, the machinery and metal products industry, as categorized by Statistics Finland using the following NACE Rev.2 classes:

- (1) 25 Manufacture of fabricated metal products, except machinery and equipment
- (2) 28 Manufacture of machinery and equipment n.e.c.
- (3) 29 Manufacture of motor vehicles, trailers and semi-trailers

-
- (4) 30 Manufacture of other transport equipment
 - (5) 33 Repair and installation of machinery and equipment

Based on employee count, we then listed the 20 biggest companies with international operations and identified and contacted top managers. We ended up with 15 informants from 10 companies. Most of the informants were directors of business divisions; some had major roles with a R&D, marketing or IT emphasis. Their titles included head of business unit/line, head of strategy, director of sales and marketing and director of business development. All informants were confident in discussing disruptions in their industry. Seven of the corporations had headquarters in Finland and three were headquartered in another European country.

3.3 Data collection and analysis

The data were collected in 15 focused interviews between June and September 2019. Each interview lasted from 30 to 60 min. List of the interviewees is included in the [Appendix](#). The interviews covered four themes: (1) competitiveness and renewal of Finnish manufacturing industry, (2) disruption and transformation, (3) barriers and challenges for organizational renewal and responding to disruptions and (4) elements supporting renewal and responses. The interview themes are in line with our aim to investigate various disruptive forces and response strategies broadly, without focusing on single sources of disruptions and their effects.

The data were initially analysed independently by three researchers using descriptive and simultaneous coding methods ([Saldaña, 2009](#)). After the initial coding, the researchers used the pattern coding method ([Saldaña, 2009](#)) to reveal patterns in the codes. During data collection and analysis the researchers wrote analytic memos with a view to fostering reflection about the data and synthesizing data into higher-level analytic meanings ([Miles et al., 2014](#)). In the analysis phase, we focused on two main areas. First, what kind of disruptions do the top managers foresee to influence their industry. We identified a number of sources of disruption from the data and categorized them into four groups ([Figure 1](#)). The categorization was influenced by extant theory on disruptions ([Table 1](#)) as our empirical findings supported them to a large extent. To achieve a good fit with our data, we combined some disruption types from the literature and named them appropriately. Our second focus area concerned how managers acknowledged sources of disruptions in their strategic choices. Likewise, we sought insights from existing theory, including [Table 2](#), and formulated eight response strategies ([Figure 2](#)). We further identified that some of the strategies resembled each other in that they addressed specific strategic issues such as ecosystems and stance on new entrants in an industry. We revisited the literature and found that the distinction between exploitation and exploration, introduced by [March \(1991\)](#), provided a way to classify the strategies into two groups based on whether they rely on exploiting existing strengths or exploring new opportunities. Consequently, we arranged the strategies as four exploitation–exploration pairs, where each pair depicted two alternative approaches to a disruption-related strategic issue.

4. Findings

According to the interviewees, incumbents prepare for potential disruptions especially at the executive team level and/or during the long-term strategic planning process. They discuss a wide variety of disruptive technologies, forces and trends, and identify the impact of these disruptive forces on several levels. In the following, we introduce the types of disruptions perceived by the interviewees and then describe “archetypal” disruption management strategies that we formulated based on the data.

4.1 Types of disruptions expected in the manufacturing industry

4.1.1 Disruptive technologies and innovations.

[Disruption] forces you to think about your own business from the outside. It helps you see if you've been doing something for too long and have become too content with yourself. . . it may reveal that something is bubbling beneath the surface, a much cheaper solution that is not as good but good enough, and it kind of sneaks in while we are seriously downplaying its odds, and suddenly we realize it has passed us by. . .

This excerpt is an example of general awareness about the possibility of low-end niche innovations. The interviewees were not, however, particularly concerned about niche innovations being hidden from their sight. Their technological concerns were focused on well-known trajectories and particularly on the timing and wide-scale diffusion of breakthrough innovations.

Two main fields of technologies were of particular interest: emerging energy technologies and information and communication technologies (ICTs). Innovations labelled under energy technology are important in manufacturing companies, which require large amounts of energy for their production processes and which are facing increasing pressure to improve their environmental performance. Specific technologies mentioned by the interviewees include energy harvesting and storage, renewable energy sources and alternative fuels. Some of these disruptions are based on breakthroughs in basic sciences such as chemistry, which might change the relative profitability of different technologies.

Many ICT-enabled disruptions also depend on fundamental breakthroughs. In particular, artificial intelligence is expected to enable numerous data-driven innovations and industry transformation. Many interviewees said they were actively following numerous potential

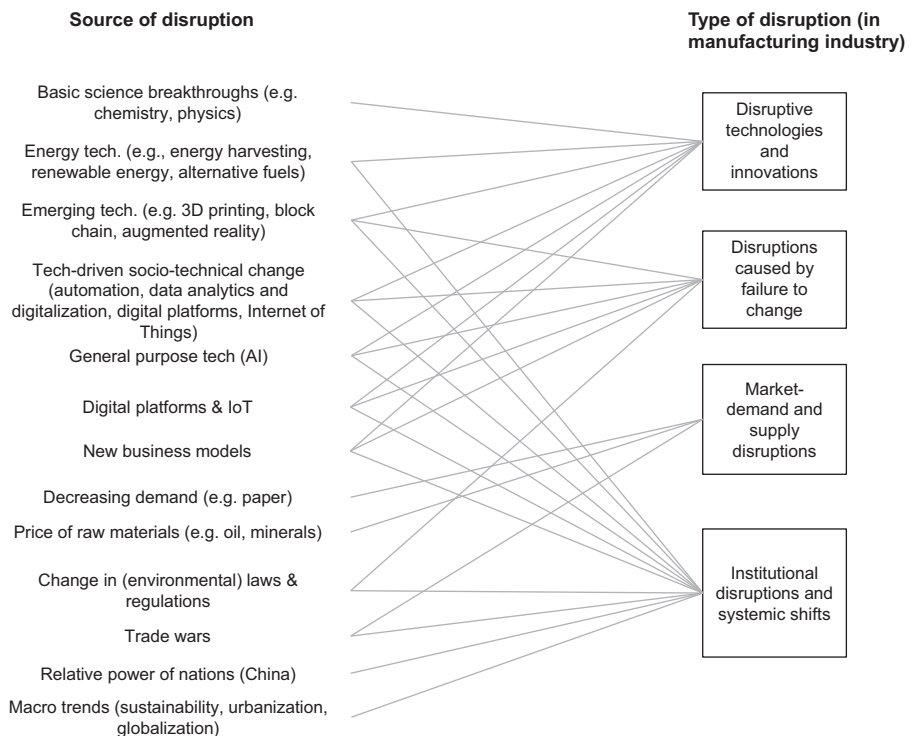


Figure 1.
Source and type of disruption in manufacturing industry

sources for technological disruptions, such as 3D printing, blockchain, connectivity technologies (e.g. 5G), digital platforms and augmented reality.

