HOW FEAR CAN AFFECT THE PURSUIT OF NOVEL TECHNOLOGIES IN INCUMBENT FIRMS

INTRODUCTION

Novel technological opportunities that lie in distant domains, characterised by low levels of competition, can be a source of superior performance for firms (Gavetti, 2012). In this respect, scholars have sought to understand incumbents' (in)ability to leverage novel technologies that are based on fundamentally new knowledge and/or resources (Eggers & Park, 2018). Famously, Polaroid surrendered their market leadership on the basis that they were unable to capitalize on digital photography, despite being a frontrunner in the technology's development (Tripsas & Gavetti, 2000). Scholars have tried to explain this phenomenon using concepts like organizational routines (Cyert & March, 1963), resource and capability bases (Leonard-Barton, 1992) and market incentives (Christensen & Bower, 1996). A particularly prominent stream of work has been managerial cognition, which links incumbents' behaviour to the mental processes of its managers (Walsh, 1995; Danneels, 2011). However, because emotion can "colour information processing" (Gavetti, 2005: 614), scholars have begun to consider the role of emotion in this process (Hodgkinson & Healey, 2011; Huy, 2011; Powell, Lovallo & Fox, 2011).

Emotion "begins with a focal individual who is exposed to an eliciting stimulus, registers the stimulus for its meaning, and experiences a feeling state and physiological changes, with downstream consequences for attitudes, behaviours, and cognitions, as well as facial expressions and other emotionally expressive cues" (Elfenbein, 2007: 315). It is the output of a cognitive appraisal process, with implications for how actors think, behave and communicate (Ellsworth & Scherer, 2003; Izard, 2009). Although an individual-level phenomenon, emotion may also become shared at the group-level, leading to similar behaviours and cognition that can influence the pursuit of novelty. A prominent experience in this process is likely to be fear. This is because fear is

triggered by appraisals of perceived threat and uncertainty (Smith & Ellsworth, 1985; Lazarus, 1991), and the pursuit of novelty is characteristically uncertain and often perceived as potentially dangerous (Baumgartner, Pieters & Bagozzi, 2008).

Prior studies have positioned fear as an impediment to organizational strategy-making and attempts to innovate (e.g. Hodgkinson & Wright, 2002; Liu & Maitlis, 2014; Vuori & Huy, 2016; Brusoni et al., 2020) on the basis it typically motivates withdrawal and avoidance behaviours in actors. However, during our study emergent insights suggested the opposite to be true. Namely, that fear could *facilitate* the pursuit of novel technology in incumbent firms. Surprised at this divergence between our data and extant theory, we asked: *how does fear affect the pursuit of novel technologies in incumbent firms?*

We examined this question through a 24-month ethnography, where we followed the attempted commercialization of a particularly novel form of security technology at a communications incumbent called TechCorp (pseudonym). The novelty of the project meant it was likely to evoke strong emotional responses, making it a theoretically relevant case to study (Eisenhardt & Graebner, 2007). We develop a process model showing how fear can affect the pursuit of novel technological opportunities in incumbents with structurally separate and autonomous exploration and exploitation divisions, which highlights how actors involved in this process may experience different forms of fear, and how fear can behave as both a motivator and inhibitor of the pursuit of novelty. We posit that whether fear motivates the pursuit or rejection of novel technology depends on actors' subjective appraisals, namely whether they see novel technology as a way to avoid a threat, or as a source of threat. Ultimately, our model highlights how novel technologies may emerge at incumbents not on the basis of rationality and intention, but as a result of conflicting fears that can cause indecision.

Our paper offers three important contributions to theory. First, we extend existing work on fear in the strategy and innovation process (e.g. Maitlis & Ozcelik, 2004; Liu & Maitlis, 2014; Vuori & Huy, 2016; 2020; Brusoni et al., 2020) by suggesting under what conditions fear may act as a motivator and inhibitor. In doing so, we propose the communication of novel technologies in terms of aspirations as a potential mechanism through which this might occur, and a problem-focused coping strategy (Lazarus & Folkman, 1984; Gross, 2015). We argue that fear should therefore be seen in a more contingent fashion than prior theorization (Lebel, 2017). Second, we extend existing unidimensional conceptualizations of fear (e.g. Kish-Gephart et al., 2009; Liu & Maitlis, 2014; Vuori & Huy, 2016), introducing the concepts of fear of failure and fear of missing out, and distinguish what their behavioural consequences may be. Third, we contribute to the literature on emotional framing (Raffaelli et al., 2019) and the political use of communication (Ocasio, Laamanen & Vaara, 2018) in organizations, suggesting that how novel technologies should be emotionally communicated (i.e. in terms of positive or negative emotion) may depend on who is communicating, and their position in the organizational hierarchy.

THEORETICAL BACKGROUND

A cognitive perspective on the challenge of incumbency

A dominant lens for examining how incumbents pursue novel projects and technologies has been managerial cognition. This posits that the pursuit of novelty is predicated upon the mental processes of managers within the firm (Hambrick & Mason, 1984; Walsh, 1995; Gavetti, Greve, Levinthal & Ocasio, 2012), particularly their ability to match opportunities and organizational capabilities (Eggers & Kaplan, 2013). Since humans are boundedly rational (Simon, 1955) and the external environment is complex, organizational actors form simplified mental representations of the world to impose meaning upon it, in order to interact with it (Barr, Stimpert & Huff, 1992;

Gavetti, 2005; Hodgkinson & Healey, 2008). Doing so helps make the world comprehensible and enables strategic decision-making (March & Simon, 1958).

However, the mental representations that managers and employees may form are subject to a variety of different biases that might lead to inaccurate understandings of reality (e.g. Tversky & Kahneman, 1974; 1981; Staw, Sandelands & Dutton, 1981; Kahneman, Knetsch & Thaler, 1991; Hodgkinson et al., 1999; Teece, 2007). Equally, managers have a finite amount of attention (Ocasio, 1997) which means they will typically attend to certain aspects of the environment at the expense of others. As a result, novel ideas and technologies are often unwisely rejected by managers at incumbent firms (e.g. Tripsas & Gavetti, 2000; Danneels, 2011). 'Cognitive inertia' is a prevalent affliction where managers fail to update their mental models, causing them to become outdated, which subsequently undermines the firm's ability to transform (Hodgkinson, 1997). Thus, the capacity to pursue novelty depends on managers' ability to update their mental models of the world. Effective cognitive change is therefore a critical – albeit difficult to achieve – determinant of firm performance (Barr et al., 1992; Gavetti & Levinthal, 2000; Gavetti, 2005).

While the cognitive perspective has afforded rich insights, it has been criticized for marginalizing and/or ignoring the potential role that emotion might play (Gavetti, 2005; 2012; Powell et al., 2011; Hodgkinson & Healey, 2011), in light of evidence that cognition and emotion are interrelated (Izard, 2009). Moreover, there is evidence to suggest that the foundations of effective cognitive change are in fact *affective*, where success depends on how the emotional responses of such endeavours are managed (Hodgkinson & Healey, 2011; Healey & Hodgkinson, 2017). Therefore, behaviourally plausible accounts of how incumbents pursue novel technology requires us "to understand what role emotion plays in it" (Simon, 1967; 1983: 29).

An emotional perspective on the incumbent pursuit of novelty

Increasingly, scholars have considered the potential role that emotion might play in the incumbent pursuit of novelty. When managers and employees interpret information, they do so not only to make the 'best' decision given their subjective interpretations, but also to understand its implications for their own wellbeing and personal goals (Vuori & Huy, 2020). The emotions they experience can affect how they act, and may also become shared at the group-level (Menges & Kilduff, 2015). Since organizations consist of various groups with different goals (Cyert & March, 1963), this can cause different emotional dynamics to emerge that influence novel projects.

