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THE LONG AND WINDING ROAD:

ROUTINE CREATION AND REPLICATION IN MULTI-SITE ORGANIZATIONS

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Abstract

Prior research on organizational routines in the 'capabilities' literature has either studied how new routines are created during an exploratory process of variation and selection *or* how existing routines are replicated during a phase of exploitation. Few studies have explored the life cycle of new routine creation *and* replication as an integrated process. In an in-depth case study of England's Highways Agency, this paper shows that the creation and replication of a new routine across multiple sites involves four sequential steps: envisioning, experimenting, entrenching and enacting. We contribute to the capabilities research in two ways: first, by showing how different organizational levels, capabilities and logics shape the development of new routines; and second, by identifying how distinct evolutionary cycles of variation and selective retention occur during each step in the process. In contrast with prior research on replication as an exact copy of an template or existing routine, our study focuses on the replication of an entirely new routine based on novel principles (in absence of an existing template) that is adapted to fit local operational conditions during its large-scale replication across multiple sites. We draw upon insights from adjacent 'practice research' and suggest how capabilities and practice studies may complement each other in future research on the evolution of routines.

Key words: routines; capabilities; creation; replication; organizational hierarchy

1 Introduction

Routines are defined as the "regular and predictable behavioural patterns of firms" (Nelson and Winter, 1982: 14). Organizations learn and adapt to the environment by encoding inferences from history into routines that guide behaviour (Levitt and March, 1988). Routines serve as stores of organizational memory, skills and tacit knowledge (Nelson and Winter, 1982; Cohen and Bacdayan, 1994) and are conceived as the building blocks of organizational capabilities (Winter, 1995; Felin, Foss, Heimeriks and Madsen, 2012). Organizations develop, stabilize and follow routines over extended periods of time and adapt to a changing environment by reconfiguring routines, creating new ones and using them consistently across organizational sites (Zollo and Winter, 2002).

In this paper we identify and analyze how new routines are intentionally created and reproduced with some degree of consistency and uniformity across multiple sites in an organization. Since Nelson and Winter's (1982) foundational work, research on routines has divided into two streams: the capabilities and practice perspectives (Parmigiani and Howard-Grenville, 2011). Capabilities research treats routines as whole entities and investigates how firms manage their portfolio of routines to achieve competitive advantage. Within this stream, research has either studied how dynamic capabilities are deployed in the search for new routines (e.g. Teece, Pisano and Shuen, 1997; Zollo and Winter, 2002) or focused on how stable routines are replicated across multiple sites (Winter and Szulanski, 2001; Szulanski and Jensen, 2006; Winter, Szulanski, Ringov and Jensen, 2012). With its focus on the internal dynamics of routines, practice research shows how routines, once conceived as stable, can be a source of flexibility and change when performed by agents, but has paid less attention to how entirely new routines are created (Obstfeld, 2012; Feldman, Pentland, D'Adderio and Lazaric, 2016; Dionysiou and Tsoukas 2013; Salvato and Rerup, 2018).

Overall, surprisingly little research attempts to understand how the creation *and* replication of new routines is conducted as an integrated process over time (Gupta, Hoopes and Knott, 2015). Identifying this process is important as part of current research efforts to understand how routines come into being and stabilize (Obstfeld, 2012; Feldman et al. 2016, Dionysiou and Tsoukas 2013) and how routines are assembled into capabilities (Eggers and Kaplan, 2013). In addressing this issue, we

adopt a capabilities perspective because we are interested in understanding how new routines – treated as whole entities – can be targets for managerial interventions and intentionally developed to achieve an organization's strategic objectives (Nelson and Winter, 1982; Winter and Szulanski, 2001; Zollo and Winter, 2002; Levinthal and Marino, 2015).

In capabilities perspective, the evolution of new routines occurs when organizations generate new patterns of action and selectively retain the most successful ones (Nelson and Winter, 1982; Zollo and Winter, 2002). Zollo and Winter (2002) developed an evolutionary model of variation, internal selection, replication and retention showing how routines emerge and stabilize over time. This evolutionary process takes place within 'dual-routines' structure (Nelson and Winter, 1982; Zollo and Winter, 2002): senior managers employ dynamic capabilities ('higher-order' routines) in the systematic search to change, create and replicate 'lower-order' operational routines (e.g. Teece, Pisano, and Shuen, 1997; Zollo and Winter, 2002). Despite these important theoretical advances, few empirical studies examine how new routines are created in contexts that require their 'rapid' reproduction across sites.

Building on Zollo and Winter's (2002) model and other streams of capabilities research, we identify the specific organizational processes involved in the development and reproduction of new routines. In contrast with the traditional conceptualization of replication as an exact copy of an historical template or existing routine with high fidelity to the original as often occurs in banking or retailing (Winter and Szulanski, 2001), our study focuses on the uniform and consistent reproduction of an entirely new routine based on novel principles (Baden-Fuller and Winter, 2005) that is adapted to fit local operational conditions during its large-scale replication across multiple sites (Jonson and Foss, 2011). Our research responds to calls for 'multi-level research' by showing how the process is shaped by different levels – strategic and operational – in an organizational hierarchy (Salvato and Rerup, 2011).

To address our research question we carried out an in-depth case study of how a large public-sector organization – England's Highways Agency – developed and implemented new routines across multiple sites responsible for maintaining England's network of highways and trunk roads. We contribute to capabilities research on routines by providing a more fine-grained account of the specific

processes involved in the life cycle of new routine creation and replication. Our model shows how actors working in different organizational levels (strategic and operational levels) interact during key phases (exploration and exploitation) in the process. We identified four sequential steps from the original decision to introduce a new routine and its widespread implementation across multiple sites: envisioning, experimenting, entrenching and enacting. Managers working in strategic and operational units perform distinct steps in the process as they navigate the long and uncertain path from routine creation to replication. By investigating how evolutionary processes occur in an empirical study, we show that there is is no one-to-one correspondence between broad-level stages of variation, selection and retention and the specific steps and activities undertaken in actual practice.

The paper is organized as follows. Section 2 reviews the literature providing alternative conceptualizations of how routines are created and replicated as an organizational process; Section 3 describes our method and data; Section 4 introduces our research setting; Section 5 presents our findings; Section 6 identifies our contribution to research on routine development and offers suggestions for future research; and Section 7 provides a summary of our research.

2   The creation and replication of organizational routines

2.1   Evolutionary theory of routines and capabilities

Building on the work of the 'Carnegie School' (March and Simon, 1958; Cyert and March, 1963; Gavetti, Levinthal and Ocasio, 2007), Nelson and Winter (1982) developed the concept of routine as the basic unit of analysis in an evolutionary theory of organizational change by natural selection. Nelson and Winter (1982) focused on the stable, predictable and learned 'behavioural' patterns of routines, whereas the Carnegie School emphasized the 'cognitive' decision rules, standardized operating procedures and other mental models that guide routine behaviour (Becker 2004; Salvato and Rerup, 2011). Nelson and Winter (1982) identified how organizations search and selectively retain entirely new routines when prevailing ones no longer provide an adequate response to environmental pressures by following a problem-solving sequence: "select element, test for desired

attributes, terminate with success if attributes are present, select next element if they are not" (Nelson and Winter, 1982: 132).