The wide-scale use of 3D printing could radically change the way that material flows are handled globally . . . 3D printing could redefine the comparative profitability of production in low-cost countries and shipping these products long distances.

4.1.2 Disruptions caused by failure to change. The interviewees reported that they had an abundance of ideas for radical innovations, but the main challenge seemed to be how to allocate scarce resources for innovation endeavours, which are somewhat disconnected from daily business operations and entail high risks. This challenge was highlighted by a respondent who claimed that disruptive technologies originate almost solely from breakthroughs in basic science and engineering. Employees and innovation teams with the resources and capabilities to make such innovations are rare but critical.

Physics and chemistry determine 99% whether the technology will work . . . Deep engineering competencies determine whether it [the next disruptive technology] comes from our company or from somewhere else.

Many interviewees considered the ability of organizations to integrate state-of-the-art technologies into their processes and practices more important than initiating disruption in the field. For example, industry 4.0 and digitalization were seen as must-win battles requiring the ability to learn and integrate new technologies. Incumbents' (in)ability to absorb new technologies and competencies was thought to depend, for example, on re-skilling existing staff, recruiting new competencies and leadership. Automation and digitalization have also fostered new ways of organizing value creation. Digital platforms alter structures of traditional pipeline businesses, and manufacturing companies face new competition from major ICT corporations that have superior capabilities in data analytics, for example.

4.1.3 Market-demand and supply disruptions.

Industry growth is an enabler for innovation. In one of our main segments demand dropped 80% in a year, which also had a major negative impact on the R&D budget and activities.

Some interviewees mentioned disruptions in market demand and supply as major sources of temporary, but sometimes also permanent disruption. One interviewee described how their field of operations had been disrupted by long-term changes in customer needs and behaviour (digitalization), causing a declining trend in paper demand.

. . . we have a concrete example of this transformation among our customers. Demand for our product has declined for many years in a row, even by more than 10% a year. And every year we're losing customers due to factory closedowns. Our disruption has been the change in what we need to produce.

Other interviewees described disruptions caused by non-technical market and political factors that impact the competitive environment, international trade and geopolitical situation. For example, a sharp drop in the international price of a specific raw material could generate a major disruption. Falling raw material prices may initiate a chain reaction within the industry and significantly reduce the profitability of production and therefore the demand for machinery. A sudden trade war was mentioned as another disruptive event:

At the moment the trade war (between US and China) is a disruptive factor that you have to follow carefully. We must think of how to adapt if this or that happens. . .

Asian countries and China in particular were considered "disruptors" by interviewees from two companies whose business was increasingly challenged by Asian competitors. Chinese companies are investing aggressively to increase supply in the market and to capture larger

market shares. Here, the source of disruption is a continuous change in the relative strength of nations in international trade. In the words of one interviewee: “*if they continue to take over the market with the same force, we are going to have to find a new way of operating*”. Hence, this ongoing market disruption may force the company to rethink its long-term strategy.

4.1.4 Institutional disruptions and systemic shifts. Institutional disruption means radically changing the informal (e.g. normative ways of doing things) and formal (e.g. regulations) rules of the game. This challenge is visible in 3D printing that was considered a potential source for a major disruption. The technology itself is not disruptive if it is not accompanied with new ways of working and new business logics. The innovation has to be institutionalized in industry practices and processes and accepted by customers before a disruption takes place.

We have many examples in our industry of solutions that use AI, machine learning and analytics, but they are still very distinct from the core business, which is conducted in the same way it has been always been conducted. Nobody has thought about how this technology should change our conventions.

Changing the informal rules requires that old taken-for-granted beliefs, practices and processes are deinstitutionalized. This was considered a major challenge among conservative customers. The interviewees pointed out that despite efforts to encourage customers to adopt innovations, the slow speed of change was experienced as a real challenge. Therefore, managers need to find ways to overcome the inertia in changing customers’ mind-set and behaviour in these traditional industries.

Changes in laws and regulations, particularly the recent tightening of national and international environmental laws, were considered “clearly a major disruptive force”. This institutional disruption provided an opportunity for companies that had anticipated regulative changes in response to long-term landscape-level changes such as climate change and increasing sustainability demands. Green-tech solutions, for example, may see improved profitability, which would bring a great boost to forerunners in the field. Regulative changes may also force technology suppliers to move towards more sustainable technologies. As the old technologies become obsolete, companies that have taken proactive actions will be in a strong position in the altered market. Those not prepared will need capabilities to absorb and integrate new knowledge fast enough to stay in the game regulated by new rules.

4.2 Strategies to manage disruptions

In this section, we outline the main disruption management strategies employed by the interviewed managers. We also elaborate the rationale with which the strategy aims to deal with disruption. For the sake of simplicity, each category of strategies is divided into two somewhat opposing ends, which are based on different sets of assumptions about the disruption. Drawing from [March \(1991\)](#), these categories are:

- (1) *Exploitation strategies* that build on the assumption that the incumbent has built a business that is highly valuable to them and that a disruption is a threat to the continuity of the business. Hence, the aim is to exploit the business opportunity to the fullest while protecting the business from the disruption.
- (2) *Exploration strategies* that build on the assumption that the company can either independently or with the help of others explore radical innovations that disrupt the business. Hence, the assumption is that major changes are inevitable and that the company has to be active in initiating change.

4.2.1 Internal development efforts. Most of the reported internal development efforts were focused on incremental technological innovations following the existing innovation trajectory rather than on path-breaking innovations that would also undermine the existing business. The main challenge is to stay at the leading edge of the existing trajectory, but at the same time to retain one’s ability to respond to any arising disruptions.