Evidence suggests that positive emotions can help facilitate incumbents as they pursue forms of novelty (Raffaelli et al., 2019) by fostering openness to, and acceptance of, new information (Fredrickson, 2004). The idea is echoed in the literature, with many advocating the use of opportunity frames and positive emotion to elicit flexible organizational responses to facilitate innovation and change (Ravasi & Schultz, 2006; Kennedy & Fiss, 2009; Bartunek, Balogun & Do, 2011 Dalpiaz, Rindova & Ravasi, 2011; Bundy et al., 2017). Strategy researchers have reported that positive emotion enables effective strategizing by establishing interpersonal alignment (Liu & Maitlis, 2014), can increase investors' confidence in early-stage investment decisions (Huang & Pearce, 2015) and help entrepreneurs gain access to key social resources required to seize opportunities (Huy & Zott, 2019). Hope – a distinct future-oriented positive emotion concerned with future events that may have positive or negative consequences – has been linked to organizations' ability to fulfil high-stakes goals and address grand challenges (Huang, Souitaris & Barsade, 2019; Sawyer & Clair, 2021), innovate (Baumgartner, Pieters & Bagozzi, 2008), and ease tensions between historical and new narratives (Holstein et al., 2018).

In contrast, negative emotion has generally been positioned as an impediment to strategy and innovation. For example, anger has been linked to decreased quality of strategic decision-making (Meissner, Poensgen & Wulf, 2021) and increased employee resistance (Kim &

Maugborne, 1998). However, others suggest that in moderate amounts anger can enhance creativity (Yang & Hung, 2014), which might be beneficial early in the innovation process, and potentially facilitate sensemaking and the development of emergent strategies (Kudesia, 2021).

There has been particular interest in the role that fear might play in organizational innovation and strategy. Typically motivating withdrawal and avoidance behaviours, fear can impede effective collaboration in strategy work (Hodgkinson & Wright, 2002; Maitlis & Ozcelik, 2004; Liu & Maitlis, 2014) and reduce employees' willingness to voice opinions (Kish-Gephart et al., 2009). Fear may also affect how information is shared (Vuori & Huy, 2016), processed and considered (Vuori & Huy, 2020), as well as the propensity to share mistakes and errors (Dahl & Werr, 2021). It can also inhibit managers' willingness to explore and pursue distant opportunities (Brusoni et al., 2020), thereby impeding organizational learning and innovation. Novel projects and technologies may also trigger identity threats for organizational actors, creating fear, anxiety and anger that prevent change from occurring (Huy, 2002; 2011; Healey & Hodgkinson, 2017).

While strategy and innovation scholarship implies that negative and positive emotion are (un)desirable respectively, there are a number of conceptual works challenging this position (e.g. Hodgkinson & Healey, 2011; Healey & Hodgkinson, 2017; Salvato & Vassolo, 2018). Adopting a more functional perspective on emotion, these authors argue that the behaviours promoted by negative emotion might be beneficial in some circumstances – for example, motivating increased critical thinking and attenuating over-optimism, potentially leading to more realistic and accurate understandings of novel technological opportunities. There is also emerging field evidence that the promotion of positive emotions can lead to oversights in organizational learning (e.g. Dahl & Werr, 2021), damaging performance. Initially, we sought to better understand these inconsistencies and explicate the nature of emotion in the pursuit of novel technologies in incumbent firms.

The experience of fear

As the research process progressed, emerging insights in our data underscored the salience of fear in in the pursuit of novel technology. However, they suggested that fear *facilitated* this endeavour (cf. Liu & Maitlis, 2014; Vuori & Huy, 2016; 2020; Brusoni et al., 2020). Given this diverged from extant theory, we focused on understanding how fear could affect the pursuit of novel technologies in incumbent firms. We review the literature here to situate later discussion.

Fear is an emotion concerned with appraisals of danger or threat, and low or uncertain coping potential (Frijda, 1986; Lazarus, 1991). Fear, like surprise, is elicited by appraisals of uncertainty, but is an unpleasant experience whereas hope may be either pleasant or unpleasant, depending on the extent to which the eliciting stimulus is motivationally congruent or not (Lazarus, 1991; Lerner, Li, Valdesolo & Kassam, 2015). Similarly, fear differs from anger – which is concerned with goal-blockage – since anger is characterised by appraisals of certainty and other responsibility, therefore motivating approach tendencies as a way of addressing wrongdoing, whereas fear leads to withdrawal (Lazarus, 1991; Lerner & Keltner, 2001).

Fearful individuals are generally motivated to withdraw from or avoid a situation or stimulus as this can create space between the individual and feared threat to enhance chances of survival (Frijda, 1986). However, this is not sacrosanct: individuals will behave in whatever manner they perceive to be the most effective form of protection, thus fear may lead to freezing and approach behaviours too (Blanchard & Blanchard, 2008). Psychophysiological adaptations induced by fear to aid survival include dilated pupils, raised heart rate, increased cortisol and adrenaline secretion, narrowing of attention, increased risk-judgement (i.e. pessimism) as well as prioritisation of short- over long-term goals (Baumeister, Vohs, Dewall & Zhang, 2007; Kish-Gephart et al., 2009; Damasio & Carvalho, 2013).

Fear and anxiety are two closely related emotions, which some authors choose to distinguish between (e.g. Lazarus, 1991), whilst others do not (e.g. Baumgartner, Pieters &

Bagozzi, 2008; Kish-Gephart et al., 2009; Cacciotti & Hayton, 2015). Lazarus (1991) argues that fear is elicited by sudden, concrete danger of physical harm whereas anxiety is brought about by less proximate, more existential threats and dangers. On this basis, we do not distinguish between the two since they are simply ways in which the body protects itself from harm or threats, real or actual. Fundamentally, fear and anxiety share the same core theme, in that they are both negatively valenced emotions evoked from appraisals of threat in the environment that the individual(s) in question deem they are unable to control (Cacciotti & Hayton, 2015). We therefore follow others and do not distinguish between fear, anxiety and worry in this study.

METHODOLOGY

Research Context

Our study took place at a communications incumbent we call TechCorp (pseudonym), where we followed the attempted commercialization of a particularly novel form of security technology called quantum key distribution (QKD). Nowadays, TechCorp employ c.150,000 employees in over 150 countries around the globe, with annual turnover in excess of $35 billion (Annual Report, 2020). Structurally, TechCorp are differentiated, with customer-serving business units for different product-market domains (CSUs) alongside a structurally separate and autonomous Research and Development (R&D) department. TechCorp thus separate their exploratory and exploitation functions.

A major concern for TechCorp was the advent of quantum computing. The provision of secure communications capabilities to customers globally was a main source of revenue, which quantum computing threatened to derail owing to their superior processing power. Having engaged with numerous possible technologies, TechCorp's R&D department were convinced that QKD was the best solution to this problem. QKD is an innovative method of key distribution technology,

where secret keys are transmitted between points in individual particles of light. Any attempts to intercept and decipher these keys alters the fundamental physical state of the photos, allowing the users to know accurately whether their communication has been tampered with or not. Compromised keys can be disposed of, and the process repeated to ensure the sanctity of communication. Critically, being based on principles of quantum physics rather than classical mathematics, QKD was not susceptible to quantum computing attacks.

Data Collection

We carried out a 24-month ethnographic study (Van Maanen, 2011) where the first author was embedded in the field for the duration of study. At the outset, our initial aim was to understand the realities of (un)successful incumbent innovation, which we felt could be achieved through prolonged proximity to those trying to innovate at TechCorp (de Rond & Lok, 2016). When our focus shifted to the role of emotion and then fear in this process, our proximity had enabled rapport to be developed such that informants were willing to talk about their experiences and emotions candidly, allowing us to examine this phenomenon in real-time.

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Observations (obs) & Informal conversations (con). The first author was a non-participant observer (e.g. Kaplan, 2008) at TechCorp, where participants were aware of his identity and purpose for being there. During the 24-months of study, we attended 72 distinct events over 62 days in the field, including weekly team meetings, meetings between different TechCorp business units, meetings with customers, customer workshops, as well as industrial events and government-funded project workshops. Detailed field notes were taken at all events, including reflective memos on what we had observed after the event.