The distinction between routines conceived as cognitive rules (Cyert and March, 1963) or behavioural regularities (Nelson and Winter, 1982) is avoided in more recent capabilities research showing how the two logics complement each other (Gavetti and Levinthal, 2000; Becker, 2004; Gavetti, 2005; Levinthal and Rerup, 2006; Eggers and Kaplan, 2013). Gavetti and Levinthal (2000) suggest that organizations engage in a cognitive and experiential search when existing routines are no longer appropriate in a changing environment and there is a perceived need to modify or replace them (Gavetti and Levinthal, 2000). Cognitive learning involves generating and assessing 'offline' analysis, experiments and consultations without implementing new practices or changing routines. Experiential learning occurs 'online' when actors engage in an activity in order to evaluate it and assess the performance of alternative practices, trial experiences and adjustments to routines. Whereas cognition refers to the 'forward-looking' rationality used to evaluate a broad set of alternatives, experiential learning depends on 'backward-looking' knowledge which accumulates as result of prior choices and behavioural patterns that change as a result of feedback from experience.

In evolutionary theory, routines are the building blocks of a firm's capabilities (Winter, 1995) located at two different levels of an organizational hierarchy. Influenced by Nelson and Winter's (1982) dual-routines framework, a distinction is made between dynamic capabilities at the strategic level and operating routines performed at the operational level (e.g. Helfat and Peteraf, 2003; Becker 2004; Helfat and Winter, 2011; Teece, 2007; Peteraf, Di Stefano and Verona, 2013; Di Stefano, Peteraf and Verona, 2014). The collection of 'lower-order' routines are performed to produce a product or provide a service are part of a firm's operational capabilities (Helfat and Peteraf, 2003; Helfat and Winter, 2011).

Dynamic capabilities are the 'higher-order routines' employed by top managers to intentionally build, integrate and reconfigure operating routines in response to a changing technology or market environment (Teece et al, 1997; Zollo and Winter, 2002; Winter, 2003; Knott, 2001; Easterby-Smith et al. 2009; Daneels, 2008 and 2010; Ethiraj, Kale, Krishnan and Singh, 2005; Helfat and Winter, 2011) and select a routine for widespread replication (Winter and Szulanski, 2001; Teece 2012). The

dual-level distinction in capabilities research provides us with a broad framework to investigate how the process of routine creation and replication occurs is shaped by different levels in an organizational hierarchy (Salvato and Rerup, 2011; Lazaric, 2011) – strategic and operational. Zollo and Winter (2002) provide an overall description of the process, but little research has attempted to investigate empirically how dynamic capabilities and operating routines interact in a hierarchical relationship during routine creation and stabilization.

2.2 Routine creation

In capabilities research, the creation of new routines is conceptualized as an evolutionary process of variation, selection and retention, which when consistently undertaken constitutes a dynamic capability. Zollo and Winter (2002) suggest that routines evolve through four stages in knowledge cycle.

First, in the generative variation stage, individuals or groups engage in an off-line cognitive process to generate new ideas to approach new challenges or existing problems in novel and creative ways. This involves responding to external stimuli (e.g. competitor's initiatives, normative changes and new discoveries) and internally generated information about the adequacy of an organization's existing routines in a changing environment. Second, in the internal selection stage, also conducted offline, the organization analyzes and debates the expected benefits and risks of the new ideas in relation to the shared understanding of the organization's previous experience and their potential for enhancing existing routines or creating new ones. Internal selection occurs when one variation is selected and others are eliminated. Third, in the replication stage, now performed online, the new operational routine or enhancement on an existing one is reproduced at relevant sites within the organization. Fourth, in the retention stage, the new information created when new routines are employed in diverse contexts can initiate a new stage of variation in the knowledge cycle. Retention occurs when selected operating routines are enacted across multiple sites and repeated on future occasions.

While conceptually separated into stages, in practice the four activities are connected by a chain of feedback loops in a recursive cycle of knowledge development (Zollo and Winter, 2002). The four

stages of evolution transition over time, in March's (1991) terms, from a phase of exploration to a phase of exploitation (Zolo and Winter, 2002: 344). The initial stages of generative variation and internal selection – or exploration – depend on deliberate and intentional cognitive forward-looking efforts to generate a range of novel ideas and intuitions and select the most appropriate ones through various evaluations and assessments. The latter stages of replication and retention – or exploitation – depend to a greater extent on backward-looking experiential mechanisms to replicate the new routines in diverse contexts and incorporate them in recurring operational activities. In addition, in recent work, Levinthal and Marino (2015) discuss a double-level selection process, in which an organization selects both at the level of broadly different classes of routines and at the level of variation in the characteristics of each selected class.

2.3   Routine replication

While the broad evolutionary process of variation and selective retention has received a great deal of attention in the capabilities literature, there has been little empirical research on the organizational processes within which this takes place, particularly the process of variation involved the generation of new routines prior to replication (Gupta et al. 2015). Replication occurs when routines are copied and reproduced across multiple sites within organizations. Based on the assumption that an existing routine or historical template is available for selection and retention (Winter and Szulanski, 2001), studies of replication neglect to consider the possibility that a new routine – in the absence of an existing template – is deliberately created and prepared for widespread replication.

A transition from exploration to exploitation underpins Winter and Szulanski's (2001) well known model of replication. A phase of exploration occurs when successful attributes of knowledge comprised of a complex set of interdependent routines are discovered, fine-tuned and refined. A subsequent phase of exploitation takes place when the replicator abandons further efforts to refine the new practice, decides to stabilize the format (or freeze the design), ignores traits that fail to add value, and initiates large-scale replication of the selected routine in many local units, often facing resistance from locally autonomous agents.

7

A 'guiding example' or 'historical template' is used as the basis for a replicated routine. The template captures all the information that contributes to the success of the replicated routine (Winter and Szulanski, 2001:733). However, not every replication is guided by a template. Replicators may completely ignore or bypass reference to existing working examples in an attempt to create a new example based on "nothing but plans, or even nothing but ideas, to guide the effort" (Winter and Szulanski, 2001: 736). Baden-Fuller and Winter (2005) considered how replication occurs when organizations 'replicate by principles' with no direct reference to a working example or existing template. Whereas templates consist of knowledge of 'how' things work, principles refer to causal explanations about 'why' certain things work. But bypassing a template is considered risky because of the unanticipated problems that can arise when implementing a complex and causally ambiguous routines in new settings. For this reason, organizations are advised to copy the template 'exactly', before attempting modifications aimed at accommodating the context of each local operating unit (Jensen and Szulanski, 2007; McDonald, 1998; Szulanski and Jensen, 2006, 2008; Winter and Szulanski, 2001).