Disruption and manufacturing executives

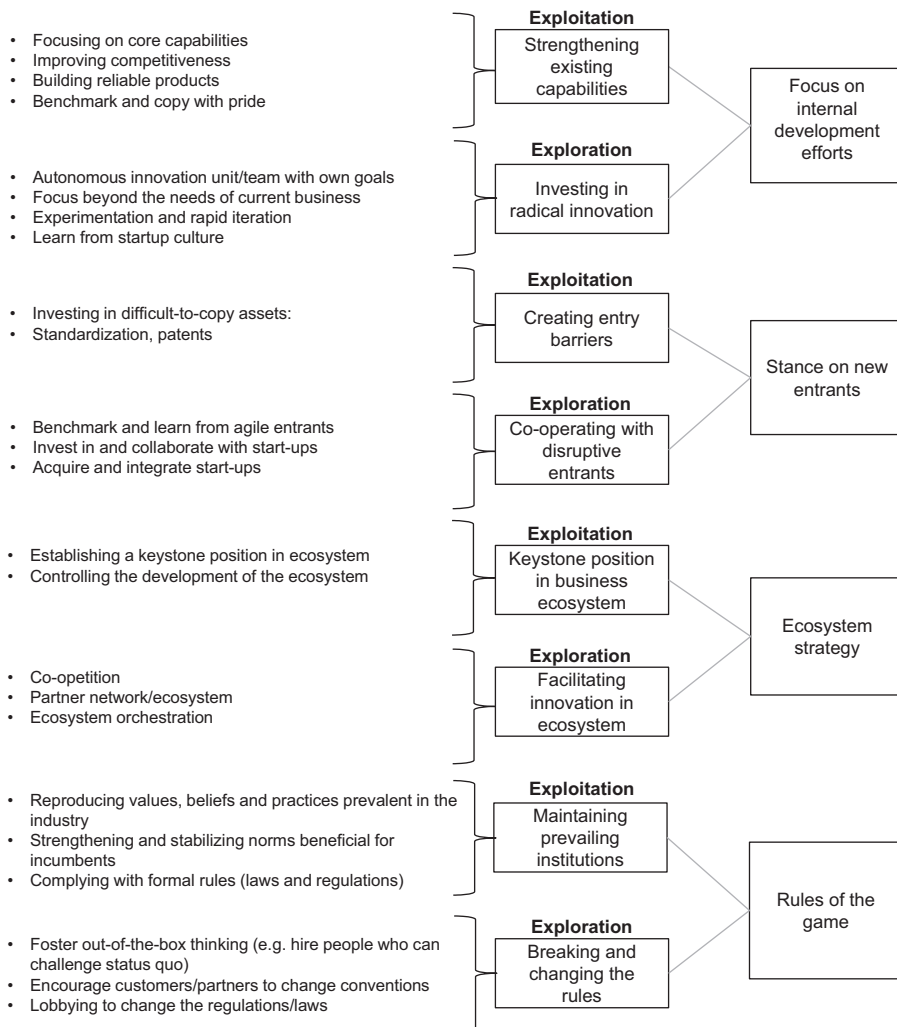


Figure 2.
Strategies to manage disruptions

4.2.1.1 Strengthen existing capabilities. The interviewees reported a tendency to focus on exploiting existing competencies by improving and developing current products and services. The reasoning is that by making sure their core competencies are strong, companies are in a better position to withstand potential disruptions. One interviewee commented that many companies do not innovate at all, reflecting a view that major investments for breakthrough innovations are unnecessary. Some manufacturing industry products are substantial investments: the delivery of heavy machinery may take up to 18 months. Given the slow pace of industrial change in some areas, focusing on further developing the company's existing strengths may be an attractive strategy. This is not to say that such a strategy is not debated. Another informant provided a critical assessment of their development activities by referring to McKinsey's three horizons model (2009) that addresses the time horizon of innovation activities:

We have a horizon 1 perspective, horizon 2 at most, but we think very little about horizon 3. We have invested in innovation, but some things have proceeded slowly because our focus has been on the here and now.

It might be possible to explain away the focus on incremental innovation on grounds of organizational inertia. Our assessment is, however, that for some top managers it is a deliberate strategic choice. One manager emphasized that it is important to invest in new business areas at the right time, indicating that there may be disadvantages to being a first mover. Another interviewee rated their capability to develop disruptive innovations as low, but thought the same was true of their competitors as well. Some new technologies, such as the use of digital twins, were considered to be groundbreaking but competence-enhancing in that they may reinforce existing strengths rather than undermine them.

4.2.1.2 Invest in radical innovation. In addition to seeing disruptions as a threat, some companies invest more heavily in developing potentially disruptive innovations. Their goal is to identify “disruptive opportunities” and to proactively develop innovations to seize them. One interviewee described their emphasis on radical innovation:

We are a small player in the bigger market picture, but we are the market leader in our own niche . . . We've been a disruptor for the big players in this market for 25 years now.

The goals of organizational units or innovation teams aiming to develop potentially disruptive innovations lie far ahead in the future. Although companies do not always talk about deliberate innovation strategies, many of them clearly define a long-term business vision where innovation has a crucial role. In contrast to a three-year time horizon for business strategy, visions for radical innovation activities can be set for 10 or even 15 years.

Our vision is to be a global leader in X and we expect this to be realized within 10 years at the latest. That's far away enough. We aim to achieve this through several strategy periods, counting backwards what we need to achieve at a certain point in time to reach our long-term vision.

Innovation teams look into future business opportunities that are beyond the scope of current business operations. They also follow new products, patents, emerging technologies and design experiments. Some interviewees said their teams were adopting innovation practices from the start-up world and aiming to speed up their experimentation cycles. Innovation teams were allowed to study potential disruptions even when they conflicted with current business operations:

We have a small research and innovation team exploring unknown paths. They'll even look into things that may cannibalize our own businesses. That is something our business units would never do.

Sometimes the focus is at odds with the goals of the business unit, which may hamper the adoption of innovations even within the company's own organization.

We must be able to push new things to our business, even though they do not want it yet, but we know it will eventually protect the future business.

4.2.2 *Stance on new entrants.* Companies have several strategic options available when it comes to potential new entrants. On the one hand, companies may aim to protect their existing offering against competing ones, but at the same time they may look out for new entrants that might be beneficial for business renewal.