We sought to understand how the attempted commercialization of QKD was taking place, and how individuals and groups contributed towards and influenced this activity. We were attentive

to what was (not) said during the interactions between individuals and groups, and became particularly observant of voiced feelings and non-verbal communication when we explicitly focused on emotion. Sufficient familiarity meant that the first author was invited to socialize with the participants of study outside the typical context of their work (e.g. lunches, coffee mornings, after-work drinks, celebratory events), making our ethnography multi-sited (Marcus, 1998). This helped us develop an intricate understanding of the phenomenon and produce an authentic account.

A critical source of data was our informal conversations with informants whilst in the field. Such conversations were unplanned, "unstructured conversations that arose spontaneously in everyday work situations" (Golden-Biddle, 2021, p.1956). Typically, these took place before and after interviews, meetings and events, when the audio recorder was off. This often provided us with an unfiltered insight into what informants thought or felt about the commercialization of QKD, as well as an opportunity for us to probe and check our understanding based on our initial analysis.

Semi-structured interviews (int). We conducted 81 interviews with various members of TechCorp's R&D and CSUs, across the hierarchy. We also spoke with government officials, academics, consultants and suppliers involved in the attempted commercialization of QKD to develop a more balanced understanding, under the guarantee of anonymity. Interviews ranged from 25 to 140 minutes, but were 45-60 minutes on average. They were audio recorded and transcribed.

Initially, interviews were used to understand the nature of the innovation process at TechCorp, speaking to informants who were knowledgeable about this process. As our analysis developed, our sampling strategy became more theoretically driven, as we sought to elucidate emerging theoretical insights. Interviews were primarily used to trace events and pinpoint facts about the commercialization of QKD, but – as our analytical focus developed – we also sought to understand how informants felt about these processes. Establishing psychological safety

(Edmondson, 1999) was therefore vital to gain honest insights, which was aided by the first author being treated as an insider by informants.

Although predominantly a real-time study, we tried to mitigate the potential for retrospective biases (Huber & Power, 1985) using two established techniques: event tracking and courtroom questioning (Ozcan & Eisenhardt, 2009). Event tracking involves getting informants to chronologically recall and 'walk through' events, whilst courtroom questioning entails pressing informants for facts (e.g. what, when, where and who). Using episodic memory in this way has been shown to provide more comprehensive and accurate accounts (Tulving, 2002), and there is evidence that emotions are encoded and attached to events, particularly when they are high-energy (Russell, 2003). Thus, if an event can be recalled, the emotion can be too (Vuori, 2018). We relied on these established precedents for investigating emotion through interviews (e.g. Vuori & Huy, 2016; 2020). In combining insights from multiple informants across the hierarchy with our other data sources, we were confident that our insights were trustworthy and authentic.

Archival Documentation (doc). We collected both private and publicly available documents, totalling over 3,000 pages of A4 (single-spaced) using Google and Lexis Nexis. At first, we used documents to establish a case history and familiarise ourselves with the research setting (Edmondson & McManus, 2007), to develop initial lines of inquiry and questioning. We read news and media articles, as well as academic literatures to understand what QKD was, its market, and who were key actors. We also gathered and read annual reports, presentations, press releases and news articles which could help us understand its potential role at TechCorp, and the key personnel at the firm. When we began our fieldwork, we gained access to various internal documents from informants, such as performance scorecards, white papers and confidential strategy information that enriched these initial insights.

As our research progressed, we continued to collect and analyse documents to ensure we had an accurate understanding of both the internal and external environment relating to the attempted commercialization of QKD. However, documents were increasingly used to corroborate insights from our observations, informal conversations and interviews. This multiple source triangulation allowed us to address potential biases in any single data source and ensure the veracity of our insights (e.g. Raffaelli, 2019).

Data Analysis

We followed established precedents for grounded-like research (Gioia et al., 2013) where data collection and analysis took place concurrently. We were attentive to emerging theoretical insights which subsequently guided further data collection. Although we initially set out to inductively derive theory about the challenges of incumbent innovation, a puzzling dynamic emerged within our empirical data, causing us to become abductive in our analysis (Mantere & Ketokivi, 2013). Abduction is increasingly popular amongst scholars (e.g. Smets et al., 2015) as a mode for generating new theoretical insights through the interplay of empirical data and existing theory. Engaging with multiple different theories that might explain the empirical puzzle leads to the development of plausible conjectures and thus the emergence of new theoretical insights.

Specifically, we were puzzled by the fact that despite the CSUs rejecting QKD and labelling it as a technology they did not need or were interested in, the R&D department remained adamant that it needed to be commercialized now and continued to allocate resources to the project. Given the CSUs held decision-making authority for which products and services to offer to customers, the behaviour of the R&D department was perplexing. Subsequently, we began to speculate about possible explanations through extant theory.

We considered multiple potential theoretical frames, including business ecosystem, disruptive technology and managerial orchestration capabilities, before noticing similarities

between the notion of 'hot' and 'cold' cognition as described by Hodgkinson and Healey (2011). It seemed plausible that the divergent responses to QKD might be explained by different emotional reactions, and so we carried out a pilot coding exercise to test this hypothesis. Pilot coding revealed numerous emotions including joy/happiness, anxiety, fear, pride and jealousy in our interviews, whilst we had recorded instances of frustration, joy and worry in our field notes. In re-examining collected documentation, we noticed that informants we had interviewed were quoted in media reports and press released as being "extremely excited" at the prospect of TechCorp providing QKD. Emotion seemed to be the most plausible explanation for our data, and so with good theory-data fit we refined our research question to *"how does emotion affect the pursuit of novel technological opportunities in incumbent firms?"* and re-coded our data. As our analysis progressed, our focus again shifted to become *"how does fear affect the pursuit of novel technologies in incumbent firms?"* due to the prevalence of fear-related codes and their apparent contradiction of prior theory.

Coding our data

Our coding followed the steps outlined by Gioia et al. (2013), involving iterative rounds of first- and second-order coding. Our first-order codes adhered to participant terms ('in vivo'), which we then grouped into categories of similar codes (second-order themes). Whilst staying close to participant terms where possible, our second-order themes became researcher-centric as we started to build on existing concepts in the literature. We regularly reviewed and distilled our second-order codes to a manageable number by merging similar or related categories. For example, we had codes including *worrying about progress of project*, *worrying about likelihood of success*, and *senior manager pressure for progress*. Upon reflection, we felt these were internal sources of threat to this group, consolidating them under one theme: *Internal perceived threats to commercialization of QKD*. This process of first- and second-order coding was iterative and continued alongside data

collection and engagement with theory, until we felt we could adequately explain the phenomenon (i.e. theoretical saturation). We then developed our process model by iterating between diagrams, informants' claims of relationships, as well as existing theory. Finally, our aggregate dimensions were established and labelled as abstract labels for different stages in the observed process.

To identify explicit instances of emotion in our data, we used established synonyms from the Geneva Affect Label Coder (GALC – Scherer, 2005). We combined this with established precedents set by others (e.g. Huy, 2011; Vuori & Huy, 2016; 2020), and used appraisal theories of emotion (for review, see Ellsworth & Scherer, 2003), to verify that the emotion being described was accurate. We also used appraisal theories (Lazarus, 1991) to help identify implicit instances of emotion, given appraisal theorists suggest that emotions are evoked by distinct appraisal patterns and therefore if this can be identified, the emotion itself can be inferred.

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Building our process model

In seeking to understand the emotional dynamics involved in the pursuit of novel technology in incumbents firms, we used established techniques for process theorizing (Langley, 1999). Initially, we established a visual timeline of key events and occurrences relating to the attempted commercialization of QKD at TechCorp, primarily using document analysis and interview data. As the research process progressed, we began integrating further insights from observations and informal conversations as well. When we began identifying different emotions, we labelled these on our map, which allowed us to temporally bracket three time-periods characterised by particularly prevalent emotions within the groups.

