Long Range Planning 57 (2024) 102480

Contents lists available at ScienceDirect

Long Range Planning

journal homepage: www.elsevier.com/locate/lrp

An evolutionary perspective on capabilities for fluid product-markets: The contingent effects of routinization and renewal in marketing, R&D, and operations

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ARTICLE INFO

Keywords:
Firm capabilities
Product-market fluidity
Environmental change
Profitability
Firm performance

ABSTRACT

The performance benefits of functional capabilities in marketing, technology, and operations rely on their routinization in organizational processes, but these also require renewal in response to environmental change. This raises a fundamental tension: is it better to maximally develop functional capabilities that offer the highest contingent benefit in present market conditions, and/or to modify capabilities as conditions change? We propose two measures of a firm's ability to renew its functional capabilities to align with market conditions: *capability heterogeneity* (variation in extant capabilities) and *capability adaptability* (selection among these strategic options). In a 20-year panel of 771 firms, we find environmental change increases the importance of these aspects of *how* capabilities are managed relative *to what* capabilities a firm possesses: In stable product-markets, capability heterogeneity and adaptability incur significant costs whereas functional capabilities improve profitability. In contrast, functional capabilities can be detrimental in fluid product-markets whereas heterogeneity and adaptability increase profitability. Notably, marketing capability remains beneficial across environments, acting as a profitable alternative to capability heterogeneity and adaptability when future conditions are uncertain. This evolutionary perspective contributes to ongoing theoretical debates on the conceptualization and consequences of capabilities, with practical implications for mitigating the risks of excessive inertia or change.

1. Introduction

The contemporary business environment is characterized by rising levels of complexity and uncertainty over which firms have little control (Kalaignanam et al., 2021; Wenzel et al., 2021). The resultant need to adjust to volatile conditions has led to an increase in research that examines the context-specific effects of firm capabilities (Morgan et al., 2019). Across key functions, such as marketing, R&D, and operations, growing evidence demonstrates that environmental contingencies are critical to the relative importance of these distinctive paths to value generation (Feng et al., 2017; Mishra et al., 2022). Contemporaneously, speed and flexibility in resource allocation are increasingly viewed as essential for operating in this rapidly shifting environment (e.g., Homburg et al., 2020; Prange,

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https://doi.org/10.1016/j.lrp.2024.102480
Received 8 May 2024; Received in revised form 13 August 2024; Accepted 20 September 2024
Available online 21 September 2024

2021). The ability to quickly shift the deployment of capabilities in response to environmental change has therefore become a key objective among managers (Ferecatu and De Bruyn, 2022; Kalaignanam et al., 2021). These two emerging trends indicate an underexplored tension in our current understanding of firm capabilities: is it better to develop functional capabilities that offer the highest contingent benefit in present conditions, and/or to modify capabilities as the environment changes?

This question is indicative of two concepts that are core to the literature on capabilities across multiple theoretical lenses: routinization and renewal (e.g., see Kalaignanam et al., 2021; Vorhies et al., 2011). Capabilities result from embedded processes, skills, and expertise that enable a firm to achieve specific organizational objectives (Dutta et al., 2005; Mishra et al., 2022) – i.e. they are *routinized* ways to reliably generate value from resources (Homburg and Wielgos, 2022; Morgan, 2012). The centrality of these routines to value generation means that the ability to *renew* capabilities as conditions necessitate is key to the long-term prospects of firms, particularly as the pace of change increases (Barney et al., 2021).

Understanding when routinization and renewal are necessary is critical if firms are to avoid ineffective strategic change and resource misallocation (Kalaignanam et al., 2021). Developing capabilities to best suit the environment requires specialization of resources and processes that enhance efficiency but are difficult to redeploy if conditions change, potentially creating a 'competence trap' (Levinthal & March 1993; Volberda and Lewin, 2003). Conversely, a heightened ability to respond to market signals improves performance when these indicate real change, but elevates the likelihood of being overresponsive to environmental noise and failing to fully develop any single route to value creation (Prange, 2021; Volberda, 1996). The balance between these activities is therefore an important area of theoretical development in strategy (Barney et al., 2021). However, research is largely bifurcated on these issues, focusing either on the functional, 'inside-out' capabilities that result from routinization or the 'outside-in' capabilities that enable renewal (e.g., Hunt and Madhavaram, 2020; Wade and Hulland, 2004).

This study aims to contribute to this ongoing dialogue, taking an evolutionary perspective to develop novel measures that bridge the empirical divide between routinization and renewal in the capabilities literature. By 'evolutionary', we refer to the recognition that the characteristics – including capabilities – of a firm are the result of ongoing processes of *variation*, *selection*, and *retention*, guided by managers who make choices in response to competitive conditions within a resource-scarce environment (Bell et al., 2002; Hunt and Morgan, 1996). This perspective provides a unique lens through which to evaluate the relative significance of *how* capabilities are managed relative *to what* capabilities a firm possesses, and the importance of each with respect to a firm's environment. The most recent meta-analyses and reviews (e.g., Bergh et al., 2024; Crook et al., 2008; Karna et al., 2016; Krasnikov and Jayachandran, 2008; Suddaby et al., 2019) lack a clear pattern of effects that can provide generalizable and practicable guidance for management. Our novel framework, which seeks to reconcile this conflicting evidence, is thus intended to be conceptually helpful in both research and practice.

To develop this framework, we draw from best practices in this expansive literature. Research on functional capabilities has historically focused on retention via routinization, resulting in sophisticated measures that capture the concept of an intermediate transformation ability (Dutta et al., 2005, p. 278) that is otherwise unobservable from a firm's resource inputs or performance against functional objectives (e.g., Feng et al., 2017; Mishra et al., 2022; Xiong and Bharadwaj, 2013). We extend these techniques, developing two new measures that together represent the *evolutionary transformation ability* of the firm. First, *capability heterogeneity* is the variation in functional capabilities at a given point in time, which determines the choices available to managers. Second, *capability adaptability* represents selection among capabilities over time, whereby firms shift the balance between marketing, R&D, and operations in response to environmental change. We examine the effects of these factors under differing conditions of *product-market fluidity,* utilizing a novel index based on textual analysis of annual 10-K filings (Hoberg et al., 2014) to quantify changes in competitive threats. Together, these measures facilitate a dynamic assessment of competitive contingencies at the conceptually appropriate level, addressing the limitations of static, industry-level measures and self-assessments, and bringing together divergent concepts from the capabilities literature.

Fundamentally, we seek to examine whether the capacity for a firm to 'evolve' in response to environmental change (renewal) is more (or less) consequential for performance than its current characteristics (routinization). We hypothesize that fluid product-markets, where firms face a high degree of competitive threat in key product-markets, increase the importance of capability heterogeneity and adaptability relative to the level of the functional capability upon which these evolutionary factors act. Results from a sample of 771 firms across 41 industries and 20 years support this: functional capabilities in marketing, R&D, and operations improve relative profitability and growth in stable environments, while the effects of capability heterogeneity and adaptability are negative. These factors improve performance in fluid product-markets, where operations and R&D capabilities are detrimental or redundant. Only marketing capabilities reliably improve profit performance across environments. This suggests that investment in marketing is an effective strategy for balancing routinization and renewal: while the ability to evolve in response to environmental change is beneficial, if these changes occur, marketing capabilities have no downside if future conditions remain stable.

In clarifying the understudied trade-offs between routinization and renewal of capabilities and their contingent effects, this study offers substantive, conceptual, and methodological contributions to the capabilities literature. We address recent concerns that capabilities research requires "greater use of empirical methodologies beyond qualitative case analyses and analysis of survey data" (Schilke et al., 2018, p. 392), developing novel measures of capability renewal grounded in current best practices and utilizing an index of environmental change that accurately and objectively captures competitive dynamics. Our empirical results evince the distinct effects of capability routinization and renewal, offering support for a broad conceptualization that may help improve discriminant validity among capabilities measures (see Karna et al., 2016). These contributions may help to integrate future capabilities research and resolve ongoing debates regarding their differing conceptualization and relative importance (e.g., Fainshmidt et al., 2019; Wilden et al., 2016).

We also offer commercially significant implications for practice. For strategizing, these findings significantly improve the salience of capabilities research to the core problems of setting strategic goals and allocating resources (e.g., see Fainshmidt et al., 2019; Wilden

et al., 2016). Capabilities are difficult and costly to develop and maintain (Morgan, 2012; Zahra et al., 2006), and we provide novel insights into the strategic sacrifices associated with their development, maintenance, and deployment. Explicating the optimal approach to such decisions can help to inform resource allocation decisions at both the top management and board level (Whitler et al., 2020). For managers, the magnitude and consistency of our results provide a strong case for increased investment in marketing capabilities. This complements recent research on macroeconomic contingencies in showing that marketing capabilities are important for mitigating environmental risks, beyond their recognized purpose of demand generation – a role that appears to be unique among the three key functional areas (Mishra et al., 2022).

Next, we develop our conceptual framework and reason four hypotheses that we test. Following this, we present our methodology and describe our analytical approach. Finally, we interpret our results and discuss these findings along with developing a series of compelling implications for further research and managerial practice while recognizing our study limitations.

2. Literature review

2.1. Routinization and renewal of firm capabilities

The role of capabilities in firm performance has long been recognized and evinced in the strategy literature (Barney, 2014; Homburg et al., 2020; Kozlenkova et al., 2014). Focused on explicating the routines and processes that firms utilize to repeatedly and reliably achieve specified objectives, this research has demonstrated that capabilities in key value-generation activities – typically categorized as marketing, R&D, and operations (Feng et al., 2017; Krasnikov and Jayachandran, 2008; Mishra et al., 2022) – are key drivers of firm-level outcomes such as product quality (Moorman and Slotegraaf, 1999), customer satisfaction (Vorhies and Morgan, 2005), growth (Feng et al., 2017), and financial performance (Dutta et al., 2005).

As evidence for the importance of functional capabilities has grown, however, these fields have progressively shifted in their view of competitive advantage, as being attainable less through the repeated enactment of operating routines and more dependent on flexibility in decision-making and resource allocation (Ferecatu and De Bruyn, 2022; Homburg et al., 2020). This change in focus is seen as a necessary response to a business environment in which the pace and magnitude of change is increasing (Kalaignanam et al., 2021; Zahra et al., 2022). The importance of speed and flexibility in response to ever-changing environments has thus also received growing empirical support (Barry et al., 2022; Ringov, 2017; Schilke et al., 2018). Across divergent definitions, operationalizations, and methodologies employed in this research, two broad concepts remain consistent: *routinization,* pertaining to the development, codification, and repetition of organizational processes, and *renewal,* representing the ability to quickly adjust these processes in response to environmental change.