The transition between phases is a critical period when the replicator depends on the dynamic capabilities of a central strategic unit to recreate complex, imperfectly understood and partially tacit knowledge in carefully-selected sites in preparation for large-scale replication (Winter and Szulanski, 2001: 731). This strategic organization is responsible for developing a repository of templates, gathering feedback on each successive replication, acquiring a detailed understanding of the existing site-specific tasks, skills, and tasks performed by local operational units, and identifying which new procedures will enable those local units to replicate the new operational routine. The strategic unit requires dynamic capabilities to capture value from replication during the exploitation phase by supporting the expansion of a standardized practice and understanding how tacit and highly complex routines provide a foundation for learning and systematic replication (Teece et al., 1997: 525).

The assumption that a template should not be modified by operational units during the process of replication (Szulanski and Jensen, 2006, 2008; Winter et al., 2012) is questioned by Jonsson and Foss (2011) who found that copy exact replication is not always appropriate. In a study of IKEA Jonsson and Foss developed a 'flexible replication' process. The model distinguishes between central

features that need to be copied exactly and peripheral features that can be adapted to local markets. This process involves local adaptation of the original template and ongoing iterations between exploration and exploitation. Importantly, knowledge moving in the reverse direction from operational to strategic units may also shape the evolution of routines and their adaptation to local contexts. This resembles the findings of an adjacent stream of research concerned with how management practices are varied and adapted to fit the particular context within which they are adopted (Ansari, Reinecke and Spaan, 2014; Peeters, Massini and Lewin, 2014). D'Adderio (2014) found that organizations deal with the conflicting goals and pressures to copy exactly (replication) and change (innovation) by separating the two processes and enacting them at different times.

2.4   Insights from practice research

Responding to recent calls to build connections between capabilities and practice research on routines (Parmigiani and Howard-Grenville, 2011; Howard-Grenville et al, 2016), we identify important insights that can help to illuminate the processes investigated in this paper. By studying the inner workings of routines, practice research provides helps us understand how routines change as people enact them (Feldman, 2000; Feldman and Rafali, 2002; Feldman and Pentland, 2003; Pentland, Feldman, Becker and Liu, 2012). Focusing on the internal dynamics of routines, practice research studies how variation and selective retention take place at the level of the individual actions that comprise a routine (Feldman and Pentland, 2003). Feldman and Pentland (2003) explain how the cognitive or behavioural dimensions of routines, discussed earlier, are entwined in actual practice (Salvato and Rerup, 2011; Howard-Grenville and Rerup, 2016). Whereas as 'performative aspects' are the behavioural actions accomplished by people at a particular time and in a specific place, 'ostensive aspects' are cognitive models, abstract understandings and rules for enacting the routine.

Recent research addresses "where routines come from" (Feldman et al., 2016; Howard-Grenville et al, 2016) including the processes of variation and retention involved in the creation and intentional development of routines (Dittrich and Seidl, 2018). Pentland et al (2012) develop a simulation model showing how new routines are generated over time through a dynamic process of variation and selective retention. Several scholars identify the role of trial-and-error learning and

sequences of action involved in the creation of routines (Lazaric and Denis, 2005; Rerup and Feldman, 2011; Dionysiou and Tsoukas, 2013).

In practice research, routine creation is conceived as an emergent process resulting from the repetitive patterns of action and internal dynamics of routines. Building on the distinction between a routine's ostensive and performative aspects, Obstfeld (2012) identifies the emergent and deliberate action associated with two alternative trajectories of routine development. A routine trajectory is based on past repetition and the stable pattern of action undertaken to keep work on track by addressing minor contingencies and adjustments. A 'creative project' trajectory is initiated to get new things done – or create new routines – by envisioning a new end state and pursuing that objective through emergent action.

Practice research helps to explain how artifacts provide the context within which routines develop, including the ostensive and performative aspects (Howard-Grenville and Rerup, 2016). Standardized operating procedures, software tools, checklists, templates and other written documentation are artifacts of the ostensive aspect of routines. But the ostensive aspect is not identical with an artifact because it also includes the subjective understandings and tacit knowledge of the actors involved. Indeed, some routines do not have artifacts because they are based entirely on abstract rules and nonformal representations. Artifacts may influence the emergence routines by "stabilizing existing action patterns, or providing the glue that can hold patterns together" (D'Adderio, 2011: 1). Recent research considers the role of artifacts in the development of new routines (Cacciatori, 2012) and how artifacts are intentionally designed to shape routine dynamics (Glaser, 2017). D'Adderio (2014) shows how artifacts are used during the transfer phase or replication to provide consistency and modified in the post-transfer to facilitate variation and adaptation. Finally, Seele and Grand (2016) and Spee, Jarzabkowski and Smets (2016) provide evidence of how artifacts perform a key role in supporting the interconnection among different routines.

Contributions from practice research shed light on the patterns of action and artifacts involved in the emergence and persistence of new routines. However, there is little understanding of how artifacts and routines work together in an overall organizational process and how the intention to

10

create new routines to achieve an organization's strategic objectives shapes their development over time.

2.5   Constructs informing our research

Our review of the literature identifies the key constructs required to answer our research question: How are new routines are created and replicated across multiple sites in organizations? By drawing together these different strands of capabilities research we are able to consider how the creation and replication of new routines can be depicted as a process involving a life cycle from early exploration to widespread exploitation. By examining the dual-level structure of routine development, we can identify how the development of new routines are shaped by different levels in the organizational hierarchy and their associated behavioural and cognitive rationalities (Salvato and Rerup, 2011). Strategic units employ high-order dynamic capabilities to develop new routines and select templates for widespread replication. Managers in strategic units primarily depend on a forward-looking cognitive reasoning to envision a future end state, creatively develop new principles and select templates for widespread replication. Operational units experiment with new routines in selected trials and subsequently adapt standardized practices during a process of implementation in multiple sites. Managers in operational units depend on a backward-looking experiential reasoning based on past routines, experience and feedback gained from the performance of routines. Practice research suggests that artifacts, such as written procedures and rules, shape the evolution of routines from their creation to replication across multiple sites.

3   Research methods

3.1   Data gathering

We conducted a case-study of how England's Highways Agency (HA) to explore our research question: How do organizations create and replicate new routines across multiple sites? Since its foundation in 1994, the HA has systematically developed new generations of new contracts and written procedures – each intentionally designed and used to create and implement a new routine – to

improve the procurement and management of the maintenance of highways and trunk roads across its geographical regions.

We initiated our research by holding high-level discussions with senior HA managers to define the scope of the research. Our close interaction with practitioners in HA and its contractual partners provided us with a rich and detailed appreciation of the context within which the work was undertaken (Barley and Kunda, 2001). The main source of data collection was 44 semi-structured retrospective and real-time interviews (60–180 minutes) using an open-ended interview protocol over a period of 20 months (March 2007–November 2008). We produced a case study as a narrative to capture the findings from our interviews which we discussed with key informants. In addition, we conducted two interviews with our main point of contact in HA (2010) to explore the validity and usefulness of our conceptual findings – the process model of routine creation and replication described below (Lincoln and Guba, 1985). While undertaking the interviews for our fieldwork we participated in workshops and conferences, and gathered and analyzed documentary material addressing the HA's strategy, procurement and contractual activities.