4.2.2.1 *Creating entry barriers.* Well-known strategies against entrants are based on standardization, patenting and designing business models around assets that protect the company against disruption. For example, many businesses may use standards and

patents to slow down or prevent the entry of new entrants. However, this may also encourage competitors to seek disruptive solutions that would make patents or standard obsolete.

The interviewees reported having invested in assets such as global sales and delivery networks, a highly specialized workforce, data analytics and production technologies. Some took the view that hard-to-copy assets could act to deter new entrants. However, heavy reliance on expensive assets may also attract disruptive innovations. A more advanced way to protect the company's business is to continuously adapt the business model to the changing needs and business environment.

One of the perceived challenges with the protection strategy was that entrants are not necessarily start-ups, but the threat may come from major players in other industries. For example, *deep knowledge about industrial processes and data acquired from production* were seen as protective assets that are hard for entrants to acquire. However, when data analytics becomes a more integral part of the industry, it is uncertain whether traditional players can sustain their competitive advantage over new rivals from the IT industry, such as IBM, Google and Microsoft. One interviewee noted that these new players are increasingly interested in the digitalization of the manufacturing industry, and although they are currently lacking in industry knowledge, the question is for how long.

4.2.2.2 Collaborating with new entrants. Incumbents increasingly regard start-up co-operation as an opportunity rather than a threat. We found that manufacturing companies have many forms of start-up co-operation. The interviewees described start-ups as potential acquisition targets, or as partners with innovative ideas and prototypes that can be exploited jointly. Many, however, give the impression that their company is somewhat conservative in acquisitions, as the following quote illustrates:

We have bought a couple of start-ups, even though this is not our strategy. Our strategy is rather to partner with companies who have new innovative thoughts that we can develop further together.

The main reason for this is that the start-ups often have radically different ways of working from the incumbents. Hence, integrating a start-up too early or too tightly is expected to be harmful for an innovation. The incumbents, therefore, have to strike a balance between start-up integration and autonomy to ensure both innovativeness and usefulness for the company.

We should work more actively with start-ups, however, in such a way that we keep them separated from the corporate world until we know they can fly. If we bring in a new idea or project into our corporation too early, it will easily get suppressed by all the rules, tools and bureaucracy.

4.2.3 *Ecosystem strategy*. One of the main mechanisms that is expected to disrupt incumbents' business is a new way of creating value that builds on restructuring the prevailing value network. Many of the studied companies were actively trying to protect their future business position by building platforms and related ecosystems. It is thought that the transformation to a platform-based business is particularly difficult for incumbents who are used to dealing with product-based competition and who do not know how to react to platform competition at an ecosystem level (Sampere, 2016).

4.2.3.1 Acquire a keystone position in business ecosystem.

The reason why our strategy focuses on participating in ecosystems as an owner or key partner is that we would not be disrupted but we would be well positioned in the field.

As the excerpt indicates, some companies want to have a central or "keystone" position in the future ecosystem. This implies a leadership position within the business ecosystem, giving

the company the possibility to exercise strong influence over co-evolutionary processes in the ecosystem (Moore, 1993). Hence, a specific company is vital for the survival of the business ecosystem, making it difficult to replace. A keystone position may, however, turn into a disadvantage. A single stakeholder dominating the business ecosystem may attract disruptive innovations aimed at replacing the keystone firm and thereby the whole business ecosystem around it.

4.2.3.2 Facilitating an innovation ecosystem. An alternative strategy is fostering the growth of a more balanced *innovation ecosystem*, in which no single actor takes up the keystone position. Some interviewees said that innovation ecosystems were strategically important for adapting to disruptive innovations and also for proactively innovating to create disruptions. These executives do not believe that their company can solve complex problems on their own, but that disruptive innovations require strong partners around them. Although the basic idea is that no-one can single-handedly control the innovation, some interviewees prefer a central position in the ecosystem.

We have made the strategic decision to engage in research and technology development within the ecosystem, which is the most effective way to get things done . . . Once we have a functioning ecosystem we will, for example, purchase research directly from our ecosystem partners.

4.2.4 *Strategies concerning institutional change.* Industries are protected against radical change by formal and informal institutions, which are constantly maintained and reproduced. This is done by enforcing existing mental models, practices and conventions, thereby sustaining the status quo beneficial for dominant players. Although a single stakeholder could go against the institutional mainstream, it has limited means to permanently change institutional structures. Nevertheless, a persistent and concerted effort by several actors can eventually change institutions and enable the breakthrough of radical innovations.

4.2.4.1 Institutional maintenance. Even though institutional maintenance is not often considered a deliberate strategy, it is a natural strategy choice for incumbents who benefit from the status quo. Some interviewees said this strategy was both a visible presence and challenging in their work. For example, some manufacturing companies operate in markets where the basic principles of conducting business have remained relatively unchanged for a long time (e.g. steel production and transporting goods around the globe). This may protect incumbents but also make it challenging to have a critical conversation about potential disruptions.

In our industry it is very difficult to talk about disruption because someone will always bring the discussion back to the point that “you cannot disrupt steel”.

Another example of institutional maintenance is the strengthening of the norms and regulations for conducting business in a certain way. One interviewee said that the foundation of their business was to provide professional maintenance services locally around the globe and that the norm of conducting maintenance on-site protects them against disruptors. Although the interviewee was aware of the remote maintenance trend, which is expected to reduce the need for physical presence, it was still thought that building the operation around a local workforce would be crucial well into the future.

This current [maintenance] work still relies quite a lot on a local workforce and there are not any directly disruptive technologies on the horizon.

4.2.4.2 Institutional entrepreneurship. Maintaining current institutional arrangements in order to provide protection against disruptions seems to be a challenging strategic option in the long term. Upholding the status quo attracts innovators who are keen to disrupt it. Therefore, incumbents are sometimes interested in institutional entrepreneurship, even though that might have a negative impact on their current business in the short term.

Several interviewees said that out-of-the-box thinking and challenging conventions was a necessity for radical renewal. Hiring people from the software industry, who do and see things differently, was considered beneficial for organizational renewal. One interviewee pointed out that high top management turnover is key to successful renewal. Inter-organizational and international job rotation was also considered to positively influence capabilities for radical renewal.