The tension between these two modes is recognized in research and practice (Prange, 2021). The perceived necessity of flexibility is counterbalanced by growing explication of its downsides, such as the risk that firms will fail to develop core competences and instead enter a self-reinforcing "acceleration trap" among competitors, where out-speeding in the short-term is prioritized over out-performance in the long-term (Bruch and Menges, 2010). This is evident, for example, in research on 'exploitation' versus 'exploration' and 'ordinary' or 'static' versus 'dynamic' capabilities (Hunt and Madhavaram, 2020). Within each of these dichotomies, routinization and renewal are often positioned as alternatives (Hunt and Madhavaram, 2020; Schilke et al., 2018). However, often omitted from these studies is the interdependence between these 'counterparts' (see Nelson and Winter 1982; Winter, 2003; Zollo and Winter 2002): the capacity to renew, redeploy, or reconfigure depends upon the prior development and current existence of resources and capabilities (Teece, 2014).

2.2. An evolutionary perspective on capabilities

We posit that understanding the relative importance of routinization and renewal of capabilities may be improved through an evolutionary perspective that involves the *recognition of a set of fundamental processes of variation, selection, and retention that underly multiple theoretical explanations of competitive behavior in resource-scarce environments*, including that of firms in a marketplace (e.g., Bell et al., 2002; Hunt and Morgan, 1996; Volberda and Lewin, 2003). Adopting this perspective, we view routinization and renewal as two broad concepts, each encompassing specific constructs from multiple empirical domains and theoretical lenses within the capabilities literature, that correspond to different aspects of this evolutionary process (cf. Nelson and Winter 1982; Zollo and Winter 2002).

Variation, in evolutionary terms, provides the basis for renewal: for any aspect of change in response to the environment to occur, a firm must have available a range of strategic options (Di Stefano et al., 2014; Nadkarni and Narayanan, 2007). Capabilities are a key strategic resource in this regard, as they determine how effectively a firm can utilize other resources to achieve its objectives; the requirements for both of which may change as environmental conditions shift (Teece, 2014). Variation in capabilities thus determines the "menu of future choice" available to a firm when faced with environmental change (Agarwal and Helfat, 2009, p. 27), as this allows a broader range of resources to be deployed to meet a wider, and potentially uncertain, set of objectives. Conversely, a narrow set of capabilities cannot be easily redeployed, even if highly developed: the most specialized and efficient organizational processes will cease to be useful if no longer aligned with market conditions (Leonard-Barton, 1992; Newey and Zahra, 2009). It is therefore the presence of heterogeneous capabilities that provides the requisite variation for evolutionary change, rather than the possession of high levels of any specific capability (see Agarwal and Helfat, 2009; Lewin and Volberda, 1999).

Selection among strategic alternatives can consequently only occur when variation in capabilities is sufficient to address novel objectives with new resource requirements. There are varying perspectives on the degree to which this is determined at the firm-level or by external market forces (Bell et al., 2002; Volberda and Lewin, 2003), but managerial control is broadly recognized as an essential

component of effective renewal (Agarwal and Helfat, 2009; Zollo and Winter 2002). This can generally be conceptualized as a process of "managed selection", in which managers seek to develop the requisite variation in strategic options to address a range of contingencies and then select among these based on experience and expectation (Volberda and Lewin, 2003, p. 2118). In the context of capability renewal and routinization, this would be evident in the presence of multiple functional capabilities within a firm ("deliberate variation"), from which specific capabilities are chosen and developed in response to environmental change.

Retention, as the final stage in this recurring evolutionary process, determines the degree to which the new sets of capabilities produced by managed selection can be effectively maintained and utilized by the firm to create value in the changed environment, as well as the variation in extant capabilities available for subsequent selection (Zollo and Winter 2002). Accordingly, retention directly corresponds to the notion of routinization that is widely recognized as a core requirement of a capability. Temporal stability, tacit knowledge, and entrenchment of activities within a firm's operations are central to the definition of capabilities as "stable patterns of collective routines and knowledge that enable firms to transform inputs into superior value propositions" (Krush et al., 2015, p. 32). A functional capability can therefore be seen as the manifestation of the retention phase, which produces, repeats, and codifies the routines that produce superior returns on resource utilization (Gavetti and Levinthal, 2000; Zollo and Winter 2002).

In these terms, extant research on functional capabilities largely examines the retention phase of capability evolution. Differences in the level of functional capabilities can be seen as differences in the effectiveness of firms or functions in executing this phase via routinization, and differences in the effects of capabilities reflect differences in the degree to which retention in each functional area is important for the achievement of function- or firm-level objectives.

Research on capabilities that aim to capture the ability of firms to modify resources and capabilities when faced with environmental change (e.g., dynamic or outside-in capabilities) correspondingly focuses on renewal, and thus the variation and selection phases of capability evolution. However, the constructs employed in this literature also represent routines, only contrasted with the former by their 'higher-order' nature that acts upon functional capabilities (e.g., Nenonen et al., 2019; Teece, 2014). Perhaps for this reason, the moderating effect of environmental conditions on the relationship between these renewal capabilities and firm performance remains ambiguous (Fainshmidt et al., 2019; Karna et al., 2016; Wilden et al., 2018b). These constructs represent the ability of the firm to orchestrate other capabilities, but not whether the conditions to do so are present. For example, a firm may have well-developed 'sensing' capabilities (e.g., Fainshmidt et al., 2019; Teece, 2007) for identifying when renewal is necessary, but not the variation in functional capabilities or ability to rapidly and effectively select among these that would be required for this ability to effect changes in performance. Rather than viewing these as separate sets of lower and higher order capabilities, an evolutionary perspective suggests that differences in the importance of deliberate variation and managed selection in a specific environmental context may be better represented by differences in the effects of heterogeneity among, and adaptability of, functional capabilities.

2.3. Environmental contingencies and the evolution of capabilities

The concepts of variation, selection, and retention allow a reconceptualization of the routinization versus renewal debate in the capabilities literature, not as a dichotomy but as a sequential and recurring process in which all aspects are required but may demand differing degrees of managerial attention depending upon current and forecasted rates of environmental change. Furthermore, this process emphasizes the importance of the internal conditions of the firm in responding to external conditions, which may provide greater insight into the presently equivocal relationship between renewal and environmental change.

While much research assumes that different capabilities are required in different environments (e.g., see Fainshmidt et al., 2016; Feng et al., 2017; Teece, 2014) and contingencies are examined in most studies (Karna et al., 2016; Krasnikov and Jayachandran, 2008; Schilke et al., 2018), the literature on renewal capabilities has progressively decentered environmental change as the primary moderator of their effects (Schilke et al., 2018; Wilhelm et al., 2021). Arguments for the necessity of renewal in stable environments are based upon the need to support certain strategic orientations (Fainshmidt et al., 2019; Wilden et al., 2018a) or enable relatively routine forms of strategic change such as business expansion (Helfat and Winter 2011; Schilke, 2014). Empirically, however, the role of environmental contingencies in determining what form of capabilities most contributes to performance remains ambiguous. The comprehensive meta-analysis of Karna et al. (2016) found that "empirical results do not lend support to the view that environmental change enhances the effects of dynamic capabilities on performance over and above the effects of ordinary capabilities" (p. 1167), leading the authors to conclude that the distinction between functional capabilities and these higher-order constructs "may well be a theoretical convention" that "lack [s] in discriminant validity" (p. 1170). Other studies, where the distinction is maintained, report conflicting results (see Ringov, 2017 for a comprehensive review). Without a clear delineation of effects, this bifurcation limits the ability of these research streams to make practical recommendations about how and when each form may benefit firms (Giudici and Reinmoeller, 2012).

Contingency-theoretic approaches should explicate the conditions that determine the optimal choice between competing strategic decisions (Peteraf et al., 2013). Managers must understand the conditions under which routinization and renewal are required, as well as the benefits and costs of developing variation, managing selection, and embedding capabilities via retention (see Prange, 2021). In terms of retention, functional capabilities are widely recognized as being costly to develop and maintain, typically justified by their payoffs in terms of more efficient and effective value generation from resources (Morgan, 2012; Zahra et al., 2006). Deliberate variation may incur even higher costs: capabilities across multiple functional areas each require investment and often represent conflicting goals. For example, a focus on cost minimization in operations versus demand generation in marketing can result in "negative synergies" when firms attempt to develop both (Feng et al., 2017, p. 83). This may create inefficiencies and coordination costs (King et al., 2008) that offset the potential benefits of heterogeneity in a firm's current set of capabilities.

Selection among strategic alternatives also poses both real and opportunity costs that may outweigh those of routine capability

development. Future market conditions in the contemporary business environment are often uncertain (Kalaignanam et al., 2021; Wenzel et al., 2021) and characterized by an increased difficulty of identifying cause-and-effect relationships and therefore understanding whether changes pose a meaningful opportunity or threat (Prange, 2021). This raises the risk that firms may erroneously react to environmental 'noise', directing their limited resources towards capabilities that ultimately do not provide the expected returns (Volberda, 1996; Volberda and Lewin, 2003) and failing to realize the payoffs from investments that are abandoned in favor of a new strategy (Bruch and Menges, 2010; Eisenhardt, 1989; Judge and Miller, 1991). Considering the balance between routinization and renewal in terms of variation, selection, and retention, it is therefore evident that the relative costs of benefits of a managerial focus on each stage of the evolutionary process will vary according to the alignment between this and the firm's environment.

3. Conceptual model

An evolutionary perspective on capabilities can provide theoretical insights in two key areas. First, the dichotomization of routinization and renewal may be reconceptualized as parts of a recurring evolutionary process to better examine their relative importance. Second, the presently ambiguous understanding of how these change under different contingencies may be improved through examination of the environmental conditions that drive evolutionary change. We proposet that these issues can be addressed through a conceptualization of routinization, renewal, and environmental change that appropriately captures these evolutionary forces.