Informants were asked questions about their role and responsibilities in the HA and its partner organizations (e.g. new joint ventures), focusing on the activities involved in creating, developing, and implementing the new maintenance contracts. Interviews addressed the skills, experience, organizational structures and support needed to perform new activities and identified the sequence of events, activities, and decisions to improve highway maintenance performance. We encouraged informants to illustrate their statements with examples from various situations and specific events. We updated our interview protocol regularly so that it was firmly anchored in our emergent findings and including more specific details about the ongoing process of routine creation, development and implementation as our understanding deepened. In this way, we moved from a more abstract understanding towards a more concrete identification of the managerial actions and organizational units involved during particular stages in the process of new routine development. Our data collection was brought to a close when we experienced conceptual saturation.

Interviews took place on site at the HA offices in London, Bristol, and Birmingham. We relied on purposeful sampling and the snowballing technique (Lincoln and Guba, 1985; Kumar, Stern and

Anderson, 1993) to identify the appropriate informants. Interviews were undertaken with managers in the strategy and central procurement units responsible for developing the new procurement methods and with managers at the operational level in a selected HA geographical areas responsible for developing the routines required to enact the new maintenance contracts. We interviewed HA board members, the CEO, directors (e.g., finance, HR, and network strategy) because they had a deep knowledge of the organization's history and were key decision makers shaping the organization's future strategy for procurement. We interviewed staff in central procurement departments (which, in our settings, was a key strategic unit) to understand the role of contracts and written guidelines in the development and implementation of the new routines across multiple sites. Interviews in the operational units were conducted with HA directors of regional offices (i.e., the people responsible for developing and implementing the actual routines) and member of the operational teams including staff working for the HA and various contractors. Recorded and transcribed for analysis, interviews were undertaken by two authors (and on several occasions a third author) and immediately followed by a debriefing and initial data analysis.

To increase confidence in the validity of our findings, we supplemented data gathering with focus-group meetings where we discussed our preliminary results, initial hypotheses, and conceptual frameworks. These sessions generated further information and documentation about the HA's strategies, project reports, minutes, and news briefs. We attended four workshops where we listened to presentations about the new maintenance contracts. Our participation provided access to informal after-work sessions where our findings were further discussed and analyzed by HA staff. Such observations allowed for greater reflexivity in making sense of our interview material and assisted our interpretation of how the organizations progressed over time (Barley and Kunda, 2001). Because the HA was publicly owned, it was legally required to be transparent and accountable for its actions, providing us with access to the large amount of rich secondary source documentation available in the public domain (Suddaby, 2006).

3.2   Data analysis

As we were interested in routine creation and replication as an integrated process, we adopted Langley's (1999) methodology. Using interviews and documentary sources, we reconstructed a broad narrative of how the HA developed and implemented the new routines across its regions. Adopting Strauss and Corbin's (1990) procedure, we manually open coded the interview transcripts and other descriptive materials into initial concepts. By iterating between coding, data collection, and relevant literature, we were able to substantiate initial concepts. We used axial coding to focus on one category at a time in order to consider the relationships between core concepts (Strauss, 1987:32). Figure 1 shows our data structure while Table 1 provides examples of how interview quotes were coded and grouped into first and second-order themes. These representative quotes are illustrative examples of corroborated findings confirmed across multiple respondents.

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Insert Figure 1 and Table 1 about here

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During the open coding process, we selected certain terms and phrases to represent the meanings various groups attached to activities involved in routine creation and development, the different types of skills and competences employed, or actions related to specific events (Van Maanen, 1979). These codes, such as how contracts were prepared, emerged as we engaged closely with the research setting. As shown in the literature review, there is a well-developed body of literature on the evolution of routines and their replication. This body of knowledge provided us with broad concepts that were useful for engaging in a dialogue with extant work. In this phase, we used theory to make us sensitive and identify broad concepts and themes in the data, rather than as a means to construct specific, testable hypotheses (Charmaz, 2014; Kelle, 2005). Therefore a few of the nine first-order codes that we develop corresponded to theoretically relevant concepts — such as capturing and sharing knowledge.

14

Our discovery that the creation and implementation of new routines follows distinct phases of progression (as we show in the Findings section) provided our primary theoretical breakthrough. This was then taken to the next step in data collection for checking and revision. In a structured process, we developed our second-order conceptual coding (Gioia, Price, Hamilton and Thomas, 2010; Corley and Gioia, 2004; Gioia, Corley and Hamilton, 2013), linking our empirical findings to conceptual themes and overarching dimensions of identified in our initial and ongoing literature review including the central idea guiding our research. The argument in capabilities research that new routines evolve through a life cycle from exploration to exploitation and are shaped by two levels in an organizational hierarchy (the strategic and operational units) helped us identify the four-step sequence of managerial actions involved in the creation and replication of new routines. The conceptualization of routines in practice research as an ensemble of actors and artifacts helped us understand the role of contracts as artifacts or written guidelines without which the new routines could not emerge.

Moving from first to higher-order codes required assessing how statements in each of the codes could be grouped into themes and, eventually, aggregate dimensions, such as exploring and exploiting (Gioia et al., 2013:20-22). As an example of this process, in the "Developing procurement principles" code we had quotes such as:

> "Traditionally in government that's always been lowest price . . . but clearly that was flawed, because it just drove down tender prices until they were unsustainable, and then you'd got all the contractual claims. So how could you develop? Our thought process was how do you develop a whole series of processes that will give, in effect, the chief executive, the chief accounting officer, the assurances that you are appointing the best suppliers to carry out the outsourced work, and at the same time it will be affordable, and you will improve budgeting certainty? . . . So that, that was a huge challenge" (HA interview 2008).

In our data, we found many similar quotes highlighting how interviewees in the strategic unit were influenced by a forward-looking cognitive logic of envisioning an desired end state and identifying the novel ideas and processes required to achieve it. This led to the development of an "envisioning" second order code. Similarly, in "Transforming working behavior":

> "I think there are certain things within contracts you can interpret without actually changing the letter of them, and that can translate through to quite a significant difference in approach out on the ground, but accepting, of course, you know, you only kind of do that if it's actually . . . fulfilling the outcome that you want." (HA interview 2010).

We discovered many quotes at level of the operational units showing how the actions of managers working with the new contracts were shaped by a backward-looking behavioural logic of modifying their existing routines, experimenting with new approaches and engaging in the trial and error learning required to use and implement the new contract.

The analysis of the interviews was complemented by the examination of HA publications and government reports on best practice in innovation, contracts, and project management (see Appendix for a list of formal publications). These archival data sources were used for triangulation purposes (Jick, 1979) and in combination with information gathered from our interviews helped us to identify the sequence of events associated with the introduction of the new maintenance contracts.