Our findings indicate that it is particularly difficult to change customers' conventional practices and rules prevalent in the markets. Some interviewees described situations where they would be willing to take bigger leaps in introducing innovations if the market were prepared for that. However, one interviewee said that, despite the slow speed of change, the role of their company was to actively feed new ideas to their customers. Another informant made the point that changing the rules of the game requires persistent efforts and a firm belief in their long-term vision.

5. Discussion and conclusions

Although there is extensive literature on disruptive innovation, it is not often clear what kind of strategies companies should adopt to survive or take advantage of forthcoming disruptions (Christensen *et al.*, 2018). Our study sheds light on this by drawing on an empirical study in the context of manufacturing companies in Finland. We have three main contributions.

First, by identifying types of disruptions expected by top manufacturing executives, we envision a disruption landscape that is more complex than typically described in the literature. The executives interviewed draw attention to multiple disruptive forces that have varying degrees of urgency, salience and uncertainty. This forward-looking examination contrasts with typical retrospective descriptions of disruptions, such as the classic examples of disk drives and mini mills (Christensen, 1997) where it is possible to identify a single defining source of disruption. We argue that as far as disruptions are concerned, companies are often “driving through the fog” (cf. Day and Schoemaker, 2004). Their operating environment is highly uncertain, elusive and emergent, and it is difficult to recognize and react to strategic threats and opportunities before it is too late. Disruptions may also overlap, with multiple distinct disruptions simultaneously affecting a single company. Further, a single source of disruption may manifest itself in different forms. The COVID-19 pandemic, for example, can be considered both a supply chain disruption and a demand disruption. Besides, it is likely to induce temporary or permanent shifts in the broader institutional and social regimes, which open up the possibility of other disruptions (e.g. technological innovations).

Second, we paint a picture of companies' strategic responses to disruptions, incorporating the aforementioned characteristics that we suggest disruptions possess. The view of disruptions as manifold and ambiguous forces that shape companies' business environment challenges the current understanding of what strategies to apply to manage them. Much of the extant research describes settings where companies formulate deliberate responses to clearly identified disruptions (Adner and Snow, 2010; Christensen, 1997; Christensen *et al.*, 2015). Our findings suggest that such responses are often unavailable. If a single disruption cannot be identified as a priority, it is impossible to develop a specific response to address that disruption. If multiple disruptions have to be addressed simultaneously, they may generate conflicting demands that managers will have to balance. As a result, the strategies are likely to be more generic than shifts from one customer segment to another (Kilkki *et al.*, 2018). When companies are in the dark about the strategic demands of the future, the critical question becomes how they can develop their capabilities such that they are best positioned to face the future with confidence.

Third, we identify four strategic dimensions that Finnish manufacturing companies consider important in anticipating and responding to disruptions: internal development efforts, stance on new entrants, ecosystems and institutional change. We furthermore make a distinction between exploitative and explorative strategies (March, 1991). Exploitative strategies build on competitive advantages and core competencies, whereas explorative strategies aim to develop a company in a new direction. Interestingly, our findings show how, in a slow-moving industry such as manufacturing, exploitative strategies are considered a valid option for weathering upcoming disruptions. This contrasts with the general tendency to recommend adaptation through organizational renewal and dynamic capabilities as the strategy of choice for responding to disruptions (e.g. Karimi and Walter, 2015). This discrepancy may be explained by the vantage point of the studied organizations and managers regarding the timing of a disruption. If a disruption has already happened, adaptation may be the only remaining choice. If it is being prepared for, other options such as putting up defences may still be available.

Though excluded from closer scrutiny here, our study also points at four modes of ambidexterity for managing disruptions. Previous research has identified organizational ambidexterity as a potential solution to the threat of disruption (O'Reilly and Tushman, 2008, 2016). This line of research promotes the simultaneous implementation of exploitative and explorative initiatives, typically regarding internal development efforts. Besides internal development efforts, examination of the strategic dimensions identified in this study opens up the possibility for other forms of ambidexterity as well. First, there may be an ambidextrous approach to dealing with new entrants. Companies may both create barriers to the entry of new companies and choose the best ones to collaborate with. This is reminiscent of the approach used by technology giants such as Google and Apple, who maintain strict control of their platforms while buying up innovative start-ups to boost their innovation. Second, companies may leverage ecosystems with ambidexterity by ensuring a keystone position in critical business ecosystems while collaborating in different ecosystems for learning and innovation. The extant literature has identified a distinction between business and innovation ecosystems (Clarysse *et al.*, 2014), and companies are known to simultaneously employ explorative and exploitative networks (Kauppila, 2010), making an ambidextrous ecosystem strategy a viable option. Finally, by engaging in both institutional maintenance and institutional entrepreneurship (Lawrence and Suddaby, 2006), it may be possible to simultaneously submit to and exploit the traditional norms and principles of the business and have a separate organization that is encouraged to break prevailing rules of the game and explore the potential of new trends with forerunner customers.

A key limitation of our study stems from the qualitative method and the focus on a limited number of interviewees. Further, in aiming to characterize archetypal strategic orientations in the industry, we did not investigate the explicitly stated strategies of individual companies. Future research should investigate how these archetypes are manifested in strategy work and its outcomes at the company level, and test the prevalence of various strategic orientations in manufacturing industries and other contexts. Furthermore, we adopted an anticipatory perspective, where the informants discussed preparation for future disruptions. In the case of the emergence of a single high-priority disruption, strategic changes for responding to that specific disruption are likely.

References

- Adner, R. and Kapoor, R. (2016), "Innovation ecosystems and the pace of substitution: re-examining technology S-curves", *Strategic Management Journal*, Vol. 37, pp. 625-648.