Above, we posit that capability renewal requires that a firm (1) exhibits variation in its current set of functional capabilities—which we term *capability heterogeneity*—and (2) can select from among these capabilities those that are strategically preferable given a new set of environmental conditions—which we term *capability adaptability*. Together, these factors provide the necessary internal conditions for the firm's set of functional capabilities to evolve in response to environmental change. Routinization is important for both creating the set of capabilities in which variation is present and from which selection can occur and embedding the new set of capabilities that are selected. The process of routinization is represented by the widely used concept of *functional capabilities*, which aims to capture the "intermediate transformation ability" (Dutta et al., 2005, p. 278) that is otherwise unobservable from a firm's resource inputs or performance against functional objectives (e.g., Feng et al., 2017; Mishra et al., 2022; Xiong and Bharadwaj, 2013). Within this tradition and our conceptual framework, we may therefore delineate routinization from renewal by defining capability heterogeneity and capability adaptability as representing the *evolutionary transformation ability* of the firm (see Fig. 1).

It is also critical to appropriately conceptualize the environmental conditions that drive evolutionary change and thus alter the relative importance of routinization and renewal. The most relevant level to examine the effects of environmental change with regards to capability routinization and renewal is the *product-market*. Changes to the set of functional capabilities that lead to value creation are necessitated by shifts in demand (Feng et al., 2017; Morgan, 2012), and the operating routines, skills, and knowledge that these capabilities represent pertain to the firm's capacity to produce according to this demand via internal processes and relationships with

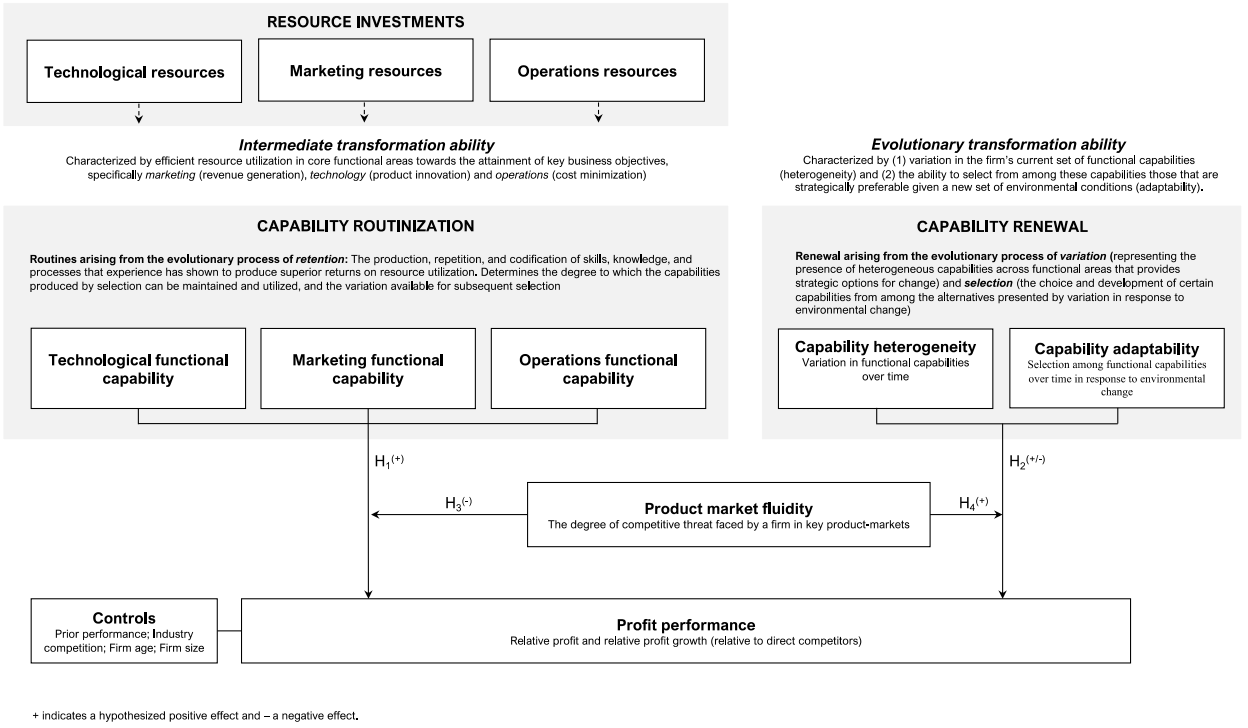

Fig. 1. Conceptual framework and hypotheses.

partners and customers (Homburg and Wielgos, 2022; Sridhar and Fang, 2019). The effectiveness of routinization and the necessity of renewal is therefore contingent on changes at the product-market level, as functional capabilities "enable the production and sale of a defined (but static) set of products and services … When the firm's output is tuned to what the market desires, [this] may be sufficient for a fleeting competitive advantage but are insufficient to undergird sustainable competitive advantage as the business environment changes." (Teece, 2014, p. 331). However, environmental change in capabilities research is typically studied using either industry-level (e.g., SIC code) measures (e.g., Feng et al., 2017; Girod and Whittington, 2017, see also Karna et al., 2016) or respondents' or researchers' judgements of market conditions (e.g., Homburg and Wielgos, 2022; Krush et al., 2015; Vorhies et al., 2009) which can introduce perceptual biases (e.g., Danneels, 2016). Industry-based measures pose further issues, as they remain static across a firm's lifecycle. If products and services change significantly, defining the competitive environment based on industry membership will fail to capture the dynamics among competitors (Hoberg and Phillips, 2016). Industry-based measures also rely on outcome metrics such as revenues or market share, reflecting firms' success or failure in adapting to change rather than the degree of change itself (Hoberg et al., 2014). These measures are thus misaligned with an evolutionary perspective, in which environmental change reflects the instability or *fluidity* in the market exogenous of the firm's assessment of, or response to, such changes (Hoberg et al., 2014). Accordingly, we posit that environmental contingencies be conceptualized and operationalized at the level of the firm's *product-market fluidity,* as the relative importance of routinization and renewal depends upon the nature of demand rather than the industry structures or macroenvironmental trends that may indirectly influence this and exist exogenously of subjective judgement.

4. Hypotheses

We formulate hypotheses regarding the effects of capability routinization and renewal on performance and the moderating role of product-market contingencies through an evolutionary perspective. Through this, we aim to shed new light on two issues: the significance of *how* capabilities are managed relative *to what* capabilities a firm possesses, and the importance of each factor with respect to the environment (e.g., see Karna et al., 2016; Suddaby et al., 2019).

We therefore reason two sets of hypotheses. First, we examine (1) the main effects of functional capabilities, representing capability routinization and the profit performance implications of the firm's intermediate transformation ability between resources and objectives, and (2) the main effects of (a) capability heterogeneity and (b) capability adaptability, together representing capability renewal and the profit performance implications of the firm's evolutionary transformation ability to change functional capabilities. Second, we introduce the moderating role of product-market fluidity, examining the effects of (3) functional capabilities, (4a) capability heterogeneity, and (4 b) capability adaptability under this key contingency.

4.1. Capability routinization, renewal, and profit performance

There is broad agreement across the literature regarding the relationship between capabilities in the key functions of marketing, R&D, and operations and firm performance. Functional capabilities have been found to positively impact a range of financial outcomes (see Karna et al., 2016, for a recent meta-analysis) including profitability (Feng et al., 2017), returns to shareholders (Mishra et al., 2022), and the initial public offering (IPO) value of young firms (Xiong and Bharadwaj, 2011). Functional capabilities have also been shown to lead to improvements in various intermediate outcomes, including product quality (Moorman and Slotegraaf, 1999), customer satisfaction (Vorhies and Morgan, 2005), and firm growth (Feng et al., 2017). These findings support the theorized role of functional capabilities as the routines and processes that enable firms to acquire, organize, and utilize other resources more effectively, prevalent in the resource-based view (Barney, 2014; Kozlenkova et al., 2014). The literature on capability renewal shares this view, with the caveat that the performance benefits of functional capabilities are likely to accrue only in stable environments due to their activity-specific and static nature (Drnevich and Kriauciunas, 2011; Teece, 2014). Accordingly, as a baseline we predict positive effects of functional capabilities on profit performance.

Hypothesis 1. Functional capabilities have a positive effect on profit performance.

In contrast to the consensus regarding the importance of capability routinization, the effects of renewal in the absence of environmental change has been the subject of greater debate (Di Stefano et al., 2014; Peteraf et al., 2013). The emergent view that capability renewal has positive effects on firm performance in stable conditions contrasts with early theoretical work in this area (e.g., Ringov, 2017; Teece, 2014). Recent reviews of the literature demonstrate increasing support for a positive main effects on firm performance (e.g., Fainshmidt et al., 2019; Suddaby et al., 2019) but meta-analyses suggest that the relationship is, at best, equivocal and that the positive effects of renewal are overstated (Karna et al., 2016; Schilke et al., 2018). This is reflected by the changing tone of practitioner-focused research, which has increasingly recognized the potential value of 'active waiting' (Sull, 2005) and maintaining stability in core dimensions of strategy (Prange, 2021) as a counterbalance to the overemphasis change. However, current evidence does not indicate whether further analysis will explicate negative effects of capability renewal in stable environments, or merely the lack of a positive effect. An evolutionary perspective may concur: if change is unnecessary due to environmental stability, it is possible that the new variation introduced by capability renewal may create novel opportunities by allowing the exploration of new markets or 'niches' (March, 1991, see also Bell et al., 2002) that can provide additional sources of revenue in the short term and more sustainable advantage in the long-term (e.g., Kalaignanam et al., 2021; Kang and Kim, 2020; Li, 2019).

Conversely, capability heterogeneity and adaptability incur both tangible and opportunity costs, and may signify a misallocation of resources away from the routines that are known to sustain competitive advantage in the current environment (Morgan, 2012; Prange, 2021). This suggests that capability renewal may have negative financial impacts in stable conditions. However, the pursuit of

excessive renewal tends to occur simultaneously among competitors in a self-reinforcing 'acceleration trap' (Bruch and Menges, 2010; Prange, 2021). If performance is measured in competitive terms, the costs of redundant renewal activities may not result in a loss of position because other firms are pursuing similarly detrimental strategies. This possibility remains underexplored in the literature, which rarely examines competitive performance outcomes (Karna et al., 2016; Sirmon et al., 2010).

Accordingly, we propose Hypothesis 2 to examine whether the emergent view that capability renewal is beneficial across environments is empirically supported, by testing the main effects of the firm's evolutionary transformation ability without specifying a directional effect.