4   Research setting: Innovation in maintenance at the HA

The HA was established in 1994 as an executive agency of the UK government's Department for Transport (DfT). In 2008, when we conducted most our original research, the HA was responsible for managing the construction, maintenance and operations of England's 10,500 km of roads and motorways. It provided 95% of its services through external consultants and contractors and employed around 2,700 staff in an organization with one corporate centre (London), 7 regional control centres, a national control centre, and 14 regional areas. On 1st April 2015, the HA became a government-owned company called Highways England with power to direct its operations, while remaining fully accountable to the UK government.

Since its foundation, the performance of the HA has been scrutinized, audited, and reviewed by various government bodies and industry reports. It has faced intense external political pressure from government, regulatory bodies, environmental groups, and road users to find more efficient, innovative ways to procure and provide customer-focused services. In the 1990s, the UK introduced radical changes in the procurement of public services, such as the Private Finance Initiative in 1992 and Public-Private Partnership in 1997, encouraging public clients, including the newly founded HA, to transfer to the private sector responsibility for financing, designing, building, operating and maintaining public assets. Some of these new policies had already been implemented to improve the performance of other UK utility sectors, such as airports, energy, and water, when the HA was under

pressure to adopt them. Several influential government-sponsored reports – such as the Latham (1994), Egan (1998), Transforming Government Procurement (2007) reviews (see Appendix for relevant policy and industry documents) – emphasized the deficiencies of traditional forms of procurement and project delivery resulting in adversarial relationships characterized by conflict and distrust between government agencies and private contractors. Public sector clients, like the HA, were encouraged to develop stronger in-house client capabilities, forge collaborative relationships with contractors and introduce innovative new practices to improve performance.

In a political environment encouraging private-sector initiative and innovation, many senior HA managers were expected to explore new ideas and consider introducing novel forms procurement, risk-sharing contracts and collaborative partnering arrangements with suppliers to improve the performance of road maintenance. This included activities to maintain road safety and the more complex work needed to repair, replace and upgrade existing assets. Overall, at £840 million a year in 2010, maintenance was well over half of the HA's annual spending.

Our study examined how the HA, in response to the above pressures, created new maintenance routines based on two new types of contracts and attempted to deploy them consistently across the organization's geographical areas. This was a non-trivial challenge because, as a procurement manager in the HA explained, there is no direct one-to-one mapping between contracts (or artifacts) and routines:

> "…contracts you can *interpret* without actually changing the letter of them, and that can translate through to quite a significant difference in approach out on the ground, but accepting, of course, you know, you only kind of, do that if it's actually, you know, fulfilling the outcome that you want. And necessarily, you know, these contracts… lend themselves to interpretation about, you know, how much you would do in terms of scope, rather than actually following the letter of the contract" (HA interview 2008).

Table 2 provides a summary of the key differences between types of maintenance contracts discussed below.

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4.1 MAC procurement

In 2001, the HA introduced the Managing Agent Contract (MAC) for highways and trunk road maintenance services in response to the government policy initiatives above, which were encouraging the HA and other public clients to jettison to traditional procurement practices (e.g. fixed-price contracts which transferred risks to the supplier and promoted arms-length adversarial contractual relationships) and explore new principles of partnering and flexible risk-sharing contracts with incentives for innovation. The procurement contract specifically aimed at stimulating more collaborative behaviour in teams comprised of members from the client and contractor organizations.

MAC replaced the Managing Agent and Term Maintenance Contract (MA/TMC), which had been in place since 1996 and involved a complicated, overly elaborate and inefficient structure consisting of a client (the HA), MA and TMC. Under the MA/TMC approach, the HA managed the MA, the MA managed the TMC and the TMC performed routine maintenance and small capital projects. This arrangement was established following a period of downsizing because the HA had relatively little expertise in house and had to rely on an external body (MA) to specify and inspect the work undertaken contractor (TMC). In consequence, the HA had two contracts: one with the MA and the other with the TMC. The HA, as client, retained ownership of the asset and contractor assumed responsibility for the risks incurred for the provision maintenance services.

MAC was an early attempt to embody some of the new principles developed in the HA 2001 procurement strategy (described in Table 3) in a new form of contract. Under MAC, the traditional MA and TMC roles were combined to form a single prime-contractor organization. As the project client, the HA now had one contract with a MAC organization. In many cases, consultant and contractor organizations responsible for MA and TMC under the old arrangement combined to form a new joint venture MAC organization. The contract was designed to create a simplified structure and stronger partnership between the client and MAC organization, thereby facilitating the innovation and improvements in efficiency. Most of the MAC contracts were awarded for a duration of 7 years including an extension subject to effective performance. The long duration of the contract provided MAC organizations with the volume and predictability of work required to incur long-term

investments in the skills and resources, carry out forward planning, and improve performance over time.

The MAC organization worked with the client (the HA) in an integrated project team which was formed before the design phase and continued during the execution of the contract. When mistakes or problems occurred during a project, the HA and MAC team were responsible for identifying them and working together to provide a solution. The first MAC contract was awarded in Area 8 in Northamptonshire in September 2001 and implemented in 2002. This was the initial step in a process eventually leading to the adoption of MAC contracts throughout the majority of England's strategic road network. However, the roll-out of the MAC contract was a long and drawn out process as many of MA/TMC organizations still had long-term contracts with the HA. Despite efforts to create uniformity and consistency across the maintenance programme, only 9 of the HA's 14 areas were using the new MAC contract as late as 2007 and the remaining areas continued to have contracts with MA/TMC organizations.

4.2   EMAC procurement

The new principles of partnering, innovation and risk sharing were extended even further in another area where the HA experimented with a new type of collaborative contract. Area 2 surrounding Bristol, was the only exception to the planned adoption of MAC procurement where an alternative approach called the Enhanced Managing Agent Contract (EMAC) was introduced in 2005. Influenced by the new strategic thinking about partnering, innovation and the HA's 'best value' strategy to achieve better outcomes for road users, a few of the HA's senior procurement managers designed the EMAC to explore how incentives for innovation and collaborative principles could be embodied in a contract and tested in practice. Conceived as a radical alternative to MAC, the new contract adopted cost-reimbursable contracts, in contrast to the lump-sum fixed price still used for MAC (see Table 2). As a result, the EMAC organization was selected based on the quality of the proposed solution, rather than a lowest-cost bid. EMAC continued to include some of the core principles underpinning the MAC contract including an integrated team project, co-location and single contract with the client. However, EMAC focused attention on the quality of services provided

and was designed to achieve desired outcomes, rather than detailed technical specifications on time and within budget.

Under EMAC, contractor did not simply carry out work under the direction of the client. It was now responsible for helping the client address strategic issues, allocate budgets and manage risks. For example, as one of HA's manager explained:

> "There's a lot more management responsibility…I mean, with, with the MAC it's basically self-managing and, and it just reports back. With the EMAC there's a lot more administrative role for the Agency and a lot more management heads up project management role,…that's something else, we have to develop the skills and the contract management skills within the Agency itself."

With much less emphasis on planning work in detail years in advance, EMAC offered a more flexible means of undertaking work when and where it was needed and responding rapidly to unforeseen changes in demand for maintenance services. EMAC was run on an open-book basis so that the HA had full access to contractor's detailed costs and forecasts by route, activity, budget and resource. To the surprise of the managers involved, the first, and only, EMAC contract was awarded in 2005.