-
- Adner, R. and Snow, D. (2010), "Old technology responses to new technology threats: demand heterogeneity and technology retreats", *Industrial and Corporate Change*, Vol. 19 No. 5, pp. 1655-1675.
- Ambulkar, S., Blackhurst, J. and Grawe, S. (2015), "Firm's resilience to supply chain disruptions: scale development and empirical examination", *Journal of Operations Management*, Vol. 33 No. 34, pp. 111-122.
- Ansari, S. and Krop, P. (2012), "Incumbent performance in the face of a radical innovation: towards a framework for incumbent challenger dynamics", *Research Policy*, Vol. 41 No. 8, pp. 1357-1374.
- Ansari, S., Garud, R. and Kumaraswamy, A. (2016), "The disruptor's dilemma: TIVO and the U.S television ecosystem", *Strategic Management Journal*, Vol. 37, pp. 1829-1853.
- Battilana, J., Leca, B. and Boxenbaum, E. (2009), "How actors change institutions: towards a theory of institutional entrepreneurship", *The Academy of Management Annals*, Vol. 3 No. 1, pp. 65-107.
- Behzadi, G., O'Sullivan, M.J., Olsen, T.L. and Zhang, A. (2018), "Allocation flexibility for agribusiness supply chains under market demand disruption", *International Journal of Production Research*, Vol. 56 No. 10, pp. 3524-3546.
- Beltagui, A., Rosli, A. and Candi, M. (2020), "Exaptation in a digital innovation ecosystem: the disruptive impacts of 3D printing", *Research Policy*, Vol. 49 No. 1, pp. 1-16.
- Bergek, A., Berggren, C., Magnusson, T. and Hobday, M. (2013), "Technological discontinuities and the challenge for incumbent firms: destruction, disruption or creative accumulation?", *Research Policy*, Vol. 42 Nos 6-7, pp. 1210-1224.
- Blanc, A. and Huault, I. (2014), "Against the digital revolution? Institutional maintenance and artefacts within the French recorded music industry", *Technological Forecasting and Social Change*, Vol. 83 No. 1, pp. 10-23.
- Bockmühl, S., König, A., Enders, A., Hungenberg, H. and Puck, J. (2011), "Intensity, timeliness, and success of incumbent response to technological discontinuities: a synthesis and empirical investigation", *Review of Managerial Science*, Vol. 5 No. 4, pp. 265-289.
- Cambridge Online Dictionary (2020), Available at: <https://dictionary.cambridge.org/dictionary/english/disrupt> (accessed 8 September 2020).
- Charitou, C. and Markides, C. (2003), "Responses to disruptive strategic innovation", *MIT Sloan Management Review*, Vol. 44 No. 2, p. 11.
- Chase, R. (2016), "We need to expand the definition of disruptive innovation", *Harvard Business Review*, Vol. 4, p. 3.
- Chesbrough, H.W. (2001), "Assembling the elephant: a review of empirical studies on the impact of technical change upon incumbent firms", in Chesbrough, H.W. and Burgelman, R.A. (Eds), *Comparative Studies of Technological Evolution*, pp. 1-36.
- Christensen, C.M. (1997), *The Innovator's Dilemma*, Harvard Business School Press, Boston, MA.
- Christensen, C.M. (2006), "The ongoing process of building a theory of disruption", *Journal of Product Innovation Management*, Vol. 23 No. 1, pp. 39-55.
- Christensen, C.M. and Raynor, M.E. (2003), *The Innovator's Solution*, Harvard Business School Press, Boston, MA.
- Christensen, C.M., Raynor, M. and McDonald, R. (2015), "What is disruptive innovation?", *Harvard Business Review*, December 2015, pp. 1-16.
- Christensen, C.M., McDonald, R., Altman, E.J. and Palmer, J.E. (2018), "Disruptive innovation: an intellectual history and directions for future research", *Journal of Management Studies*, Vol. 55 No. 7, pp. 1043-1078.
- Clarysse, B., Wright, M., Bruneel, J. and Mahajan, A. (2014), "Creating value in ecosystems: crossing the chasm between knowledge and business ecosystems", *Research Policy*, Vol. 43 No. 7, pp. 1164-1176.
- Cohen, W. and Levinthal, D. (1990), "Absorptive capacity: a new perspective on learning and innovation", *Administrative Science Quarterly*, Vol. 35, pp. 128-152.

-
- Cozzolino, A., Verona, G. and Rothaermel, F.T. (2018), "Unpacking the disruption process: new technology, business models, and incumbent adaptation", *Journal of Management Studies*, Vol. 55 No. 7, pp. 1166-1202.
- Cusumano, M.A., Yoffie, D.B. and Gawer, A. (2020), "The future of platforms", *MIT Sloan Management Review*, Vol. 61 No. 3, pp. 46-54.
- Day, G.S. and Schoemaker, P.J. (2004), "Driving through the fog: managing at the edge", *Long Range Planning*, Vol. 37 No. 2, pp. 127-142.
- Dubois, A. and Gadde, L.-E. (2002), "Systematic combining: an abductive approach to case research", *Journal of Business Research*, Vol. 55 No. 7, pp. 553-560, doi: [10.1016/S0148-2963\(00\)00195-8](https://doi.org/10.1016/S0148-2963(00)00195-8).
- Eisenhardt, K. and Martin, J. (2000), "Dynamic capabilities: what are they?", *Strategic Management Journal*, Vol. 21 Nos 10/11, pp. 1105-1121.
- Eggers, J.P. and Park, K.F. (2017), "Incumbent adaptation to technological change: the past, present, and future of research on heterogeneous incumbent response", *Academy of Management Annals*, Vol. 12 No. 1.
- Gans, J. (2016a), *The Disruption Dilemma*, The MIT Press, Cambridge, Massachusetts.
- Gans, J. (2016b), "The other disruption", *Harvard Business Review*, Vol. 2016, pp. 2-8.
- Gawer, A. and Cusumano, M.A. (2002), *Platform Leadership: How Intel, Microsoft and Cisco Drive Industry Innovation*, Harvard Business School Press, Boston, MA.
- Gawer, A. and Cusumano, M.A. (2014), "Industry platforms and ecosystem innovation", *Journal of Product Innovation Management*, Vol. 31 No. 3, pp. 417-433.
- Geels, F.W. (2004), "Understanding system innovations: a critical literature review and a conceptual synthesis", in Elzen, B., Geels, F.W. and Green, K. (Eds), *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy*, Edward Elgar.
- Geels, F.W. (2018), "Disruption and low-carbon system transformation: progress and new challenges in socio-technical transitions research and the multi-level perspective", *Energy Research and Social Science*, Vol. 37, pp. 224-231.
- Geels, F.W. and Kemp, R. (2007), "Dynamics in socio-technical systems: typology of change processes and contrasting case studies", *Technology in Society*, Vol. 29 No. 4, pp. 441-455.
- Geels, F.W. and Schot, J. (2007), "Typology of sociotechnical transition pathways", *Research Policy*, Vol. 36 No. 3, pp. 399-417.
- Gilbert, C.G. (2001), "A dilemma in response: examining the newspaper industry's response to the Internet", *Academy of Management Proceedings*, Vol. 2001 No. 1, p. 7.
- Gobble, M.M. (2016), "Defining disruptive innovation", *Research-Technology Management*, Vol. 59 No. 4, pp. 66-71.
- Hagel, J., Brown, J.S. and Davison, L. (2008), "Shaping in a world of constant disruption", *Harvard Business Review*, Vol. 86 No. 10, p. 11.
- Hardy, C. and Maguire, S. (2008), "Institutional entrepreneurship", in Greenwood, R., Oliver, C., Suddaby, R. and Sahlin, K. (Eds), *The SAGE Handbook of Organizational Institutionalism*, pp. 262-280.
- Haren, P. and Simchi-Levi, D. (2020), "How coronavirus could impact the global supply chain by mid-March", *Harvard Business Review*, February, pp. 2-7.
- HBR (2015), "Tesla's not as disruptive as you might think", *Harvard Business Review*, May 2015, pp. 22-23.
- Henderson, R. (2006), "The innovator's dilemma as a problem of organizational competence", *Journal of Product Innovation Management*, Vol. 23 No. 1, pp. 5-11.
- Henderson, R. and Clark, K.B. (1990), "Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms", *Administrative Science Quarterly*, Vol. 35 No. 1, pp. 9-30.