Hypothesis 2. (a) Capability heterogeneity and (b) capability adaptability affect profit performance.

4.2. Moderating effects of product-market fluidity

Across the literature on capability renewal, it is assumed that firms require a different set of capabilities to maintain leadership in rapidly changing environments (e.g., Agarwal and Helfat, 2009; Kalaignanam et al., 2021; Teece, 2014). Routinized capabilities in key functional areas may cease to be useful, and potentially be detrimental, if no longer aligned with market conditions (Leonard-Barton, 1992; Newey and Zahra, 2009): these require new knowledge, while the benefits of functional capabilities rely on accumulated routines and past experience (Helfat and Peteraf, 2003). Research in IT (Drnevich and Kriauciunas, 2011) and organizational restructuring (Girod and Whittington, 2017) supports this notion, finding that the capability—performance relationship is nonsignificant or negative during environmental change. Similarly, the benefits of functional capabilities diminish or reverse in turbulent environments (Feng et al., 2017).

Directly contrasting the effects of functional capabilities, evidence indicates increasingly positive effects of capability renewal as environments become less stable. These effects are remarkably robust considering the inconsistent operationalization of environmental contingencies in prior research (see Karna et al., 2016). Conceptualizing environmental change at the product-market level, we have no reason to expect that this pattern of effects will differ. Arguably, the observable effect of capability renewal may be stronger when the moderating factor of environmental change is defined and measured in accordance with level at which firms are faced with the evolutionary forces of the product-market. We therefore predict that the hypothesized positive effects of functional capabilities on profit performance will diminish in fluid product-markets, while the effects of capability heterogeneity and adaptability will be increasingly positive as product-market fluidity increases.

Hypothesis 3. Functional capabilities have a decreasingly positive effect on profit performance as product-market fluidity increases.

Hypothesis 4. (a) Capability heterogeneity and (b) capability adaptability have an increasingly positive effect on profit performance as product-market fluidity increases.

Fig. 1 summarizes the hypothesized relationships, illustrating how both routinization (Hypothesis 1) and renewal (Hypothesis 2) influence performance and setting the baseline for understanding their interaction with environmental contingencies in Hypotheses 3 and 4. Operationalizations for each construct are discussed in detail in the following section.

5. Measures

5.1. Functional capabilities

We use stochastic frontier analysis (SFA) to model capabilities in key functional areas as an unobservable variable between an input (resource base) and output (firm objective) (Dutta et al., 2005). This method avoids misattribution of effects to either the resources upon which functional capabilities act or the proximal outcome they generate (Dutta et al., 1999) and the tautological problems of subjective measurement (Teece et al., 1997). The SFA model for each capability is a production function that estimates a 'frontier' for a functional area based on the notion that no firm can exceed the optimal utilization of inputs in the production of a specified output. The stochastic component accounts for exogenous shocks, such that deviations from the frontier represent firm-specific inefficiencies arising from suboptimal resource deployment.

Focusing on the three key functions of marketing, R&D, and operations (Krasnikov and Jayachandran, 2008), we follow precedent in defining the inputs and outputs of the SFA function (Dutta et al., 1999, 2005; Feng et al., 2017; Mishra et al., 2022). Marketing inputs are the current and previous year's advertising and sales, general, and administrative expense, with sales revenue as the output. Operations inputs are the current year's labor and capital costs, with the (inverse of) cost of goods sold representing the minimization of production costs. R&D capability inputs are the current and previous year's R&D expense, and output is defined as the total value of intangible assets minus goodwill and acquired intangibles.[1] Web Appendix A provides full details of the SFA model specification, estimation method, production functions, and derivation of efficiency estimates that represent the level of functional capability.

[1] These adjustments remove the value of brand equity, thus avoiding overlap with marketing activities, and the value of acquired R&D outputs that are not the result of the firm's internal capabilities. Our measure therefore includes the value of patents, blueprints, unpatented designs, and non-compete covenants. We also include licenses, which we consider part of the firm's internal capabilities due to their closer integration into the firm's operational processes. This measure thus comprehensively captures the commercial value of proprietary technology and knowledge.

5.2. Capability heterogeneity and adaptability

To capture variation within a firm's current set of functional capabilities, we compute an index of *capability heterogeneity* as the coefficient of variation in firm-year efficiency estimates, i.e., the standard deviation of marketing, R&D, and operations divided by the mean of these three functional capabilities. The coefficient of variation is considered the most suitable operationalization of variation among attributes with ratio scales (Harrison and Klein, 2007). Importantly for the purposes of this study, this measure does not increase with a firm's *level* of functional capabilities, allowing us to capture the precondition for evolutionary selection independent of whether a firm's current set of capabilities is well-developed (see above and Agarwal and Helfat, 2009; Lewin and Volberda, 1999).

$$CH_{it} = \left(\frac{\sigma_{it}^{FC}}{\mu_{it}^{FC}} \right) \tag{1}$$

To measure *capability adaptability,* we first sum the SFA-derived efficiency scores for marketing, R&D, and operations in each firm-year. We then divide each individual score by the total to compute the proportion of functional capabilities attributable to each area. For each of the three functions, we then subtract the previous year's proportion from the current year. The sum of the absolute differences yields the aggregate measure of capability adaptability. Aggregating changes across marketing, R&D, and operations capabilities in this way is consistent with prior research on resource investments (Fombrun and Ginsberg, 1990; Nadkarni and Narayanan, 2007), and represents the degree to which a firm shifts its prioritization of functional capabilities independent of the level of those capabilities.

$$CA_{it} = \sum_{k=1}^{3} \left| \frac{FC_{it}^{k}}{\sum FC_{it}} - \frac{FC_{it-1}^{k}}{\sum FC_{it-1}} \right| \tag{2}$$

5.3. Product-market fluidity

To measure *product-market fluidity* we use the index developed by Hoberg et al. (2014) (PMFI hereafter), which provides firm-year scores for product-market fluidity derived from textual analysis of 10-K filings. The PMFI captures year-to-year changes in the product-market relative to the focal firm, based on changes in the business descriptions of competitors in the usage of words that are also used in the business description of the focal firm. For a given word j in year t, this is represented by $D_{t-1,t}$, the sum of the absolute differences in word usage:

$$D_{t-1,t} = \left| \sum_{j} \left(W_{j,t} - W_{j,t-1} \right) \right| \tag{3}$$

J_t is the number of unique words in the descriptions of all firms in a given year. W_{it} is an ordered Boolean vector of length J_t, where element j is equal to 1 if firm i uses word j in its description and zero otherwise. $N_{i,t}$ is the word vector for firm i, normalized for unit length. The PMFI is then calculated as the dot product between the firm-level vector $N_{i,t}$ and the product-market word vector $D_{t-1,t}$, which measures the cosine similarity between the two vectors:

$$PMFII_{it} \equiv \langle N_{i,t} \bullet \frac{D_{t-1,t}}{\left\| D_{t-1,t} \right\|} \rangle \bullet \tag{4}$$

The PMFI of a firm thus increases with year-to-year changes in word usage and the degree of overlap between a firm's product descriptions and those of competitors. This ensures that the measure captures a higher level of competitive threat rather than reflecting the volatility of a firm's own product descriptions, thus avoiding the perceptual biases of managerial self-reports (see Danneels, 2016). The PMFI also offers several advantages over measures that are based on industry classification codes. First, annual updates to business descriptions are legally required, whereas industry classification are fixed. Thus, the PMFI provides more timely information about the state of product-markets. Second, product descriptions are created by management whereas industry classifications are externally imposed. As the development and use of capabilities is internal to the firm, using a measure that accounts for *internal assessments* of fluidity (while avoiding the issues inherent in relying solely on subjective measures) is thus conceptually better suited to this context. Third, the PMFI addresses issues of endogeneity, reflecting the activity of rivals rather than the focal firm such that "changes [in the index] are likely to be exogenous from any one firm's perspective" (Hoberg et al., 2014, p. 305).

In developing the PMFI, Hoberg et al. (2014) present several validations of these advantages. First, the PMFI has more significant effects on firms' financial decisions when compared to SIC or NAIC code-based measures, suggesting that it better captures product-market uncertainties that are pertinent to managers. Second, the PMFI is shown to be uniquely distinct from other risk measures (stock market volatility and cash flow risk): effects remain significantly associated with competitive threats even when controlling for these, indicating that the PMFI provides incremental information about competitive threats. Third, an association between venture capital investment, IPO activity, and the PMFI, absent in models utilizing traditional industry-based measures, suggests that firms with higher fluidity face greater competitive threats from new entrants; a nuance not captured by traditional industry classifications. Based on these empirical justifications and the conceptual alignment between the PMFI and our proposed framework, we therefore utilize this index as our primary measure and control for industry-level differences, as detailed in the following section.

6. Model specification and estimation

6.1. Model formulation

Our sample comprises U.S. firms operating between 1997 and 2017 (the coverage of the PMFI). We obtain data for all the other variables from Compustat. As the TRE model requires panels of ten or more years (Belotti and Ilardi, 2012), we restrict our sample to firms for which ten years of data is available on the inputs and outputs of functional capabilities. This results in 8805 firm-year observations of 771 firms in 41 2-digit SIC code industries (200 by 4-digit), with an average of $7.3 billion in assets, (see Web Appendix B for additional sample characteristics).

Given the panel structure of this data, we require an empirical approach that accounts for both time-variant and -invariant sources of endogeneity (Hill et al., 2020). While we detail below a comprehensive selection of control variables to alleviate these concerns, some unobserved sources of endogeneity common to capabilities research, such as simultaneity and serial correlation, cannot be accounted for by these measures (Feng et al., 2017). To address these, we adopt an empirical approach based on the assumption that taking first differences removes the correlation of variables between successive periods (Arellano and Bond, 1991; Blundell and Bond, 1998). From this, we formulate two model specifications: (a) a dynamic panel model in which the lagged first differences are used as instrumental variables, and (b) a fixed effects regression model in which first differences are used for the dependent and independent variables of interest.