Having decomposed our data into three time periods, we examined each period more closely to speculate about the antecedents and consequences of these emotions. For example, we noted that R&D's fear of failure (Phase 2) seemed to follow a meeting between R&D and the CSUs,

and the intensity of this fear of failure seemed to grow with the announcement that it was an organizational target for the R&D department. In tandem with interview and conversation data, we learned that the outcome of this meeting contributed to this emerging emotional experience.

Throughout this process we conducted regular member checks to ensure our account accurately reflected the lived experience of our participants (Pratt, Kaplan & Whittington, 2019). These meetings also helped refine our emerging model. Typically, our member checks were informal and carried out before, during or after interviews or observations. However, we also held six formal feedback sessions to various members of the organization and its hierarchy throughout the research process to establish the veracity of our insights.

FINDINGS

Our empirical analysis illuminated the emotional dynamics involved in the attempted commercialization of QKD at TechCorp, and alluded to the antecedents and consequences of these. Specifically, our findings highlight the salience of fear in this process, and showed how this shaped subsequent cognitions and actions amongst R&D and CSU managers and employees. We present our findings in three stages, which are then synthesized into a process model in the next section.

Phase 1: Inertia at TechCorp

STRUCTURAL-BEHAVIORAL ANTECEDENTS OF INERTIA

(a) R&D's exploratory logic. TechCorp operated using a multi-divisional structure, meaning their R&D department was structurally separate and autonomous from their CSUs. Although responsive to the needs of the CSUs, R&D were primarily accountable for exploring nascent areas of science and technology outside of the firm's core business (doc). Put simply, R&D were solely responsible for exploration at TechCorp:

> "About 70% of our research is what we would call 'core' and it's very much linked to what the business needs are… Other areas of our research are more long-term, maybe

> looking at things that are slightly to the side, slightly orthogonal to what the business thinks it needs, but actually we think they need to be aware of" (TM 3, R&D).
>
> "We are the dreamers and thinkers of tomorrow" (Emp 11, R&D)

The focus on external technological developments occurring outside of TechCorp's core business manifested as a strong exploratory logic, which was corroborated by confidential corporate scorecards we were shown (doc). These emphasised the introduction of "new products and services that might give [TechCorp] a competitive advantage in the market" (doc) as their key performance indicator.

(b) CSUs' exploitative logic. Structurally separate from R&D, the CSUs held clear exploitative logics. Their focus was "selling products that exist today" and "meeting market needs" across various product-market domains (TM 5, R&D) to generate revenue and maintain the firm's viability in the immediate term. Each CSU was concerned with upholding their own product-market domain through incremental improvements and innovations in existing products and services. This was surmised by one informant who explained:

> "CSUs are more customer-pull rather than technology-push: it's difficult to get seniors [top managers] within CSUs engaged with new technologies because they are focused on the portfolio of products and services they provide and the economic return that they will provide" (MM 2, CSU).

The dominant exploitative logic of CSUs was also corroborated in confidential corporate scorecards emphasizing financial outcomes, such as return-on-assets (ROA) and return-on-investment (ROI), as the primary metrics of performance for CSUs (doc).

(**c) R&D's positive appraisal of novel technology.** The distinct logics held by R&D and CSUs respectively led to different appraisals being made of QKD, a highly novel security technology. R&D identified QKD as a potentially transformative technology for TechCorp, believing it could address the threat posed by the emergence of large-scale quantum computing, which would render their existing encryption techniques obsolete (doc, con).

Since R&D's performance was evaluated on their ability to deliver radically new technologies to the business, the possibility of commercializing QKD evoked strong positive appraisals by R&D managers. It was well-placed to help them fulfil their performance targets. These positive appraisals were evident during interviews when we asked about the technology's prospects:

> "If [QKD] takes off, it will completely revolutionize interconnectivity, not just from the customer to the business, but business-to-business, business-within-business… the revenue opportunities are **huge**, beyond belief" (Emp 1, R&D).

> "It is [QKD] the kind of capability we expect to underpin our entire infrastructure" (MM 3, R&D).

However, we discovered many of these appraisals were unsubstantiated. When pressed to elaborate, one informant responded: "well I don't have [the numbers]. David probably does, if not, Charlotte from all the talks and presentations. They'll certainly have them…it's worth asking them." Yet, we learned that the entire market for quantum-secure communications was approximated at a total of $70 million over the next five years (doc), and QKD was only one aspect of this. TechCorp could therefore only expect a fraction of this figure. Nevertheless, favourable revenue figures were propagated by R&D in presentations that we attended (obs), whilst a demo using prototype QKD technology was used to showcase its 'cool features' at the organization's R&D facility.

(d) CSUs' negative appraisal of novel technology. The CSUs' exploitative logic and corporate goals around generating revenue meant QKD was interpreted through an economic lens. CSU managers were less concerned with QKD's 'cool' features, and more focused on revenue projections and financial estimates. The lack of a clear market therefore undergirded their decision not to support the technology.

> "I spoke about how there are companies out there selling the technology right now, and so what you've got, you've got the potential to sell QKD technology today. Now we haven't

> – as a company – taken the decision to do that, and the main reason is because we are customer-driven, in terms of demand. If we don't see a customer demand on something, then we aren't going to spend time, effort, and money trying to support that" (MM 1, R&D).
>
> "What [R&D] really need is a customer, because in the end we need to try and make money. Despite my feelings, if customers say they want this and are going to pay for this, then I'm not going to cut my nose off to spite my face" (TM 2, CSU).

Whilst R&D was described as "the most patient money in the business" (TM 2, R&D), QKD was too distal a proposition to consider for CSU TMs. CSU managers highlighted how QKD always seemed to be "five to ten-years away" and this was "optimistic" (obs). A report developed for a government-funded project by TechCorp of outlined global demand at less than 1,000 units (doc), resulting in QKD being rebuffed as interesting but not (currently) viable or valuable (obs).

INERTIA TOWARDS NOVEL TECHNOLOGY

(e) CSU inertia towards novel technology. In light of the limited customer demand for QKD, the CSUs exhibited an aversion towards pursuing the technology and thus remained inert. CSU TMs were forthright with doubts as to whether QKD was even necessary:

> "If QKD was something you could press one button and it was there, no problem. But you potentially have to alter infrastructure, you potentially have to put in a whole specific infrastructure for this capability, and it might only work on one part of the network. You have to do a lot of plumbing to make it work across your whole infrastructure. Essentially, would you go to all that effort for what might be a small percentage of likelihood that you face this as an issue?" (TM 1, CSU)

CSU MMs blamed "resource constraints" (MM 1, CSU) and "performance targets" (MM 2, CSU) as reasons why QKD and other novel technologies historically were ignored or rejected in favour of more incremental courses of action. Incremental solutions were seen as less "high-risk" (TM 1, CSU) and better suited to fulfilling their revenue goals.

R&D managers lamented how the CSUs operated on an 18-month time horizon (con). Efforts to engage the CSUs over exciting technological opportunities often fell on deaf ears when revenue couldn't be delivered within this time horizon (con). Informants from both R&D and the

CSUs highlighted one CSU who had been tasked with doubling their revenue in three years (con). Such a financial orientation further exacerbated the firm's myopic and inertial tendencies.

Phase 2: Emerging fears at TechCorp

R&D's EMERGING FEAR OF FAILURE

(f) Perceived external threats to commercialization of QKD. Given the CSUs' commercial concerns, R&D sought evidence of market support (obs). They hoped "to see…someone making a 'big bet'…putting a lot of money into [QKD]" (MM 1, R&D), which might provide impetus for the CSUs to adopt QKD despite the uncertainty. However, it seemed that organizations engaging with QKD were doing so off the back of government funding rather than investing their own capital (obs, doc). This led one R&D informant to describe that QKD "is more like part of a government-sponsored exercise than a truly healthy, commercial activity moving towards a new product" (Emp 10, R&D).