5   Findings

5.1   The four-step process of routine development

Our analysis of how the HA created and implemented new ways to perform maintenance activities led us to identify a four-step process of new routine development involving phases of envisioning, experimenting, entrenching and enacting (illustrated in Figure 2).

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Insert Figure 2 about here

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5.1.1   Envisioning

In the first phase of the process, the HA faced external pressures to achieve government policy objectives and improve the performance of road maintenance services. The HA's the central procurement department was responsible for finding a way of achieving those objectives. Managers faced the difficult challenge of taking rather generic policy statements about collaboration, risk sharing and partnering and turning them into processes that could be reliably and consistently

performed by operational units in the geographical areas. They began to do so by creating a vision of the outcome they wanted to achieve: an approach to road maintenance based on a collaborative client and contractor relationship implemented consistently across the HA's geographical areas. This process of envisioning captures the activities undertaken by HA's procurement managers over period of several years when they identified and defined the new principles described in Table 3.

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Insert Table 3 about here

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In its efforts to envision a new way forward, the HA decided to "take a more strategic view on delivering maintenance projects, acknowledging that it takes leadership and that the HA needs to bring in and develop skills" (HA interview 2008). The procurement department drew on government reports, consultancy studies, and knowledge of successful procurement practices found in other utility and infrastructural industries. Consultants with knowledge and experience in other industries and leading-edge clients (e.g. British Airports Authority) were recruited to lead the procurement team. As an HA director explained:

> "We recruited some of the new people for procurement from outside. They were either working in the supply chain, supporting the supply chain, or in other industries where commercial issues were similar" (HA interview 2008).

As they refined the principles described in Table 3, the strategic unit translated these ideas into two alternative contracts (MAC and EMAC), which were seen as the main tools to implement the principles consistently across areas. As one manager commented, HA's procurement team:

> "were very much driven by policy. They had driven MAC, changed MAC and then EMAC came about in the Labour Party [which subsequently won the UK government election] manifesto" (HA interview 2008).

The HA's procurement department had previously developed various trances of MA/TMC contracts and used the knowledge and experience gained to identify what elements of existing practices could be combined with the new collaborative principles for undertaking road maintenance. Three of the HA's senior managers in the procurement unit were responsible for drafting the MAC contract and processes that could achieve the HA's overall corporate strategy and new objectives for collaborative

21

procurement. In an offline cognitive process, these managers explored alternative solutions and selected the preferred combination of existing and new elements which were codified in a type of MAC contract. While the MAC contract was being implemented in selected trials, the procurement team decided to develop EMAC as a radically new type of contract incorporating the latest thinking about risk-sharing collaboration and innovation which could substitute for MAC in the HA's next generation of contracts.

By 2005, the HA had therefore developed two alternatives ways of undertaking collaborative procurement: MAC and EMAC. Although there are distinct differences in the principles underpinning the two contracts, both were designed to stimulate collaboration and innovation, while avoiding the waste and inefficiencies of the past, such as having "professionals checking the work of other professionals" (HA interview 2007). As one of the HA's procurement managers explained:

> "…what we've done with EMAC is, you know, we're trying to get them [sub-contractors] to act on our behalf rather than incentivize them to work on their own behalf. So we've tried to remove a lot of barriers that were between them and us" (HA interview 2008).

The operational units (the HA regional areas) were not consulted during the envisioning step because the procurement team felt that the experience gained by working on the HA's existing contracts and associated path dependencies might constrain efforts to explore new ways of delivering road maintenance.

5.1.2 Experimenting

The experimenting phase began when operational units in the HA's geographical areas were selected as pilot trials to explore how to implement the new MAC and EMAC contracts. The teams in the trials were given the task of turning the new contracts and processes for road maintenance into day-to-day maintenance activities. In an online experiential process of trial-and-error learning, members of trial teams had to adapt behaviours acquired to perform existing routines based on previous contracts and discover the new ways of working collaboratively stipulated by the MAC and EMAC contracts. The HA's procurement department assumed that the members of the trial teams "knew what they needed to know" and were "left to their own devices" to execute the new contracts (HA interview 2008). The teams received the contracts and process documents and were expected to

discover what new behaviours and sequence of activities would be required to perform the roles broadly described in the contracts, achieve specified performance targets, identify corrective actions to address sub-optimal performance, and establish effective lines of communication between the client and contractor.

The HA launched four new MAC contracts in 2002 (including Area 9 where we conducted our interviews) when the previous tranche of MA/TMC contracts were coming to an end. When members of the integrated client and contractor team in Area 9 team first read the MAC contract and process documents, they had little or no idea how to put them into practice and received almost no further guidance from the HA's procurement team. Contrary to the procurement department's expectations, the Area 9 team had only a "very sketchy" knowledge of how to proceed and "a lot of things were worked out on the hoof" (HA interview 2008). Apart from one or two procurement staff in Area 9, few people had a thorough understanding of the MAC contract. The HA's central procurement department responsible for developing the MAC contract literally "disappeared when the contract was awarded" (HA interview). Over a period of about two years, the team had to work out how to implement the contract by "talking amongst ourselves" (HA interview 2008), adapting previous routines and developing the knowledge needed to achieve more predictable and reliable performance. As an HA manager explained, "Success doesn't come automatically; you have to keep on testing" (HA manager interview 2007). Not surprisingly, it took a considerable amount of time before the new contracts and processes could be turned into a reliable operational routine.

The HA's staff working in Area 9 had previously developed the routines required to work with the traditional MA/TMC contract based on an arms-length and often adversarial relationships. When asked to work with the new MAC contract, many staff found it difficult to collaborate with the contractor in an integrated project team. They continued "operating the old-fashioned way for the next 12 to 18 months. Then there was a slow sea change" (HA interview). With little help from the HA's procurement department, members of the client and contractor team in Area 9 spent a lot of time and effort promoting a culture of partnering during the first six months of the MAC contract by holding workshops and mentoring staff. These efforts were successful because when the MAC contract was initially introduced:

> "You could almost walk into a room and see who was [the contractor under the old procurement] and who was [the consultant (MA) under the old procurement]. Within a year, you couldn't" (HA interview 2008).

By 2008, after several years of working with the new contract, members of the Area 9 team had established the routines required to work in collaborative and risk-sharing arrangement. Achieving such reliable and predictable performance was, however, a protracted and painful process of trial-and-error learning for members of the Area 9 team who felt that the HA's procurement department "should have helped us with a lot more training" (HA interview 2007).