For the panel instruments model, we specify a system comprising a levels equation (5) and differences equation (6) to represent the capability—performance relationship. For functional capabilities:

$$P_{it} = \beta_0 + \beta_1 FC_{it} + \beta_2 PMF_{it} + \beta_3 FC_{it} \times PMF_{it} + \beta_k X_{it} + \gamma P_{it-1} + \varepsilon_{it} \quad (5)$$

$$\Delta P_{it} = \beta_1 \Delta FC_{it} + \beta_2 \Delta PMF_{it} + \beta_3 \Delta (FC \times PMF)_{it} + \beta_k \Delta X_{it} + \Delta \varepsilon_{it} \quad (6)$$

Where I indexes the focal firm, and t the current year. P_{it} represents the dependent variable of profit performance, FC_{it} represents the three functional capabilities of marketing, R&D, and operations; PMF_{it} product-market-fluidity; X_{it} a vector of control variables; and, ε_{it} unexplained variance in P_{it}. Δ represents the first difference of each variable, e.g., ΔPMF_{it} is the year-to-year change in product-market fluidity (or PMF_{it} - PMF_{it-1}). The effects of functional capabilities are therefore represented by β_1, and the contingent effects in fluid-product-markets by β_3. To examine the effects of capability renewal, we replace FC_{it} with CH_{it} and CA_{it}, representing capability heterogeneity and capability adaptability, respectively, and estimate the same system of equations. Both models are estimated using generalized method of moments (GMM), as this provides unbiased estimates for the instruments and parameters (Arellano and Bond, 1991; Blundell and Bond, 1998).

For the fixed effects model, we specify the following equation for functional capabilities:

$$\Delta P_{it} = \beta_0 + \beta_1 \Delta FC_{it} + \beta_2 PMF_{it} + \beta_3 \Delta (FC_{it} \times PMF_{it}) + \beta_k X_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad (7)$$

Where variables and error terms are denoted as in Equations (5) and (7) and fixed effects are included at the firm- and year-level, represented by μ_i and η_i respectively. As indicated, we take the first differences of independent variables for functional capabilities only. We also estimate Equation (5) with CH_{it} and CA_{it}, in place of FC_{it}, again taking first differences for these variables only. In sum, we estimate four relationships: (1) functional capabilities and levels of profit performance, (2) capability heterogeneity, capability adaptability and levels of profit performance, (3) changes in functional capabilities and changes in profit performance, and (4) changes in capability heterogeneity, capability adaptability, and profit performance. For each relationship, we also (a) estimate the main effects of capability variables, PMF, and controls, and (b) include the interaction between capabilities and PMF, resulting in eight empirical models.

6.2. Variables and controls

Research on capabilities, being grounded in the resource-based view, fundamentally seeks to explain competitive advantage and posits profitability as the relevant measure of this outcome (Barney, 2014; Teece, 2014). However, extant research has been argued to suffer from a "theoretical and empirical misspecification of competitive advantage" resulting from operationalizations of performance without reference to competitors (Sirmon et al., 2010, p. 1387). We thus use *relative profit* as our dependent variable in the panel instruments models, calculated as the natural log of a firm's gross profit scaled by the natural log of the median gross profit in the firm's 2-digit SIC code. In the first differences models, this dependent variable becomes *relative profit growth* (Δ relative profit), representing the year-to-year change in a firm's gross profit relative to competitors. We therefore examine the effects of both the *level* of functional capabilities, capability heterogeneity, and capability adaptability on a firm's position relative to competitors and how *changes* in these variables alter these competitive dynamics.

As the environmental moderator we employ captures annual shifts in product-market fluidity, we examine short-term performance, i.e., in the year following the measurement capability adaptability and contemporaneous with measurement of capability heterogeneity and functional capabilities. In each model, the coefficients of interest are the main effects of functional capabilities (technical efficiency estimates obtained from SFA), capability heterogeneity, and capability adaptability, and the interactions with product-market fluidity. We also include a quadratic term for each functional capability, to account for the possibility of diminishing returns at high levels.

We control for *industry concentration*, as this has been shown to influence the effects of capabilities (Feng et al., 2017), and to assist in isolating the effects of environmental change at the product-market level. In additional robustness checks (see Web Appendix C), we isolate the effects of capability heterogeneity and adaptability from the effects of the underlying functional capabilities by including these as independent variables in our model (c.f. Nadkarni and Narayanan, 2007).[2] We further control for *firm age* in the panel instruments models and *firm size* in both models, as the resource deployment decisions of younger and smaller firms are more responsive to environmental conditions (Eisenhardt and Martin, 2000). These controls ensure that the effects of capability heterogeneity and adaptability in capabilities reflect our operationalization of the requisite evolutionary conditions for capability renewal rather than other firm-level factors. We also include year fixed effects in the first differences model, as indicated by a Wald test ($F_{(18,8014)} = 10.70$, $p < .001$) and use robust standard errors to correct for heteroskedasticity (modified Wald statistic: $\chi^2_{(757)} = 4.3e{+}30, p < .001$). Both of our chosen model specifications also account for the potential influence of past performance.[3]

Managerial cognition is a key source of potential omitted variables in capabilities research (Helfat and Peteraf, 2015), and we account for this in two ways. First, the construction of the PMFI removes endogeneity issues related to managerial cognition (see above and Hoberg et al., 2014). Second, we control for these variables in the capability—performance relationship directly via the inclusion of firm fixed effects in the first differences models (Hill et al., 2020). A significant Hausman test ($\chi^2_{(16)} = 1498.83$, $p < .001$) for covariance between firm-specific error and independent variables also indicates that fixed effects are required to ensure consistency (Greene, 2012). Table 1 provides a summary of all variables, descriptive statistics, and the procedures for calculating controls. Correlations are provided in Web Appendix B.

7. Results

Table 2 presents the results of the panel instruments models examining the effects of functional capabilities, capability heterogeneity, and capability adaptability on firms' profitability relative to competitors. The results of the first differences models examining year-to-year growth in relative profitability are presented in Table 3. In each case, models are estimated with (a) main effects only and (b) interactions between capability variables and product-market fluidity. Web Appendix C presents simple slopes analyses for these interaction effects.

Across these models, we observe that marketing, R&D, and operations capabilities each improve financial performance in stable product-markets in terms of both profitability relative to competitors (RP: Models 1 and 2) and year-to-year growth in relative profits (ΔRP: Models 3 and 4). For marketing capabilities, these positive effects (RP = 0.401, $p < .001$; ΔRP = 0.491, $p < .001$) indicate diminishing returns, as shown by a negative quadratic effect (RP = −.180, $p < .001$; ΔRP = −.186, $p < .001$). While the significance of the quadratic effect is less consistent for operations capabilities, this also suggests diminishing returns (RP = −.060, $p = .076$; ΔRP = −.027, $p = .387$). In contrast, the quadratic effects of R&D capabilities are positive (RP = 0.001, $p = .937$; ΔRP = 0.019, $p = .253$). Combined with a small main effect (RP = 0.040, $p = .011$; ΔRP = 0.008, $p = .640$) this suggests that a threshold must be reached before R&D capabilities contribute to competitive advantage, whereas the benefits of marketing and operations capabilities can be attained at lower levels of development.

These positive effects diminish or reverse when product-market fluidity is high. R&D (RP = −.005, $p < .001$; ΔRP = −.002, $p = .104$) and operations (RP = −.005, $p = .002$; ΔRP = −.004, $p = .028$) capabilities have a negative interaction effect, indicating that these capabilities may hinder performance in fluid product-markets. The interaction effects of marketing capabilities remain positive but greatly reduced from the main effects, indicating a smaller contribution to financial performance (RP = 0.003, $p = .195$; ΔRP = 0.006, $p = .024$). However, this also suggests that marketing capabilities may be the *least risky* investment among all functional capabilities (as well as capability renewal, as discussed in the following section) if future product-market conditions are uncertain: the degree of benefit varies with product-market fluidity, but strong marketing capabilities do not adversely affect relative profitability or relative profitability growth. Extant evidence also suggests that marketing offers the largest contribution to financial performance among these three functional capabilities (Feng et al., 2017; Krasnikov and Jayachandran, 2008; Mishra et al., 2022). These results add the important insight that marketing may also provide the *only* mitigation against losses in turbulent markets. Overall, these results support our hypotheses: functional capabilities have a positive effect on competitive advantage (Hypothesis 1), which is reduced or reversed in fluid product-markets (Hypothesis 3).

We find positive effects in fluid product-markets for both capability heterogeneity (RP = 0.002, $p = .178$; ΔRP = 0.003, $p = .050$). And capability adaptability (RP = 0.005, $p = .004$; ΔRP = 0.003, $p = .005$), supporting Hypothesis 4. We formulated Hypothesis 2 as a baseline with which to compare these effects, predicting a significant effect of these variables in stable product-markets but not specifying a directional effect. This is supported, and both main effects are negative (heterogeneity: RP = −.043, $p < .001$; ΔRP = −.062, $p < .001$; adaptability: RP = −.031, $p = .004$; ΔRP = −.018, $p = .026$), lending further support for the increasingly positive

[2] Web Appendix C also presents the following robustness checks: i) Controlling for functional capabilities in the models of capability heterogeneity and adaptability; ii) combining all capabilities variables in a single model; iii) excluding the quadratic effects of functional capabilities; iv) estimating effects on an absolute measure of firm performance (the natural log of profit); v) estimating the models in Table 2 with fixed effects; and vi) controlling for self-fluidity, i.e., the annual change in a firm's own product descriptions. Overall, results support the main models presented below.

[3] First-order autocorrelation is corrected for by this model specification (Roodman, 2009). Tests of overriding restrictions and second-order autocorrelation indicate that our models are robust, not weakened by instruments and that residual second-order autocorrelation is not a significant issue (For functional capabilities, Hansen = 748.70, $p = .98$, Arellano & Bond AR(II) = −1.22, $p = .22$; capability heterogeneity and adaptability, Hansen = 698.58, $p = .17$; A&B AR(II) = −1.14, $p = .26$).

Table 1
Variable descriptions.