QKD's limited commercial prospects were reaffirmed during a meeting we observed between global communications incumbents, where unanimous concerns were raised about its economic viability given the lack of customer interest (obs). Whilst this could've been competitive misdirection, we were told the industry was still "pre-competitive" (Emp 4, R&D; MM 5, R&D), an insight corroborated by other informants (TM 1, QKD Co; TM 1 & TM 2, Quantum Solutions; TM 1, Government). Further investigation confirmed that only four out of the twelve participating organizations were actively researching QKD at the time (doc).

There was also evidence that customer support was indeed low. During a technology demonstration, an informant described how a prospective customer "came up and said 'yeah, so what? It's an expensive student project, isn't it? Why would we do it?'" (Emp 10, R&D). Prospective triallists also showed little urgency in committing to trials (obs), whilst the interest

shown by the most promising potential customer at the prospect of a trial (obs), quickly became "dead-end" just weeks later (obs). Poignantly, R&D failed to attract *any* customers whatsoever to an event held to celebrate their pioneering work around delivering QKD using extant infrastructure and technology (obs). Ultimately, without customer support, the CSUs' stance on QKD would not change. Commercialization remained a distant prospect.

(g) Perceived internal threats to commercialization of QKD. Although some R&D TMs held high hopes for QKD, other informants began voicing doubts. One informant who worked closely on the technology conceded that QKD was "unlikely to revolutionize communications networks for a very long time" (MM 5, R&D). This was problematic, because you needed "one of the businesses [CSUs] to go 'yep, I want that in my portfolio." (MM 4, R&D) but this was unlikely to happen without reasonably immediate commercial prospects. The informant went on to state:

> "We have warnings around it [QKD], the biggest is we don't have any customers crying out for it. So, in the end, if we had customers, everyone would forget about any of these issues and cash in, but we can't. It's not being sold, and it's not obvious. It would make a huge difference [in terms of CSU support] if we had people going 'I need that in my network." (MM 5, R&D)

In meetings we observed, the CSUs expressed a general lack of support (obs), with CSU informants explaining that "the more pilots and success stories that come out of quantum computing, the more action people are going to take" (TM 1, CSU). However, until the threat of quantum computing crystallized, the demand for quantum-secure solutions like QKD wasn't ostensive. Subsequently, the CSUs would not support the technology's proposed commercialization.

(h) R&D's fear of failure. QKD's limited commercial prospects translated into a lack of CSU support, making the proposed commercialization unlikely. We learned R&D "need[ed] to be able to show big, thought leadership…every two years, R&D need[ed] a big win" (MM 5, R&D), and TMs saw QKD as a way to do this, even naming its commercial delivery within two years a

key department goal (obs, con). Failure to deliver QKD and fulfil these goals began to create a fear of failure amongst R&D personnel, who believed aversive consequences like reduced budgets, redundancy and even department divesture may occur (con).

During interviews, informants described feelings of fear ranging in intensity. One employee told us they were "feeling more worried now [about QKD] than when we last spoke" (Emp 5, R&D). Another revealed that they were "terrified" (Emp 4, R&D) at the involvement of new personnel who lacked the expertise to accurately describe to potential customers what QKD could (not) do. This threatened their ability to deliver QKD, they felt.

Others told us how there was now "lots of pressure on the team [working on QKD]" (MM 5, R&D) from R&D TMs. We discovered that the Head of R&D had "bet their career on QKD" (Emp 6, R&D), and so MMs and employees subsequently felt as though they "had [their] fate in their hands" (Emp 6, R&D; con) which further exacerbated the aversive consequences associated with failing to deliver QKD because this individual was well-liked and respected throughout the department.

Perhaps the most telling instance was when one employee described their "fear of the next [collaborative project] meeting" (Emp 4, R&D), which might be curtailed because of their lack of progress with customers. When asked about the implications for QKD at TechCorp if this didn't change, they looked straight ahead with wide eyes and stated: "we are absolutely fucked if that happens" (Employee 4, R&D).

We discovered that R&D had "strong memories of being punished for failure" (TM 4, R&D). A previous CEO had slashed budgets and enforced significant redundancies such that R&D was almost 10% of the size it once was (con, doc). Therefore, failure to deliver QKD and meet R&D's corporate target for breakthrough innovation was seen to be a major threat to the wellbeing

of the department and its members. Unless R&D could somehow garner CSU interest – which was uncertain – failure was likely to occur.

COMMUNICATING NOVEL TECHNOLOGY USING ASPIRATIONS

(i) Communicating novel technology in terms of internal aspirations. Since TechCorp was "run by accountants" (MM 3, R&D, MM 6, R&D; Emp 6, R&D; Emp 7, R&D; obs), in order for QKD to be commercialized it was necessary to show "a clear path to profit" (Emp 7, R&D). As one MM reflected, "unless [the CSUs] see the immediate threat or profit, they're not going to do much about it" (MM 6, R&D).

R&D personnel began to re-frame QKD and communicate it in terms of the CSU financial goals and aspirations that it could help fulfil, to pique CSU interest. By prospecting the technology with potential customers (obs), R&D established speculative sales figures that were shown to the CSUs on "glitzy slides" (MM 5, R&D) along with figures from other marketing reports (doc, obs). QKD was positioned as a financially attractive, albeit speculative, technology with the potential to become a $5bn global industry and $400 million market for TechCorp. R&D thus sought to align QKD with the CSUs' financial performance goals to encourage their sponsorship and investment (obs).

However, when pressed on these figures, R&D personnel accepted they were inherently speculative (con). The notion of a $5bn industry emerged from previews of external marketing reports that were never bought, and members of R&D acknowledged the actual market would be "an order of magnitude" (Emp 6, R&D) smaller. Nevertheless, informants explained to us that presented financials needed to be significant enough to attract CSU interest. As one informant stated, "the modelling is a tool to win the hearts and minds" (Emp 12, R&D).

Furthermore, having recognized that customers valued the guarantee of absolute security, the R&D department began to pitch QKD as a way of becoming "seen as the provider of choice for trust and security" (Emp 1, R&D). The technology was framed to the CSUs as a way to fulfil one of the CEO's personal wishes: to re-establish the company as "systemically important" (TM 5, R&D) to the nation.

(j) Communicating QKD in terms of external aspirations. Additionally, R&D began to communicate how commercializing QKD could help fulfil external, national aspirations espoused by the government to the CSUs. The government wished to become the "go-to place" (TM 2, Government) for quantum technologies, and had invested billions of dollars attempting to do so (doc). In fact, TechCorp had received funding to the extent that QKD was cost-neutral for the business. The government also held concerns about malevolent state actors attacking critical national infrastructure, thereby necessitating secure communications capabilities (MM 5, R&D; OM 4, R&D; MM 1, R&D). With significant investments being made in many other countries including the United States and China (doc), QKD had become seen as a "national endeavour" (MM 2, R&D), an insight substantiated by various government officials:

> "So, think of this as critical national infrastructure, a critical national capability. Secure comms is in that domain. It is a competition and a race, but it's also one of those things that if you can't be first, you have to be a close second" (TM 2, Government).

> "These are programmes to put us at the forefront of artificial intelligence and the data revolution" (TM 1, Government).

R&D therefore sought to align QKD with this aspiration, portraying it as a way through which TechCorp could become the provider of trust to the nation. This would be a unique differentiation strategy that few – if any – other organizations could pursue. Members of R&D also argued that the government's pro-QKD stance was tangible evidence of demand, to further appeal to and align QKD with their financial performance goals. With other organizations developing their

QKD propositions (obs), there was pressure to act sooner rather than later to re-establish TechCorp as "a national treasure" (TM 5, R&D).