Introduced in 2005, three years after the first MAC contract, EMAC was designed to explore how maintenance services could be provided when the client-contractor relationship involved high degrees of cooperation, risk sharing, and a cost-reimbursable contract. Under EMAC, the contractor received a share of the profits depending on its performance. The first and only EMAC contract was applied to HA's Area 2 in Bristol and awarded to a consortium called InterRoute. Area 2 was selected for the EMAC partly because its previous MA/TMC contract arrangement had recently been completed, providing a convenient opportunity for the HA to pilot the EMAC. But it was also selected because members of the Area 2 had the right capabilities and knowledge required to engage with and test the EMAC approach. Learning how to implement EMAC took much longer than the MAC contract. Area 2 faced the additional challenge of moving directly from a traditional MA/TMC structure to an EMAC contract. They could have benefited from the cumulative build-up in experience and knowledge gained by first learning about MAC and then using that experience to move incrementally towards EMAC. As one manager in Area 2 explained: "…forget the EMAC, just getting it together as a MAC takes a year, 18 months or so" (HA interview 2008).

Although the Area 2 had shown that EMAC offered improvements in performance and were confident in their belief that the HA should select this contract for large-scale implementation, it was eventually abandoned when the MAC contract was selected as the HA's preferred approach highways and road maintenance.

The entrenching phase began when responsibility for preparing the standardized maintenance contracts for large-scale implementation passed back to the HA's central procurement department. We use the word 'entrench' to describe the offline work undertaken by the strategic unit during the selection and preparation of the new maintenance contract for large-scale replication across the HA's operating units. The HA's decision in 2004 to use MAC as the preferred contract for the next generation of maintenance activities was confirmed when 9 MAC agreements were awarded and the original five-year MAC contracts were given two-year extensions. Yet the HA's procurement team still wanted to consider whether EMAC implemented in Area 2 in 2005 might offer a viable replacement for the next generation of MAC contracts. EMAC was, however, always considered a risky option because it introduced radically new and unproven principles which had not been applied to road maintenance, such as cost-plus contracts and a more strategic risk-sharing partnership between the HA and the contractor.

The HA's procurement managers wanted to see how EMAC worked in practice before it could substitute for MAC. They waited at least six months before starting to evaluate the experience gained from the MAC and EMAC contracts. The intention was to use the information gathered during audits and evaluations to reach an informed decision about which contract to select and prepare for large-scale implementation. Audit and review procedures were used to evaluate the first MAC and EMAC pilot projects. As one manager put it, "there was a desire from the top to have greater consistency and uniformity in terms of these contracts" (HA interview 2008). Audit teams visited the pilot Areas for a few days and identified how local units modified their bevahiours and activities to improve the performance of the contracts. In-house and external consultants were employed to identify compliance failure, take remedial measures, and drive process improvements. The audits helped the procurement team understand what parts of the contracts worked well and how they could be improved. Beyond working on the contracts, the HA strategic unit sent "Focus on Best Practice" report sheets to each Area MAC team, inviting them to provide examples of best practice that could be disseminated across the MAC areas.

Under pressure to implement the government's new agenda to improve the performance of public infrastructure services as quickly as possible, however, the HA's procurement team did not wait to fully evaluate the performance of each contract before launching new trials. Commenting on why the MAC contract was implemented in 2002 in three other areas before waiting for feedback from Area 8 to decide how this maintenance approach could be improved, one manager said:

> "…rather than wait for lessons learnt. The HA went straight ahead with commissioning and inviting tenders for the next three MACs in the Midlands Areas 7, 9 and 11. We went ahead with those before any lessons were learnt from Area 8" (HA interview 2008).

In the words of one senior manager, there was a feeling that the HA was "addicted to change" (HA interview 2008). As a manager in Area 9 pointed out:

> "One of the problems the HA have got is that they constantly go from this to these different models, without assessing the real benefits of that first model and without briefing out the requirements of the second one" (HA interview 2008).

The same point was reiterated by another manager:

> "…First you think we've got EMACs and then we're not doing EMACs anymore, we're doing something else" (HA interview 2008).

Our interviews suggest that the need to demonstrate "quick wins" (HA interview, 2008) contributed to the HA's decision to abandon the EMAC contract. Asked explicitly why EMAC was not selected, a senior HA manager emphasized the importance of external political stimuli, rather than to wait to evaluate the relative advantages of each contract for enhancing the effectiveness of the HA's maintenance activities:

> "I think that there was a time imperative, in so far as many of the local governments were changing anyway, and many of those were actually moving to outsourcing…because of their own financial pressures and also pressure from central government on, you know, funding them in the form of grants" (HA interview 2008).

The HA Manager went on to explain:

> "There was also, you know, the overarching political pressure to privatize as much as possible, and really the pressure was then on to actually roll out the MAC form as quickly as it could possibly be done. But to be frank, the EMAC was seen as a little bit of an entertaining nicety. But you it really wasn't sufficient to say well, we'll go not go ahead with the wider programme….I think we weren't sufficiently confident in the EMAC contract as we go forward, and indeed the decision has now been made that there won't be another EMAC contract" (HA interview 2008).

26

The HA's decision to continue with MAC rather than a new generation of EMAC contracts was taken before the procurement team had time to evaluate the advantages of this alternative approach. According to one HA manager of Area 2, "everybody feels it's [EMAC] doing well" (HA interview 2008). Yet most of the managers we interviewed always believed that only one of the proposed trial contracts – the MAC – would be selected for widespread implementation across the HA's geographical Areas. Although the procurement office recognized that EMAC was a more flexible and responsive form of contract, they believed that more knowledge and experience had be acquired to improve the contract before it could be selected as HA's preferred approach for nationwide road maintenance. For example, some of the Area 2 managers believed that an element of fixed price tendering could be brought back into the EMAC contract, but recognized that reintroducing a lump-sum contract would undermine the EMAC approach (HA interview 2008). The decision to jettison EMAC was controversial, with other interviewees arguing that the failure to wait and accommodate the learning gained from the performance of the EMAC pilot reflected the preconceived notions of individuals in HA's procurement department about the advantages of the MAC contract.

5.1.4   Enacting

The enacting phase began when the revised MAC contract was implemented in the HA's geographical areas. Although the HA attempted to implement the MAC contract in a consistent and standardized way, there was a recognition that each contract had to be adjusted to the context of each local area, which varied considerably in terms of the configuration of routes, density and type of traffic and physical geography. As one manager: "we're not even doing things in the same way within a given area" (HA interview 2008). Further trial-and-error learning and experience had to be acquired by the operational units to ensure that the routines were adjusted to fit the local requirements and challenges of each geographical area.

The HA operational units involved in this final step of experiential online learning continued to adapt their routines during the widespread roll out of the new contract. Each unit benefited from learning acquired through HA's central procurement department and from the other adjacent operational areas running MAC contracts. The HA ensured that lessons learnt from the initial round of

trial MAC contracts were used incrementally to improve subsequent tranches of contracts during the rollout. For example, the procurement department provided the Area 1 MAC team in Exeter with training and advice on what to expect during the implementation of the new contract. An Area 9 manager also visited the Area 1 MAC to provide cross-learning from one MAC to another. The operational units assisted in efforts to achieve some uniformity in routines by establishing a "Maintenance Community and Maintenance Best Practice Group", including staff from the contractor companies across the HA maintenance areas, to share their knowledge and experience with the new MAC contracts.