Variable	Mean	SD	Description
Relative profit	2046.052	6243.797	Natural log of gross profit (million USD) of the focal firm scaled by the natural log of the median gross profit in the firm's 2-digit SIC code
Δ Relative profit	82.481	1012.038	Year-to-year change in relative profit
Marketing capability	.776	.141	Estimates of technical efficiency computed with JLMS estimator following SFA using TRE specification, with inputs defined as the current and previous years' advertising and SG&An expense and output defined as the current year's sales revenue.
R&D capability	.457	.209	Estimates of technical efficiency computed with JLMS estimator following SFA using TRE specification, with inputs defined as the current and previous years' R&D expense and output defined as the current year's intangible assets minus goodwill and acquisitions.
Operations capability	.699	.169	Estimates of technical efficiency computed with JLMS estimator following SFA using TRE specification, with inputs defined as the current year's cost of capital (interest and dividends paid) and labor expense and output defined as the current year's cost of goods sold.
Capability heterogeneity	.136	.144	Sum of the absolute year-to-year differences in marketing, R&D, and operations capabilities as a proportion of a firm's total ordinary capabilities.
Capability adaptability	−.487	.192	Coefficient of variation across functional capabilities, calculated as the standard deviation of marketing, R&D, and operations capabilities divided by the mean.
Product-market fluidity (PMF)	5.719	2.919	Cosine similarity between product descriptions used by the focal firm and competitors, using procedure and dataset provided by Hoberg et al. (2014) [a]
Industry competition	.051	.042	Herfindahl-Hirschman Index (sum of squared market shares) in firm's 2-digit SIC code
Firm age	28.380	17.981	Natural log of years elapsed since firm first appears in Compustat database
Firm size	6.991	2.027	Natural log of total assets (million USD)

[a] Updated (2017) dataset available at https://hobergphillips.tuck.dartmouth.edu/tnic_poweruser.htm.

Table 2
Effects of capabilities on *relative profit* in stable and fluid product-markets.

DV: Relative Profit	Functional Capabilities				Capability Heterogeneity and Adaptability			
	(1a) Main effects		(1 b) Interactions		(2a) Main effects		(2 b) Interactions	
Main effects								
Marketing capability	.416	(.000)[c]	.401	(.000)[c]				
R&D capability	.013	(.365)	.040	(.011)[b]				
Operations capability	.051	(.042)[b]	.104	(.001)[c]				
Capability adaptability					−.002	(.592)	−.031	(.005)[c]
Capability heterogeneity					−.015	(.000)[c]	−.043	(.000)[c]
Marketing capability^2	−.188	(.000)[c]	−.180	(.000)[c]				
R&D capability^2	.003	(.846)	.001	(.937)				
Operations capability^2	−.038	(.249)	−.060	(.076)[a]				
PMF	.001	(.504)	.004	(.023)[b]	.001	(.611)	.001	(.306)
Interaction effects								
Marketing capability × PMF			.003	(.195)				
R&D capability × PMF			−.005	(.000)[c]				
Operations capability × PMF			−.005	(.002)[c]				
Capability adaptability × PMF							.005	(.004)[c]
Capability heterogeneity × PMF							.002	(.178)
Controls								
Industry competition	.040	(.422)	.042	(.393)	−.050	(.371)	.016	(.853)
Firm age	−.005	(.000)[c]	−.005	(.000)[c]	−.005	(.000)[c]	−.005	
Firm size	.029	(.000)[c]	.029	(.000)[c]	.645	(.000)[c]	.047	(.000)[c]
Relative profit$_{t-1}$	.587	(.000)[c]	.586	(.000)[c]	.579	(.000)[c]	.698	(.000)[c]
Constant	.111	(.000)[c]	.078	(.006)[c]	.185	(.000)[c]	.093	(.001)
Observations		7986		7986		7986		7986
Wald χ^2	6482.81	(.000)[c]	6516.74	(.000)[c]	4261.55	(.000)[c]	2117.48	(.000)[c]

PMF = product-market fluidity. Squared capabilities (^{2}) indicate quadratic terms. P-values are shown in parentheses.
[a] $p \leq .10$.
[b] $p \leq .05$.
[c] $p \leq .01$.

effects predicted and corroborated in Hypothesis 4.

While these results support Hypotheses 1–4, there are aspects of the effects we observe that warrant further explanation considering the extant capabilities literature. Specifically, the notion that functional capabilities are beneficial across a range of contingencies and the debate as to whether and how capability renewal is beneficial under stable conditions (e.g., Schilke et al., 2018; Suddaby et al., 2019) appears to conflict with negative effects on profit performance. The nature of each capability, conceptually and as operationalized in this analysis, offers insights into these observations. We discuss these in further detail in the next section.

Table 3
Effects of capabilities on *relative profit growth* in stable and fluid product-markets.

	Functional Capabilities				Capability Heterogeneity and Adaptability			
	(3a) Main effects		(3 b) Interactions		(4a) Main effects		(4 b) Interactions	
Main effects								
Δ Marketing capability	.552	(.000)[c]	.491	(.000)[c]				
Δ R&D capability	−.005	(.707)	.008	(.640)				
Δ Operations capability	.045	(.055)[a]	.076	(.007)[b]				
Δ Capability adaptability					.003	(.460)	−.018	(.026)[b]
Δ Capability heterogeneity					−.043	(.000)[c]	−.062	(.000)[c]
Δ Marketing capability^2	−.200	(.000)[c]	−.186	(.000)[c]				
Δ R&D capability^2	.019	(.247)	.019	(.253)				
Δ Operations capability^2	−.025	(.414)	−.027	(.387)				
PMF	.001	(.135)	.001	(.149)	.001	(.080)[a]	.001	(.064)[a]
Interaction effects								
Δ Marketing capability × PMF			.006	(.024)[b]				
Δ R&D capability × PMF			−.002	(.104)				
Δ Operations capability × PMF			−.004	(.028)[b]				
Δ Capability adaptability × PMF							.003	(.005)[b]
Δ Capability heterogeneity × PMF							.003	(.050)[b]
Controls								
Industry competition	.103	(.051)[a]	.102	(.022)[b]	.063	(.206)	.063	(.202)
Firm size	.007	(.021)[b]	.007	(.000)[c]	.009	(.000)[c]	.009	(.000)[c]
Constant	−.032	(.000)[c]	−.032	(.004)[c]	−.052	(.000)[c]	−.052	(.000)[c]
Firm fixed effects		Yes		Yes		Yes		Yes
Year fixed effects		Yes		Yes		Yes		Yes
Observations		8805		8805		8805		8805
R^2		.101		.101		.005		.006
F-value	52.38	(.000)[c]	47.66	(.000)[c]	11.93	(.000)[c]	11.54	(.000)[c]

PMF = product-market fluidity. Squared capabilities (^{2}) indicate quadratic terms. P-values are shown in parentheses.
[a] $p \leq .10$.
[b] $p \leq .05$.
[c] $p \leq .01$.

8. Discussion

As responsiveness to the complex and uncertain contemporary business environment has become a strategic priority for firms, research has shifted from evincing the benefits of capability routinization to supporting the need for capability renewal (e.g., Kalaignanam et al., 2021; Suddaby et al., 2019). However, both the managerial and academic discourse now cautions against an over-emphasis on change (Prange, 2021). Presently, there remains an underexplored tension in the capabilities literature: should firms develop functional capabilities that provide the highest payoff given current and predicted conditions, or focus on developing the ability to rapidly change capabilities in response to unpredictable environmental change?

This study aimed to contribute to this ongoing dialogue by adopting an evolutionary perspective on capabilities. We argue that this approach offers opportunities to synthesize the hitherto bifurcated literatures on capability routinization and renewal, conceptualizing and measuring these concepts as representing stages in a recurring process of variation, selection, and retention. We find that functional capabilities improve relative profitability and growth in stable environments, whereas capability heterogeneity and adaptability impair performance. In fluid product-markets, operations and R&D capabilities become detrimental or redundant, whereas capability heterogeneity and adaptability exert positive effects. Only marketing capabilities reliably improve profit performance across environments.

Offering new clarity regarding the trade-offs between routinization and renewal, their contingent effects under different levels of environmental change, and the unique role of marketing capabilities for mitigating the uncertainty associated with operating in fluid product-markets, this study has numerous substantive implications. Table 4 summarizes how these arise from our definitions, conceptualization, and operationalization of capability routinization and renewal, our key findings, and the unresolved research questions raised by our results.

As highlighted in our results, there are two issues that prompt further discussion. Examples of how these can be observed in firms may serve to clarify how this study augments current evidence and thus offer new implications for research and practice.

First, the notion that functional capabilities are beneficial across a range of contingencies appears to conflict with the negative or small effects on profit performance that we observe in some cases. In the case of marketing, a smaller contribution to competitive advantage in fluid product-markets may be due to the decreased scope and/or importance of the marketing function under these conditions. With frequent and substantive shifts in the products offered in a market, marketing strategy is likely to be more product- than customer-centric (Visnjic et al., 2019). The marketing investments associated with this capability – SG&A, advertising, and communications expenses (Feng et al., 2017; Xiong and Bharadwaj, 2013) – are less specific to a product-centric strategy, which relies more on customer-generated promotion arising from product superiority or differentiation (Gatignon and Robertson, 1989; Micheli

Table 4
Definitions and implications of capability routinization and renewal.