Phase 3: CSUs' ambivalence and indecision

CSUs' EMOTIONAL AMBIVALENCE TOWARDS NOVEL TECHNOLOGY

(k) CSUs' fear of missing out. Amongst global developments in quantum computing (doc) and separate propositions from long-term collaborators OptiCo and Red Technologies to jointly deliver commercial QKD (obs), the CSUs' position on QKD seemed to change. In contrast to their earlier rejection of it as an interesting but not commercially viable technology, they now seemed to fear that they might miss out on the opportunity to competitors.

This outcome would be "highly embarrassing" (MM 3, CSU & MM 4, R&D in obs), whilst one CSU TM referred to the "embarrassment of our competitors doing something we couldn't do," and stated that "we *need* to do [QKD]" (TM 4, CSU in obs). The threat of potential embarrassment was exacerbated by the willingness of R&D TMs to point out that "the rest of the world are doing [QKD], and we're missing out because of you" (MM 4, R&D).

TechCorp had "missed out on stuff before" (Emp 4, R&D) and "been stung" (TM 1, Government) by acting with insufficient haste. These negative experiences were readily recalled and reflected upon by managers (obs), who felt compelled to engage with and pursue QKD. CSU managers "did not want to end up with egg on their face" (Emp 2, CSU) and had a "fear of looking like an idiot" (MM 4, R&D). This resulted in heightened interest and interaction with QKD, demonstrated by increased CSU attendance at internal and external meetings (obs). CSU TMs also began to proactively assign responsibilities amongst their subordinates for overseeing aspects of the QKD project (obs) to ensure they had a detailed understanding of the opportunity.

(l) CSUs' fear of failure. Although warming to the idea of QKD, the CSUs were "cash-strapped" (Emp 2, CSU) yet in pursuit of "stretching revenue targets" (Emp 8, R&D). This meant

their projects "[couldn't] afford to fail" (Emp 8, R&D) if they were to hit targets, creating a proclivity towards more certain, incremental solutions.

Like the R&D department, failure was seen as a threat by CSU actors, with risks to status, job security and departmental funding. We were told that "socially, we [TechCorp] are not long out of the time when you *couldn't* fail" (MM 4, R&D), and an era where employees constantly "feared for their jobs" (TM 2, R&D). This impacted managers' willingness to take risks, making managers primarily "concerned about making money in the short-term" (Emp 2, CSU) to meet revenue goals. Fundamentally, "next year's budget depend[ed] on this year's performance" (MM 4, R&D).

There was "scepticism…about the commercial success of [QKD]" (Emp 4, R&D) amongst CSU managers because "customers [were not] clamouring" (MM 5, R&D) for the technology. The CSUs also "worried that QKD might undermine existing revenues on encryption today" (OM 4, R&D), which might jeopardise their ability to fulfil revenue targets. Ultimately, the thought of pursuing QKD created a fear of failure within the CSUs.

Many informants corroborated this insight. We were told that the CSUs "[had] a fear of taking on novel innovations and them failing" (TM 1, R&D), whilst others told us that the CSUs were "particularly fearful" (TM 5, R&D) and that they "went in [to meetings] looking for reasons not to [do QKD]" (TM 6, R&D). CSU managers were said to be "scared of the unknown" (Emp 10, R&D) and numerous informants described them as "risk-averse" (MM 5, R&D; OM 11; R&D, TM 1, Government; MM 6, R&D; TM 1, R&D, OM 1, CSU), a postulated behavioural consequence of fear (Lerner & Keltner, 2001).

When queried about fearing failure, CSU informants agreed that fear of failure was a principal factor preventing their engagement with novel technologies like QKD (con). Although "petty" (Emp 2, CSU), failure loomed large for CSU mangers, making them uneasy about risk-

laden decisions like QKD. Thus, QKD triggered a fear of failure in the CSUs, motivating withdrawal and avoidance of the opportunity.

EMERGING NOVEL TECHNOLOGICAL CAPABILITIES THROUGH INDECISION

(m) CSUs' indecision. Caught between their fear of missing out on QKD to competitors but held back from committing to QKD by their concerns about its commercial prospects, the CSUs' ambivalence manifested as indecision. Their increased attendance at meetings and general engagement with the QKD project was tempered by the lack of clear financials (obs). Although some "synchrony with the CSUs' strategies" was established, QKD's economic uncertainty surrounding meant it "still [didn't] move the needle" (Emp 6, R&D) to gain acceptance.

Despite emerging success stories from the United States and Japan (obs, doc) and an increasing number of meetings organised by the CSUs to try and facilitate the investment required (obs), they remained unable to entirely accept or reject QKD. This "[slowed] things down" (MM 7, R&D), with one R&D MM wryly remarking: "waiting for a decision on QKD [from the CSUs] is like watching continents drift" (MM 4, R&D). Trapped by their dual fears, the CSUs were seemingly awaiting the 'right' course of action to become clear (con).

(n) Emerging QKD capabilities. Whilst no consensus was reached, work on QKD continued within the R&D department. They began to develop a real-world understanding of the technology and how it might be implemented outside of a lab through "very positive" (MM 8, R&D) field trials that were planned and executed (obs). Triallists included a manufacturing organization and an arm of TechCorp (obs), whilst there was also engagement with the government, who expressed a desire to work with TechCorp on trials and the possibility of TechCorp building part of a national QKD network (obs, con). Such developments were indicative that TechCorp could reliably deliver QKD (i.e. had an emerging capability), whilst members of R&D told us they felt they now truly understood what was required to deliver QKD outside of the laboratory (con).

Reflecting these developments, customers began voicing interest in QKD (obs), corroborated by CSU managers who remarked that they were beginning "to see interest from customers" (TM 4, CSU), whilst R&D produced a report for the CSUs explaining how QKD could work with other quantum-secure solutions in a holistic, hybrid communications system (obs, doc). It was now about scaling up operations for widespread deployment and consumption of QKD. Despite the CSUs' ambivalence, their subsequent indecisiveness towards the technology kept it on the organizational agenda, during which time they became able to reliably deliver QKD. Reliably delivering a "specific and intended purpose" (Helfat & Winter, 2011, p.1244) is the definition of possessing a capability, and so whilst managers at TechCorp were perhaps not consciously aware, the capability to provide QKD had begun to emerge at the organization.

HOW FEAR CAN AFFECT THE PURSUIT OF NOVEL TECHNOLOGIES IN INCUMEBNT FIRMS: A PROCESS MODEL

---- Insert Figure 2 about here ----

As summarized in Figure 2, our findings suggest how fear can affect the pursuit of novel technological opportunities in incumbent organizations. It shows how fear can exist in different forms with differing behavioural consequences, depending on the degree to which actors believe they have the capacity to deal with or avert a feared threat.

Initially, divergent appraisals of novel technology may emerge in incumbent firms where exploration and exploitation functions are structurally separated. This is because novel technologies are aligned with the logic and goals of exploratory business units, eliciting positive appraisals, whereas they are poorly aligned with the more financially-focused logic and goals of exploitative business units, resulting in more negative appraisals. When contestation over the efficacy of novel technology exists, it generally resolves in favour of the more powerful actor (Cyert & March, 1963), which is the exploitative business unit because they provide the critical

resource – finance – to the firm (Lavie, Stettner & Tushman, 2010). Thus, incumbents typically engage with incremental over more novel forms of technology, and display inertial tendencies.

In circumstances where exploratory business units are struggling to fulfil their organizational targets for delivering novel technology and innovation, such a rejection may be construed as a threat and evoke fear responses amongst managers and employees from the department. This response may specifically be a fear of failure when there is a history of being punished for failure within the organization. However, when actors in exploratory business units believe this threat can be avoided by successfully commercializing a novel technology – in this case, QKD – fear of failure can motivate them to act and try to address the threat. In this instance, actors tried to deal with the threat by directly acting on the situation (i.e. problem-focused coping – Lazarus & Folkman, 1984), manifest as communicating how the novel technology could help fulfil the internal organizational goals (i.e. revenue targets) of exploitative business units. They may also convey how it is aligned with the goals of external actors, to confer legitimacy onto the technology and highlight how there is market demand for it, to reiterate how it can be with internal financial goals. In our case, this external actor was the government, but it is feasible that it could be any important stakeholder such as a key customer, supplier or regulator.