-
- Hill, C.W.L. and Rothaermel, F.T. (2003), "The performance of incumbent firms in the face of radical technological innovation", *Academy of Management Review*, Vol. 28 No. 2, pp. 257-274.
- Hinings, B., Gegenhuber, T. and Greenwood, R. (2018), "Digital innovation and transformation: an institutional perspective", *Information and Organization*, Vol. 28, pp. 52-61.
- Hopp, C., Antons, D., Kaminski, J. and Salge, T.O. (2018), "The topic landscape of disruption research – a call for consolidation, reconciliation, and generalization", *Journal of Product Innovation Management*, Vol. 35 No. 3, pp. 458-487.
- Iansiti, M., McFarlan, F.W. and Westerman, G. (2003), "Leveraging the incumbent's advantage", *MIT Sloan Management Review*, Vol. 44 No. 4, pp. 58-64.
- Ivanov, D., Pavlov, A., Dolgui, A., Pavlov, D. and Sokolov, B. (2016), "Disruption-driven supply chain (re)-planning and performance impact assessment with consideration of pro-active and recovery policies", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 90, pp. 7-24.
- Kaltenecker, N., Hess, T. and Hüsig, S. (2015), "Managing potentially disruptive innovations in software companies: transforming from on-premises to the on-demand", *The Journal of Strategic Information Systems*, Vol. 24 No. 4, pp. 234-250.
- Kammerlander, N., König, A. and Richards, M. (2018), "Why do incumbents respond heterogeneously to disruptive innovations? The interplay of domain identity and role identity", *Journal of Management Studies*, Vol. 55 No. 7, pp. 1122-1165.
- Karimi, J. and Walter, Z. (2015), "The role of dynamic capabilities in responding to digital disruption: a factor-based study of the newspaper industry", *Journal of Management Information Systems*, Vol. 1, pp. 39-81.
- Kaupila, O.P. (2010), "Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships", *Strategic Organization*, Vol. 8 No. 4, pp. 283-312.
- Kilkki, K., Mäntylä, M., Karhu, K., Hämmäinen, H. and Ailisto, H. (2018), "A disruption framework", *Technological Forecasting and Social Change*, Vol. 129, pp. 275-284.
- Kumaraswamy, A., Garud, R. and Ansari, S. (2018), "Perspectives on disruptive innovations", *Journal of Management Studies*, Vol. 55 No. 7, pp. 1025-1042.
- Laurell, C. and Sandström, C. (2016), "Analysing uber in social media – disruptive technology or institutional disruption?", *International Journal of Innovation Management*, Vol. 20 No. 5, p. 19.
- Lawrence, T.B. and Suddaby, R. (2006), "Institutions and institutional work", in Clegg, S., Hardy, C., Lawrence, T.B. and Nord, W.R. (Eds), *Handbook of Organization Studies*, SAGE Publications, London.
- Leonard-Barton, D. (1992), "Core capabilities and core rigidities: a paradox in managing new product development", *Strategic Management Journal*, Vol. 13, pp. 111-125.
- Lin, B., Omoju, O.E. and Okonkwo, J.U. (2015), "Will disruptions in OPEC oil supply have permanent impact on the global oil market?", *Renewable and Sustainable Energy Reviews*, Vol. 52, pp. 1312-1321.
- Madjdi, F. and Hüsig, S. (2011a), "The heterogeneity of incumbents' perceptions and response strategies in the face of potential disruptions", *Foresight*, Vol. 13 No. 5, pp. 14-33.
- Madjdi, F. and Hüsig, S. (2011b), "The response strategies of incumbent mobile network operators on the disruptive potential of public W-LAN in Germany", *Telecommunications Policy*, Vol. 35 No. 6, pp. 555-567.
- March, J.G. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, Vol. 2, pp. 71-87.
- Markides, C. (2006), "Disruptive innovation: in need of better theory", *Journal of Product Innovation Management*, Vol. 23 No. 1, pp. 19-25.
- McDowall, W. (2018), "Disruptive innovation and energy transitions: is Christensen's theory helpful?", *Energy Research and Social Science*, Vol. 37, pp. 243-246.