	Capability Routinization	Capability Renewal
Definition	**Retention:** The production, repetition, and codification of skills, knowledge, and processes that experience has shown to produce superior returns on resource utilization (Gavetti and Levinthal, 2000). Determines the degree to which the capabilities produced by selection can be maintained and utilized and the variation available for subsequent selection (Zollo and Winter 2002)	**Variation:** the presence of heterogeneous capabilities across functional areas that provides strategic options for change (Agarwal and Helfat, 2009; Lewin and Volberda, 1999) **Selection:** the choice and development of certain capabilities from among the alternatives presented by variation in response to environmental change (Volberda and Lewin, 2003).
Conceptualization	**Intermediate transformation ability** (Dutta et al., 2005), characterized by efficient resource utilization in core functional areas towards the attainment of key business objectives, specifically *marketing* (revenue generation), *R&D* (product innovation) and *operations* (cost minimization) (Feng et al., 2017; Krasnikov and Jayachandran, 2008).	**Evolutionary transformation ability,** characterized by (1) variation in the firm's current set of functional capabilities (heterogeneity) and (2) the ability to select from among these capabilities those that are strategically preferable given a new set of environmental conditions (adaptability).
Operationalization	Proximity to the efficient frontier of resource transformation between, • **Marketing** investments (SG&A and advertising) and sales revenue, • **R&D** investments and intangible assets, and • **Operations** costs (capital and labor) and the cost of sales estimated with stochastic frontier analysis (Dutta et al., 1999; Mishra et al., 2022).	**Capability Heterogeneity***:* Coefficient of variation in the level of functional capabilities across key areas (marketing, technology, and operations). **Capability Adaptability:** Changes in the proportion of functional capabilities attributable to each area over time (based on Fombrun and Ginsberg, 1990; Nadkarni and Narayanan, 2007).
Key Findings	**Product-Market Fluidity**: Environmental change conceptualized as the degree of competitive threat faced by a firm in key product-markets and operationalized as the year-to-year change in the similarity of business descriptions of a focal firm and its competitors (Hoberg et al., 2014).	
	Stable Product-Markets • Largest positive effects from marketing capabilities, with diminishing returns. • Significant positive effects of R&D capabilities on levels of profitability, trend towards increasing marginal returns. • Consistent positive effects of operations capabilities, with diminishing returns.	• Negative effects of capability adaptability and heterogeneity on both levels and growth of profitability. • Largest and most consistent negative effects from capability heterogeneity.
	Fluid Product-Markets • Positive effects of marketing capabilities persist but are reduced, and significant for profit growth only. • Negative effects of R&D capabilities, significant for levels of profitability only. • Largest and consistent negative effects of operations capabilities.	• Largest and consistent positive effects from capability adaptability. • Positive effects of capability heterogeneity for profit growth only.
Implications	• Focusing on functional capabilities is best when product-markets are likely to remain stable. • Marketing and operations capabilities should not be over-developed (diminishing returns). • R&D capabilities may benefit performance only at high levels and therefore be most costly to develop. • Marketing capabilities may be the preferable investment in uncertain conditions, as they remain beneficial in fluid product-markets.	• Focusing on renewal is only beneficial when product-markets are fluid. • Capability adaptability is less detrimental in stable product-markets and more consistently beneficial (across performance outcomes) in fluid product-markets than capability heterogeneity. • Developing the conditions for capability renewal, particularly heterogeneity, will incur costs that outweigh their benefits if product-markets remain stable.
Unresolved Research Questions	• How are the contingent effects of functional capabilities affected by the internal conditions of the firm (e.g., strategic positioning)? (see Fainshmidt et al., 2019) • Which other environmental risks can be mitigated through marketing capabilities? Can R&D or operations capabilities serve this role in other contexts? (see Mishra et al., 2022)	• Does the degree to which managers face pressure to adopt an 'agile' approach affect the likelihood of a focus on routinization or renewal? (see Prange, 2021) • What external and internal factors affect this decision and its consequences? (c.f. Helfat and Peteraf, 2015; Suddaby et al., 2019)

et al., 2018).

Product-market fluidity may therefore mean that efficiently leveraging the investments associated with marketing capabilities is less consequential to performance than in stable markets that favor a customer-centric approach (c.f. Hausman et al., 2002). Apple provides an illustration of how this approach does not align with common conceptions of marketing capabilities. While the company spends heavily on advertising in absolute terms, these investments are relatively inefficient. During Apple's rise to leadership in the smartphone market (2007–2010), its marketing capability ranged from .366 to .602. Even in recent years, Apple's efficiency in marketing is low for a dominant brand, with an average of .730 since 2017 (sample mean = .776). This apparent inefficiency in marketing investments can be understood by considering the high product-market fluidity that Apple faces. In the technology and consumer electronics markets, which are characterized by frequent innovations and intense competition, traditional measures of efficiency may not capture the strategic value of Apple's marketing. Rather than the efficiency of its marketing spend, Apple's success depends on its ability to create a strong, product-focused brand that inspires consumer loyalty and evangelism, enabling the company to maintain its market leadership despite the fluidity of its competitive landscape. In such an environment, success may depend more on the effectiveness of marketing in building a compelling brand narrative rather than efficiency in resource utilization.

The negative effect of R&D capabilities in fluid product-markets is ostensibly surprising. Firms may benefit from a greater ability to efficiently utilize resources to produce R&D advances in fluid environments. However, there is also a well-documented trade-off between efficiency and innovativeness (e.g., He and Wintoki, 2016; Lyandres and Palazzo, 2016). A key consideration when interpreting these effects is that our measure of R&D capabilities – and those commonly employed in prior research (e.g., Dutta et al., 1999, 2005; Feng et al., 2017) – is based on R&D investments. The forms of R&D that can generate the innovations necessary for success in fluid product-markets are often inefficient, requiring divergence from a firm's core R&D expertise and frequently exhibiting a high rate of failure (Hoberg and Phillips, 2016; Konya-Baumbach et al., 2019). In the routine-based conceptualization and efficiency-based operationalization, this highly risky process would not be considered a capability: empirically, failure to generate any return on an R&D investment would yield an OC score of zero. However, firms rarely succeed in fluid product-markets without such investments (Hoberg et al., 2014; Lyandres and Palazzo, 2016). In such markets, it may therefore be more important to maintain and shift the deployment of R&D resources rather than develop efficient routines, aligning with the observed effects of capability heterogeneity and adaptability.

Microsoft offers an example of this difference in resource utilization efficiency when pursuing R&D strategies that aim to disrupt or reinforce a firm's core product offering. In recent years, the company has shifted its technological development strategy, adopting a focused approach to R&D in combination with greater use of partnerships. This is reflected in high R&D capabilities, reaching a peak of .873 and .791 in 2018 and 2019, respectively (sample mean = .457). In contrast, leading up to the introduction of the Surface range and Xbox One in 2012–2013 – two products that represented a divergence from Microsoft's core business – the company's R&D efficiency was at its lowest, ranging from .153 to .370 between 2009 and 2012. The company's technological development is broadly considered to be successful in both cases but reflects divergent approaches to the use of R&D capabilities.

The positive effects of operations capabilities also reverse in fluid product-markets, which can similarly be understood to reflect the suitability of this functional capability under different conditions. High operations capabilities reflect efficient resource utilization in terms of the costs of labor, manufacturing processes, and capital relative to the firm's productive output (Krasnikov and Jayachandran, 2008). These characteristics tend to be associated with a cost leadership strategy and/or with incumbents with large production capacity, as these factors enable a firm to develop and maintain efficient routines in these key aspects of operations (Nath and Bharadwaj, 2020). However, fluid product-markets require changes to production, personnel, and financing (Hoberg et al., 2014; Teece, 2014). In this case, strong operations capabilities may become a hindrance, as the efficiency gains from established or large-scale processes also increase the difficulty of adapting as the market changes (Arend, 2004; Ramaswami et al., 2009).

The shift from hardware to software in computing illustrates how this may occur. Software is a more fluid product-market, requiring greater agility in operations. Adaptation to this shift is evident in the operations capabilities of notable firms in this market, such as IBM, which have de-emphasized operational efficiency in hardware in favor of more agile product development in the software market (see Web Appendix D and Visnjic et al., 2019).

In sum, while these findings appear to challenge the theoretical consensus regarding the beneficial effects of functional capabilities, the reduction or reversal of positive effects in fluid product-markets is consistent with the operational and practical notion of functional capabilities as the direction of resources in a repeatable and reliable manner towards a specific objective. This enables firms to realize greater payoffs from resources but may incur costs that outweigh these benefits when strategic change is required, and efficiency is no longer an appropriate goal.

Second, our results align with one side of the debate as to whether and how capability renewal is beneficial under stable conditions. We observe negative effects in stable product-markets and posit that these are due to the high costs associated with these variables, i.e. of maintaining the preconditions for capability renewal. If firms cannot realize the payoffs from capability heterogeneity or adaptability due a lack of evolutionary pressure in the environment, these costs may impair relative profitability and limit relative profitability growth. Capability heterogeneity may be costly for two reasons. First, the development and maintenance of multiple functional capabilities requires sustained investment (Winter, 2003). When these are in functional areas that are not central to a firm's competitive advantage, such investments may outweigh the benefits of maintaining optionality (Zahra et al., 2006). Second, capabilities in different functional areas often represent conflicting goals. For example, a focus on cost minimization in operations versus demand generation in marketing can result in "negative synergies" when firms focus on both capabilities (Feng et al., 2017, p. 83). This may create inefficiencies and coordination costs (King et al., 2008) that offset the potential benefits of capability heterogeneity, regardless of the level of development achieved in those capabilities. While capability adaptability does not necessarily involve significant investments, it incurs opportunity costs. Altering the configuration of the resource base can prevent the realization of benefits from any one functional capability, as capability development requires sustained commitment (Schilke, 2014). Frequent shifts in resource deployment will also raise coordination and transaction costs (Karim, 2006). In stable environments, where the functional capabilities associated with success can be predicably identified, capability adaptability may therefore impair performance by diverting resources from their most profitable use (Zahra et al., 2006).

Our results for functional capabilities indicate that routinization may not always be a suitable objective; equally, these effects suggest that renewal should be a context-specific goal in capability development. Tesla offers an illustrative example of this. In 2019, Tesla announced plans to expand production in response to strong demand. However, the company was instead forced to shut down its main manufacturing facility following the California government's response to the Covid-19 pandemic and distribution was severely limited due to economy-wide restrictions. Despite this ill-timed investment, the company capitalized on variations in government policy to rapidly shift manufacturing and R&D activities to favorable jurisdictions (Boudette, 2020). Demand-wise, Tesla's marketing strategy of relying on word-of-mouth generated by its products and the public relations of CEO Elon Musk, combined with its independence from traditional dealer networks, enabled the company to adapt to shifting consumer sentiment and behavior while avoiding heavy marketing investments (Bellon, 2020).

Tesla's actions exemplify the strategy of prioritizing renewal over routinization. This is reflected in our data: Tesla's capability adaptability is extremely high at .519, (sample mean = .136, SD = .143). Capability heterogeneity, at −.426, is slightly above average (mean = −.487, SD = .192). The implications for the company also demonstrate the arguments made above: while its financial performance has historically been volatile and its high valuation is divisive among investors (the company has not made a profit for four consecutive quarters since its founding), Tesla has outgrown all other automakers since the start of the pandemic in terms of brand value, and reported profits while others incurred significant losses (Brand Finance, 2022).

Together, these results support the notion that capability renewal drives superior performance in changing environments, while demonstrating the conditions that raise the costs of capability heterogeneity and adaptability beyond their payoffs (see Schilke et al., 2018; Wang et al., 2015). Conceptualizing and measuring the capability—performance relationship therefore requires recognition of the contingent relevance of both routinization and renewal. If consistent profitability is the objective, efficiency is a suitable goal and functional capabilities may be most beneficial. However, this comes at the expense of responsiveness to environmental change. If this is a priority, firms can sacrifice consistency in performance to avoid the losses that may occur if resource utilization cannot be appropriately adapted. Our results therefore suggest that capability heterogeneity and adaptability are effective in situations where competitive advantage is more transient and that this expectation should be a factor in decisions regarding firms' relative focus on routinization versus renewal (see McGrath, 2013; Vanpoucke et al., 2014). Finally, our results highlight that prioritization of functional capabilities in marketing can be an effective strategy for mitigating these trade-offs.