Whilst establishing how novel technologies are aligned with the goals of exploitative business units may be intended to create positive sentiments towards them (e.g. Healey & Hodgkinson, 2017; Raffaelli et al., 2019), this outcome is inherently uncertain. Coupled with the use of multiple different aspirations which can create ambiguity, exploitative business units may actually experience negative emotions. They might recognize the opportunity and fear missing out on it to competitors, for the embarrassment it might cause. Again, historical instances of missing out and being embarrassed or ashamed might be readily recalled and experienced in the present as fear, exacerbating this emotion, and motivating them to engage with and pursue novel technology.

However, they may simultaneously experience a fear of failure which motivates them to avoid and reject novel technologies. Without fully understanding whether it will be a commercial success, the idea of pursuing novel technological opportunities may be seen as a threat to revenue goals, and when failure is associated with aversive consequences, trigger fear of failure. Such a duality of fear can manifest as emotional ambivalence towards novel technology, where exploitative business units are torn between pursuing and rejecting them.

When ambivalence stems from dual fears, it can be difficult to choose between the positive and negative orientations. Exploitative business unit actors may fear the ramifications of missing out to competitors if they reject the technology and avert their fear of failure. Equally, the idea of pursuing novel technology to address this threat may evoke a fear of failure if the technology fails to help them fulfil financial performance targets. These emotions can prevent acceptance and rejection, breeding indecision. Although indecision may slow the progress of novel technologies through formal innovation processes, it can keep them on the organizational agenda. Such time and space can allow additional understanding on how to commercially deliver novel technology to accumulate, whilst their economic value might become more ostensive as time passes. Thus, indecision can lead to the emergence of novel technological capabilities within the organization.

DISCUSSION

Fear in the pursuit of novel technology

Our findings offer a more balanced, contingent perspective on the role that fear might play in incumbents as they pursue novel technological opportunities, behaving as both a motivator and inhibitor. We also highlight how different forms of fear may exist. These ideas advance our understanding of fear in strategic management, which we elaborate below.

Fear as a motivator and inhibitor. Our findings contradict prior scholarship positioning fear in strategy and innovation as an impediment (Hodgkinson & Wright, 2002; Maitlis & Ozcelik,

2004; Liu & Maitlis, 2014, Vuori & Huy, 2016; 2020; Brusoni et al., 2020), yet we believe are complementary. Although fear's default action tendency is withdrawal, this can be overridden if actors deem approach or even freezing responses are more likely to have address the danger or threat faced (Frijda, 1986). We provide field evidence of how fear might facilitate the pursuit of novel technology by motivating fearful actors to build positive sentiment around the technology (Healey & Hodgkinson, 2017). Specifically, by communicating how it can fulfil various aspirations. We therefore propose the communication of novel technology in terms of aspirations as a possible problem-focused coping strategy (Lazarus & Folkman, 1984; Gross, 1998) used by fearful actors attempting to facilitate the development of, and investment in, novel technologies.

Critically, we corroborate recent work by König et al. (2021) which states that perceptions of threat – the cognitive antecedent of fear (Lazarus, 1991) – can motivate action under conditions of moderate perceived control. In this study, the belief held by R&D personnel at TechCorp was that they could avoid the threat of failure by commercializing QKD, thus fear was galvanizing and promoted engagement with the novel technology. Our findings also correspond with the literatures on fear appeals in healthcare (e.g. Witte & Allen, 2000), and fear of failure in both entrepreneurship (Cacciotti & Hayton, 2015; Cacciotti et al., 2016; 2020) and psychology (Conroy et al., 2002). All theorize that it is the perception that a threat can be avoided which motivates individuals to act. This view has been largely absent in corporate contexts of innovation and strategy.

We argue for a more contingent perspective to be taken on fear (e.g. Lebel, 2017), since it can free up physical and psychological resources for remedial action (Frijda, 1986). Whilst fear may be undesirable in earlier stages of the innovation process where creativity and a wide lens of attention are important (Amabile et al., 2005), in the latter stages – such as the transition between development and implementation – a narrowing of attention might actually be valuable, as fear could help actors to identify and address threats impeding progress, or to create sufficient

dissatisfaction with the status quo that facilitate their pursuit (Healey & Hodgkinson, 2017). This also brings into focus the importance of managerial emotional capabilities (Huy, 2002) and the ability to up- and down-regulate emotional experiences depending on the action requirements of the situation (Huy & Zott, 2019; Healey & Hodgkinson, 2017; Vuori & Huy, 2020).

Different types of fear. While the presence of fear in attempts at innovation and strategy has been acknowledged, prior conceptualizations have largely been unidimensional (e.g. Kish-Gephart et al., 2009; Vuori & Huy, 2016). Our study suggests that different forms of fear may exist in the pursuit of novel technology– namely, fear of failure and fear of missing out – with distinct behavioural consequences. Consistent with extant theory (e.g. Cacciotti & Hayton, 2015), fear of failure was evoked by fear of the aversive consequences associated with failure, whilst fear of missing out was triggered by the fear of missing out on a valuable opportunity to competitors, leading to embarrassment. Although fear of failure motivated both approach and avoidance behaviours, the nature of fear of missing out seems to solely motivate approach tendencies to avoid the threat of missing out and suffering embarrassment.

Whilst fear of failure has been covered in psychology and entrepreneurship, the concept of fear of missing out is notable. Whilst prevalent in popular culture, it has received scant attention in strategic management research bar fleeting reference in Snellman and Cacciotti (2019). Psychologists have understood it as a desire to stay connected with others, and subsequent driver of consumption behaviours (Przybylski et al., 2013; Alt, 2015), evoked by psychological threat to the self-concept (Zhang, Jiménez & Cicala, 2020). In conceptualizing fear of missing out as caused by the possibility of embarrassment, we understand it similarly, whereby anticipated embarrassment constitutes a potential threat to the social status and wellbeing of managers and employees, triggering an immediate fear response. Such anticipated-immediate emotion pathways

are well-established (e.g. Loewenstein & Lerner, 2003), but we believe we are the first to link anticipated embarrassment as the basis of present-day fear of missing out.

More notably, avoiding a fear of missing out involves approach and engagement behaviours. Thus, fear of missing out could be a powerful tool for overcoming incumbents' inertial tendencies (Hill & Rothaermel, 2003). Additionally, as fear of missing out is predicated on social comparison, this raises questions about practices like benchmarking and the use of social aspirations (Shinkle, 2012), The tendency to benchmark against similar or better-performing firms – commonly referred to as striving social referents (Labianca et al., 2009) – could trigger fears of missing out and motivate approach behaviours. If these social referents are not suitably similar, the courses of action they motivate might be inappropriate and/or dysfunctional for the firm. Similarly to the use of analogies requiring deep structural similarities (Gavetti, Levinthal & Rivkin, 2005), the same could be said for using striving social referents.

How managers emotionally communicate novel technologies. Our findings also contribute to the growing literature on emotional framing (Raffaelli et al., 2019). Given R&D's efforts to gain support for QKD were more effective when they evoked fear in decision-makers, this suggests that prior theory advocating the use of positive emotional frames may need nuancing (e.g. Ravasi & Schultz, 2006; Raffaelli et al., 2019). Whilst prior studied have focused on top management, our study examined more peripheral actors (middle managers and employees). We therefore believe that whether positive or negative emotional frames ought to be used may depend on who is communicating, and their hierarchical position.