-
- McKinsey (2009), "Enduring ideas: the three horizons of growth", *McKinsey Quarterly*, December 2009, available at: <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/enduring-ideas-the-three-horizons-of-growth>.
- Miles, M., Huberman, M. and Saldana, J. (2014), *Qualitative Data Analysis: A Methods Sourcebook*, 3rd ed., Sage Publications, London.
- Moore, J.F. (1993), "Predators and prey: a new ecology of competition", *Harvard Business Review*, May-June.
- Munir, K.A. (2005), "The birth of the 'Kodak moment': institutional entrepreneurship and the adoption of new technologies", *Organization Studies*, Vol. 26 No. 11, pp. 1665-1687.
- Oke and Gopalakrishnan (2009), "Managing disruptions in supply chains: a case study of a retail supply chain", *International Journal of Production Economics*, Vol. 118 No. 1, pp. 168-174.
- Oliver, C. (1992), "The antecedents of deinstitutionalization", *Organization Science*, Vol. 13 No. 4, pp. 563-588.
- O'Reilly, C.A. and Tushman, M.L. (2008), "Ambidexterity as a dynamic capability: resolving the innovator's dilemma", *Research in Organizational Behavior*, Vol. 28, pp. 185-206.
- O'Reilly, C.A. and Tushman, M.L. (2016), *Lead and Disrupt: How to Solve the Innovator's Dilemma*, Stanford University Press, Redwood City, CA.
- Perrons, R.K. (2009), "The open kimono: how Intel balances trust and power to maintain platform leadership", *Research Policy*, Vol. 38 No. 8, pp. 1300-1312.
- Raffaelli, R. (2019), "Technology reemergence: creating new value for old technologies in Swiss mechanical watchmaking, 1970-2008", *Administrative Science Quarterly*, Vol. 64 No. 3, pp. 576-618.
- Rosli, A.A., Beltagui, A. and Candi, M. (2017), "Understanding disruption in innovation ecosystems: an effectuation perspective", *Academy of Management Proceedings*, No. 1, 16803.
- Saldaña, J. (2009), *The Coding Manual for Qualitative Researchers*, Sage Publications, London.
- Sampere, J.P.V. (2016), "Why platform disruption is so much bigger than product disruption", *Harvard Business Review*, April 08 2016, pp. 1-6.
- Schmidt, G. and Druehl, C. (2008), "When is a disruptive innovation disruptive?", *Journal of Product Innovation Management*, Vol. 25, pp. 347-369.
- Scott, W.R. (1995), *Institutions and Organizations*, 1st ed., Sage Publications, Thousand Oaks, California.
- Shen, B. and Li, Q. (2017), "Market disruptions in supply chains: a review of operational models", *International Transactions in Operational Research*, Vol. 24 No. 4, pp. 697-711.
- Skeete, J.-P. (2018), "Level 5 autonomy: the new face of disruption in road transport", *Technological Forecasting and Social Change*, Vol. 134, pp. 22-34.
- Skog, D.A., Wimelius, H. and Sandberg, J. (2018), "Digital disruption", *Business and Information Systems Engineering*, Vol. 60 No. 5, pp. 431-437.
- Snyder, L.V., Atan, Z., Peng, P., Rong, Y., Schmitt, A.J. and Sinsoysal, B. (2016), "OR/MS models for supply chain disruptions: a review", *IIE Transactions*, Vol. 48 No. 2, pp. 89-109.
- Sood, A. and Tellis, G.J. (2011), "Demystifying disruption: a new model for understanding and predicting disruptive technologies", *Marketing Science*, Vol. 30 No. 2, pp. 339-354.
- Teixeira, T.S. and Jamieson, P. (2014), "The decoupling effect of digital disruptors", Working paper 15-031, Harvard Business School, 28 October.
- Tushman, M.L. and Anderson, P. (1986), "Technological discontinuities and organizational environments", *Administrative Science Quarterly*, Vol. 31 No. 3, pp. 439-465.
- Urbinati, A., Chiaroni, D., Chiesa, V., Franzò, S. and Frattini, F. (2018), "An exploratory analysis on the contextual factors that influence disruptive innovation: the case of uber", *International Journal of Innovation and Technology Management*, Vol. 15 No. 3, pp. 1-26.

- Utterback, J.M. (1994), *Mastering the Dynamics of Innovation: How Companies Can Seize Opportunities in the Face of Technological Change*, Harvard Business School Press, Boston, MA, p. 253.
- Utterback, J.M. and Acee, H.J. (2005), "Disruptive technologies: an expanded view", *International Journal of Innovation Management*, Vol. 9 No. 1, pp. 1-17.
- Walrave, B., Talmar, M., Podoynitsyna, K.S., Romme, A.G.L. and Verbong, G.P.J. (2018), "A multi-level perspective on innovation ecosystems for path-breaking innovation", *Technological Forecasting and Social Change*, Vol. 136, pp. 103-113.
- Wang, J.C., Wang, Z., Wang, Y.Y. and Lai, F. (2017), "Impacts of information reliability in a supply chain with market disruption risks", *International Transactions in Operational Research*, Vol. 24 No. 4, pp. 737-761.
- Webb, A. (2020), "The 11 sources of disruption every company must monitor", *MIT Sloan Management Review*, Vol. 61 No. 3, pp. 65-70.
- Weeks, M.R. (2015), "Is disruption theory wearing new clothes or just naked? Analyzing recent critiques of disruptive innovation theory", *Innovation: Management, Policy and Practice*, Vol. 17 No. 4, pp. 417-428.
- Yoo, Y., Lyytinen, K., Thummadi, V. and Weiss, A. (2010), "Unbounded innovation with digitalization: a case of digital camera", *Annual Meeting of the Academy of Management*, pp. 1-41.
- Yu, D. and Hang, C.C. (2010), "A reflective review of disruptive innovation theory", *International Journal of Management Reviews*, Vol. 12 No. 4, pp. 435-452.

Appendix

Interviewee #	Company	Date	Position
1	A	19.8.2019	President, Business area
2	B	20.8.2019	Director, R&D
3	C	4.7.2019	Executive Vice President, Business area
4	C	9.8.2019	Executive Vice President, Business area
5	C	30.8.2019	Executive Vice President, Technology
6	D	15.8.2019	Director, Business development
7	E	14.9.2019	Director, Business development
8	F	12.8.2019	President, Digital business
9	G	4.9.2019	Vice President, Marketing
10	H	29.8.2019	Director, Business Development
11	I	4.7.2019	President, Business area
12	I	2.7.2019	Executive Vice President, Strategy
13	I	2.7.2019	President, Digital business
14	J	10.9.2019	Vice President, Business area
15	J	13.6.2019	Director, Strategy

Table A1.
List of interviewees

Corresponding author

Arto Wallin can be contacted at: arto.wallin@vtt.fi

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgrouppublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com