8.1. Implications for research

Our evolutionary perspective on capabilities offers new insights into how to define, measure, and understand the significance of *how* capabilities are managed relative *to what* capabilities a firm possesses, and the importance of each factor with respect to a firm's environment (e.g., Karna et al., 2016; Schilke et al., 2018; Suddaby et al., 2019). Resultantly, this study has four main implications for the literature: (1) methodologically, providing a theoretically grounded precedent for future empirical research; (2) substantively, offering generalizable insights from a multi-industry dataset; (3) theoretically, by clarifying critical debates; and, (4) reconciling conflicting conceptualizations in an integrated framework.

First, our methodology characterizes capability routinization and renewal in a way that is conceptually independent of their intended outcomes (see Dutta et al., 2005). Our measures of heterogeneity and adaptability are non-tautological and carry no inherent judgement regarding the value of these factors, facilitating a more accurate assessment of both the costs and benefits of capability renewal. Furthermore, we demonstrate the utility of a measure of environmental change that is applicable across firms and contexts (Hoberg et al., 2014) and conceptually appropriate to examining how capabilities respond to evolutionary pressures in a firm's competitive environment. Prior research has relied on subjective or industry-level assessments, whereas both theory ((Barney, 2014) and evidence (Hoberg and Phillips, 2016) suggests that the relevant changes occur at the product-market level. These measures may be adopted and developed to improve the alignment between theory and empirics in future research, for which we discuss possibilities below.

Second, by applying this methodology, we provide a substantive contribution to a literature that has historically comprised of small-scale, qualitative studies and context-specific cases. The second key implication of this study is therefore to offer a counterbalance to the fragmentation of empirical research on capability renewal, which has increasingly focused on contextual nuances while the core question – whether and when the ability to modify capabilities as the environment changes outweighs the benefits of developing strong functional capabilities via routinization – still requires rigorous verification (e.g., see Fainshmidt et al., 2019; Karna et al., 2016; Schilke et al., 2018). In contrast, we formulate hypotheses to represent common assumptions regarding the benefits of capability renewal and examine these in a large, longitudinal dataset spanning multiple industries. Our findings therefore provide a consolidation of knowledge on the implications of capability routinization and renewal, offering generalizable insights into the capability—performance relationship from which future research can develop more pertinent questions. We provide examples in Table 4 and discuss below.

Third, this substantive contribution is theoretically significant, as it offers insight into prominent debates within the capabilities literature. Specifically, that (1) capability renewal may also be necessary in stable environments to enact more routine forms of strategic change, and (2) that the benefits of renewal may have been overstated and the costs, relative to the development and maintenance of routines in a firms core areas of competence and advantage, minimized (see Prange, 2021; Schilke et al., 2018). We directly address these issues, and our findings suggest that (1) the conceptualization of capability renewal as a requisite of changing environments is better reflected by the empirical data than recent critiques that advocate renewal across both stable and fluid conditions, and (2) there are understudied costs to capability renewal that are mitigable by targeted investments in functional capabilities, particularly in marketing.

Finally, we therefore offer an additional and related theoretical contribution to the literature, providing clarification on the veracity of contemporary critiques and debate within the capabilities literature (e.g., Fainshmidt et al., 2019; Suddaby et al., 2019; Wilden et al., 2016). Our results support the premises of, for example, work on dynamic capabilities (Teece, 2014) and exploration versus exploitation (March, 1991) in their various conceptualizations of capability routinization and renewal (see Hunt and Madhavaram, 2020), and may be interpreted to suggest that capability renewal is a necessary alternative to routinization in changing environments. However, by adopting a novel evolutionary perspective on these broad constructs, we also offer a framework for reconceptualizing the relationship between routinization and renewal not as a dichotomy but as sequential, integrated stages in a recurring process of variation, selection, and retention. Within this framework, the key managerial problem is to determine the appropriate degree of attention and investment dedicated to each stage given the evolutionary pressure (i.e., rate of change) faced by

the firm (e.g., see Volberda, 1999; Volberda and Lewin, 2003). By explicating the understudied costs of renewal (Karna et al., 2016; Schilke et al., 2018), we offer additional insight into the practical applicability of this theoretical approach.

In addition to aiming to bridge the bifurcation between research on capability routinization and renewal, our findings also suggest another fruitful avenue for integration in the capabilities literature: between strategic management and marketing. Among the three functional capabilities most commonly studied, marketing appears to have unique effects on risk mitigation beyond its role in enhancing performance (see also Mishra et al., 2022). The theoretical and conceptual insights of marketing research may therefore be valuable for theoretical progress on a broader, interdisciplinary level (e.g., see Barney, 2014; Kalaignanam et al., 2021).

8.2. Implications for practice

Theoretical debate in the capabilities literature reflects recent managerial discussion of the costs and benefits of developing reliable, efficient routines versus the ability to rapidly respond in uncertain environments (Bruch and Menges, 2010; Prange, 2021). Accordingly, this study also provides actionable insights. In contrast to the context specificity of much prior research that has limited the ability to generate specific, practical implications for management (see Schilke et al., 2018), our multi-industry approach facilitates (1) general recommendations for strategic management and (2) specific guidance for marketing managers.

First, our results may inform top management in the setting of strategic goals and allocation of resources, specifically in decisions regarding the prioritization of capability routinization and renewal based on the current and expected levels of product-market fluidity. Furthermore, evidence of diminishing returns (in marketing and operations) and increasing marginal returns (in R&D capabilities) provides a basis for assessing which functional capabilities will be most costly to develop and whether this investment is worthwhile. The relevance of these factors will depend on firm-specific factors that management must assess (e.g., see Fainshmidt et al., 2019; Wilden et al., 2016). By linking capability investments to performance outcomes, this study thus complements other work in the capabilities literature that focuses on managerial decision-making in offering guidance for these decisions (Ferecatu and De Bruyn, 2022; Helfat and Peteraf, 2015). Further, as boards of directors assume an increasingly active role in setting strategic priorities and allocating resources (Whitler et al., 2020). These implications for decision-making may be extended to board-level decisions.

Second, this research has additional practical relevance for marketing executives. Beyond our results regarding the optimal conditions and level of capability development being informative for decision-making at the functional level, we show that marketing capabilities play an overlooked and apparently unique role in mitigating the risks associated with uncertain environments (see also Mishra et al., 2022; Xiong and Bharadwaj, 2013) and offer a profitable alternative to the high costs and risks of capability renewal. In light of recent concerns about demonstrating marketing's contribution to profit performance (CMO Survey, 2020; Whitler et al., 2020) and difficulties justifying investment in the marketing function at the executive and board level (Edeling et al., 2020), this evidence is valuable to marketing executives seeking to ensure that their function receives appropriate consideration in budgeting decisions.

8.3. Limitations and directions for future research

Several limitations regarding the scope and design of this study leave unresolved questions, which we summarize in Table 4. First, following the emphasis of prior research on capabilities (see Karna et al., 2016; Krasnikov and Jayachandran, 2008; Schilke et al., 2018), we focus on external contingencies. Further consideration of factors internal to the firm therefore presents additional opportunities to address unresolved debates: for example, whether the effects of capability routinization and renewal differ according to strategic positioning (Fainshmidt et al., 2019; Karna et al., 2016). This could provide greater insights into the conditions under which the benefits of renewal are outweighed by their costs: differentiation strategies generally require greater investment in capability renewal (Fainshmidt et al., 2019), suggesting that both costs (in stable environments) and payoffs (in fluid environments) may be greater for firms pursing this strategy. Our methodology offers a foundation for pursing such questions.

Second, the evidence we present for the unique role of marketing capabilities in mitigating the trade-off between routinization and renewal and risks associated with fluid product-markets opens two avenues for future research: (a) can marketing capabilities protect against other forms of risk or environmental change? And (b) can R&D or operations capabilities serve this role in other contexts? Recent evidence indicates that marketing capabilities can similarly reduce the risks associated with economic policy uncertainty (Mishra et al., 2022) and negative financial news (Xiong and Bharadwaj, 2013), suggesting opportunities to explore the risk reduction role of marketing and other functional capabilities under various contingencies at the macro- and micro-level.

Third, we focus on the capability—performance relationship. Managerial cognition is beyond the scope of this study; however, the pressure that firms face to prioritize renewal over routinization is a common topic of managerial discourse (see Prange, 2021). Exploring the antecedents to managers' prioritization of functional capabilities versus heterogeneity and adaptability could provide insights into how firms can manage decision-making processes to ensure this decision is based on evidence rather than internal or external pressures. This would enhance the ability of managers to utilize the practical implications of this study.

Addressing questions of managerial cognition and capability development requires data about conditions internal to the firm (Helfat and Peteraf, 2015). While we argue and demonstrate that our methodology offers a stronger basis for deriving generalizable conclusions about the *deployment* and *outcome* of functional capabilities, capability heterogeneity, and capability adaptability, qualitative approaches remain important for such investigations. For example, recent work has argued for a configurational approach, examining the antecedents and effects of capabilities under multiple interactions between contingencies (Fainshmidt et al., 2019; Wilden et al., 2016). Combining case studies or surveys with the measures developed in this study would allow variables under managerial control (e.g., the cognitive processes of capability development) to be examined in an appropriately subjective manner whilst remaining detached from assessment of those resulting from and/or outside of this control (e.g., external conditions,

capabilities, and outcomes), thus avoiding the methodological issues associated with prior research. This combination of approaches would enable examination of a broader range of contingencies than we address here and may be necessary to address questions regarding the antecedents to the prioritization of capability routinization and renewal.

CRediT authorship contribution statement

Kerry Hudson: Writing – review & editing, Writing – original draft, Software, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **V. Kumar:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Robert E. Morgan:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization.

Data availability

The authors do not have permission to share data.

Acknowledgements

The authors are grateful to the following for feedback that has helped to shape the theoretical arguments in this article: Alessandro Giudici, Tom Mom, Oliver Schilke, Henk Volberda, Richard Whittington, and Ralf Wilden.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.lrp.2024.102480.

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