When these lower-level actors communicate novel opportunities to decision-makers, often they must first capture their finite attention (Ocasio, 1997; Kaplan, 2008). Managers are known to be sensitive to both threats (Jackson & Dutton, 1988) and losses (Tversky & Kahneman, 1981) more so than opportunities, whilst negative emotions are known to overpower positive ones

(Baumeister et al., 2007). We believe that middle managers and employees may therefore be better served trying to evoke negative – rather than positive – emotions, to establish an issue as salient (Dutton & Ashford, 1993). While negative emotions or unpleasant frames might trigger defensiveness, if it is also communicated how the threat can be avoided, it may motivate fast-paced action by decision-makers (König et al., 2021). This could be seen as a way to regulate the emotions and actions of top management by peripheral actors in the organization (Vuori & Huy, 2020).

We believe that our findings complement existing theory because top managers demand attention, by virtue of their power from being atop the organizational hierarchy (Magee & Galinsky, 2008). Thus, they could frame issues either as opportunities or threats. However, middle managers and employees must *gain* attention of decision-makers before putting their case forwards, for which negative emotion might be more effective when time and attention are precious. We therefore extend Raffaelli et al. (2019) work by introducing position in the organizational hierarchy as a factor influencing the efficacy of different emotional rhetorical tactics. In doing so, we also extend understanding of how emotion and communication may be used politically within organizations (Kaplan, 2008; Ocasio et al., 2018), and challenge ideas in the issue-selling literature (Ashford & Dutton, 1993) by arguing that emotion *does* matter when capturing the attention of the organizational elite.

CONCLUSION

Our paper is not without limitations. Being a field study means we cannot definitively claim causality, however, our multi-method approach permitted triangulation, making us confident in our assertions. Future research could examine our model in a more controlled setting, perhaps using experimental methods (e.g. Healey, Bleda & Querbes, 2018). Second, our context of a structurally differentiated incumbent struggling to deliver novel technologies and successfully innovate is a

key boundary condition of our model. In an undifferentiated incumbent where goals are shared, convergent appraisals of novel technology might emerge, leading to different dynamics in terms of emotion, cognition and behaviour. It is possible that fear may not even manifest in incumbents that are successfully innovating, or perhaps in growing industries or less competitive industries. Future research could examine whether our assertions hold in different contexts. Additionally, we cannot speak to the longer-term effects of experiencing fear on actor wellbeing and relationships. Future research could examine this more closely.

Practically, our study suggests that emotion is innate to attempts to deliver novel technological breakthroughs. Thus, it makes sense to acknowledge and use emotion as a source of information rather than ignore or marginalize it, or brand it as 'irrational.' Our findings thus underscore the importance of emotional capabilities in managers, and suggest that emotion regulation could be a critical determinant of success. More specifically, they suggest that negative emotions are a natural and important part of this journey, and that eradicating all negative emotion within organizations might be short-sighted. Finally, that the efficacy of different rhetorical tactics used by managers may depend on their position in the organizational structure.

In summary, our study shows how fear can affect the pursuit of novel technologies in incumbent firms, with both motivating and inhibiting effects. Crucially, when novel technologies are seen as a way to escape a feared threat, fear can be a powerful facilitator of the pursuit of novelty. The pursuit of novelty is innately emotional, and something that we believe incumbents must recognize and act upon to promote their chances of success.

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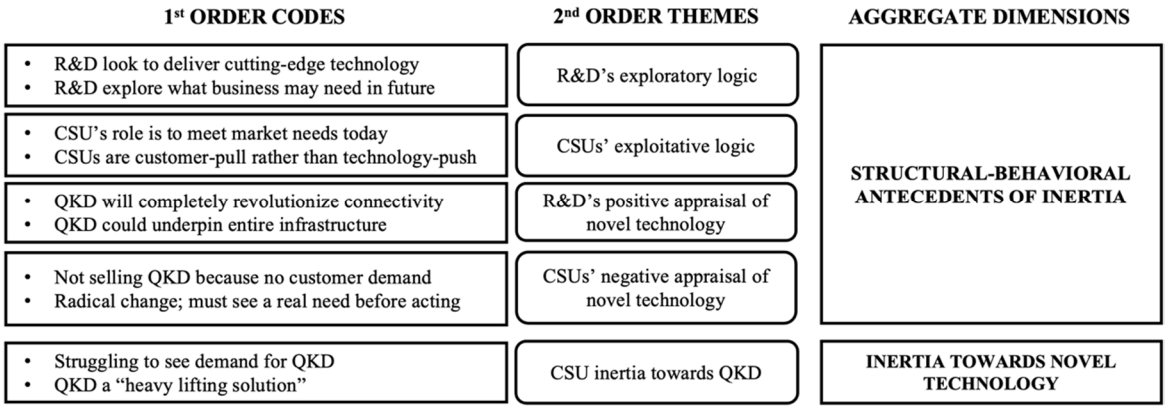
TABLES & FIGURES

TABLE 1 – Overview of data collected and use in analysis

Data Source	Total	Use in Analysis

Semi-Structured Interviews (int)	81 (107 Hours)	• Understand lived realities of participants involved in the attempted commercialization of QKD, including their thoughts, feelings, opinions, and activities/processes they were involved in. • Contextual and historical insight regarding QKD, and its subsequent development at TechCorp and more broadly. • Examine social dynamics in privacy, where participants could be honest and without fear of repercussion. • Appreciate different views and why participants supported/opposed courses of actions, particularly when their divergent with the others.
Informal Conversations (con)	272 (approx. 40 hours)	• Check understanding 'off the record' as well as to triangulate findings from interviews and observations, where participants may be behaving in a socially desirable manner. • Deepen understanding of social dynamics. • Insight into latest news with respect to commercialization of QKD, and opportunity to comprehend what was considered important or controversial to guide further investigation
Observations (obs)	72 (63 hours)	• Naturalistic insight into the taken-for-granted aspects of reality involved in commercializing novel technology. Understand conventions of interaction and communication that were not readily observable or understood through interviews or document analysis. • Witness activities and practices involved in attempted commercialization of QKD. Also, an opportunity to observe the social dynamics between different groups of actors.
Documentation (doc)	81 (3,359 A4 1.5 spaced)	• Source of contextual and background information, especially regarding TechCorp's corporate direction and attitude towards QKD. • Helped with triangulation of insights. Press insights helped to overcome corporate rhetoric. • Enriching the data set with third-party insights.

FIGURE 1 – Data structure



• No pull from CSUs • Need CSU sponsorship to start commercializing	Perceived internal threats to commercialization of QKD	**EMERGENCE OF R&D's FEAR OF FAILURE**
• Funding for QKD public rather than private • Customers aren't demanding QKD	Perceived external threats to commercialization of QKD	
• Failure to fulfil goals has aversive consequences • Memories of being punished for failure historically • Worrying about progress of QKD project • Terrified by others presenting QKD poorly	R&D's fear of failure	
• Can become national provider of trust using QKD • QKD could be financially lucrative	Communicating QKD in terms of internal aspirations	**R&D COMMUNICATING NOVEL TECHNOLOGY USING ASPIRATIONS**
• Government want to be "go-to place" for quantum • Need for national secure communications capabilities	Communicating QKD in terms of external aspirations	
• Have missed out on opportunities before • Embarrassment of competitors doing something TechCorp can't • Fear of looking like an idiot	CSUs' fear of missing out	**CSUs' EMOTIONAL AMBIVALENCE TOWARDS NOVEL TECHNOLOGY**
• Failure makes employees fear for their jobs • CSUs fear pursuing novel technologies and failing • Budget depends on performance – can't afford to fail	CSUs' fear of failure	
• CSUs acknowledge need to take position on QKD • CSU not making firm decision • Waiting for decision "like watching continents drift"	CSUs' indecision	**EMERGING NOVEL TECHNOLOGICAL CAPABILITIES THROUGH INDECISION**
• Technology working in internal and external trials • Understand how to combine QKD and PQC • TechCorp seen as market leader	Emerging QKD capabilities	

FIGURE 2 – Process model showing how fear can affect the pursuit of novel technology in incumbent firms