6   Discussion

Our research findings show how new routines develop as an integrated process in four distinct steps: envisioning, experimenting, entrenching and enacting. We contribute to the literature on organizational routines by showing how different organizational levels and capabilities shape the development of new routines and distinct cycles of variation and selective retention during each step in an integrated process.

6.1   Organizational levels and capabilities

To ground our discussion, Figure 3 illustrates how the steps in our process model are undertaken by two different levels of organization (strategic and operational) and correspond to the phases (exploration and exploitation) identified in capabilities research. While managers in strategic and operational units were present throughout the creation and replication of the new routine, one or other levels prevailed during each step in the process. The strategic unit was primarily concerned with envisioning and entrenching, whereas the operational units were involved in experimenting and enacting the new operating routines.

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Insert Figure 3 about here

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The dual-routines approach in capabilities research identifies the higher and lower-order levels of the organization responsible for creating and replicating new routines across multiple sites. Strategic units – the HA's strategy and procurement departments – employed dynamic capabilities to search for alternatives to the prevailing operating routines, select the new routine, and prepare for large-scale replication. Managers in the strategic units played the role of 'routine developers' by envisioning a desired end state and taking the action required to achieve it. They developed the artifacts around which the new routines were developed (a new type of contract and associated processes) and selected the preferred template to support the consistent and uniform roll-out of new routines across multiple sites.

Operational units – in the HA's regional areas – were responsible for exploring how to develop entirely new routines from scratch associated with the contract they employed (the MAC and EMAC contracts and procedures) and making the adjustments required during the large-scale replication of the preferred routine (the MAC contract). Staff in the operational units were 'routine performers'. They had to abandon their existing routines, change their behaviour and create the new patterns of action required to create new routines in pilot trials. In the process of large-scale replication, actors across multiple sites learned from each other as they made the additional adjustments needed to support the adoption of the new standardized practice.

In contrast with traditional view that dynamic capabilities are applied in a top-down, unidirectional way to create or replicate new routines (Zollo and Winter, 2002; Helfat and Winter, 2011), our findings – in line with the observations in recent research (Jonnson and Foss, 2001; D'Adderio, 2014) – suggest a more interactive and recursive relationship between higher and lower-order activities. As our four-step process model illustrates, dynamic capabilities are employed to modify or develop new routines and select among alternatives based on the feedback and learning gained from trial experiments with lower-order operational routines.

A stream of research points to the development of routines being shaped by the coexistence of cognitive and behavioural logics (Gavetti and Levinthal, 2000; Gavetti, 2005; Eggers and Kaplan, 2013). Our findings are consistent with research showing how routines may be interpreted and performed in different ways by actors at different levels of the organizational hierarchy and guided by

alternative trajectories of action (Obstfeld, 2012; D'Adderio, 2014). As illustrated in Table 4, managers in the higher-level strategic units were guided by a cognitive logic of forward-looking, creative and deliberate choices, whereas staff in the lower-level operational units followed a behavioural pattern of backward-looking, experiential and emergent action.

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Insert Table 4 about here

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The existence of opposing cognitive and behavioural rationalities may contribute to breakdowns in communication, conflicts and tensions between organizational levels (Salvato and Rerup, 2011). The strategic units in our study, for example, failed to provide operating units with the support they need to modify and create the new routines required to implement the MAC and EMAC contracts. The primary objective of the pilot trials was to take the time required to explore how the new artifacts and principles would introduced in actual practice, whereas managers in the strategic units was motivated by the need to exploit what had been learned and move as quickly as possible to the next step. Motivated by different logics, pressures and time constraints, actors working at these different levels often neglected to exchange knowledge or failed to learn from each other during each step in the process.

Although our observations about the relationship between higher and lower-order capabilities and tensions between logics are largely consistent with prior research, we now advance the debate in capabilities research by showing how evolutionary processes of variation and selective retention are performed by actors working different levels of the organizational hierarchy.

6.2   Evolutionary processes and phases

Building a clearer view of larger scale dynamics of new routines, requires an understanding of how the evolutionary processes of variation and selective retention occur in practice. Zollo and Winter (2002) argue that that variation and internal selection correspond to a broader phase of exploration, while replication and retention to a subsequent phase of exploitation. Our findings

suggest that there is no simple one-to-one correspondence between the stages of evolution depicted in Zollo and Winter's (2002) model and the actual practice of routine creation and replication. Our model (Figure 3) identifies how the process is performed by actors working at different organizational levels and each contains distinctive mechanisms of variation and selective retention.

The exploration phase in our model involved two distinct cycles of variation and selective retention. The envisioning step was a deliberate, off-line activity undertaken to generate and select alternative routines developed to achieve improvements in organizational performance. Because our research focused on the creation of new routines, these alternatives were based on novel principles (Baden-Fuller and Winter, 2005) rather than existing templates (Winter and Szulanski, 2001). Members in the strategic units developed novel ideas and principles, and simultaneously evaluated alternatives before settling on two approaches. These 'routines as rules' were codified and embodied in two artifacts, the MAC and EMAC contracts and their attendant process documentation.

In the experimenting step, the two contracts were transferred and converted from 'routines as rules' (the two artifacts) to 'routines as patterns of action' by members of the pilot trials in the operational units. The stable properties of rules contain elements that guided, but did not determine behaviour. Actors adapted to the rules and select among new patterns of action. A subsequent cycle occurred when the artifacts were tested online in a trial-and-error learning process and new patterns of action were generated and selectively retained in the new routines (Pentland et al, 2012; Levinthal and Marino, 2015). Variation within a broad pattern of action was generated when the actors changed their behaviours, abandoned existing routines and found new ways of working associated with the contracts and process documentations. Selection occurred when specific variations within those patterns were repeatedly tried out and those behaviours that worked well were retained by staff in the operational trials. When this second cycle was completed, the artifact and newly selected routine moved to the next phase.

The exploitation phase in our model also involved two cycles of variation and selective retention. In the entrenching step, the learning gained during the operational trials provided managers in the strategic units with the knowledge they required to select one of the two new trial routines as a working example that could be prepared widespread replication. Audits and site visits were

31

undertaken to evaluate the performance of the MAC and EMAC contracts and identify which patterns of action and practices that could be codified and replicated. In an offline process, managers in the strategic units selected the MAC contract as the preferred template for large-scale implementation. A revised version of the MAC contract and a new guidebook provided a detailed description of the processes that the operational teams could use to support the consistent and uniform application the new maintenance routine across the local operating units.

In the enacting step, responsibility for the routine passed back to the operational units. The selected routine was refined and developed when it was adapted to the local requirements of each operating unit. A more constrained cycle of variation and selective retention occurred within the wider community of operational units as they enacted the routines, shared practices and adapted to local conditions.

By studying the larger pattern of new routine development over an extended period of time, our findings show that distinct cycles of variation and selective retention occur throughout the process and involve a series of interactions between strategic and operational units. Variation is not reducible to an initial stage in the creation of new routines when senior managers in strategic units engage in a purely off-line cognitive process of discussing alternatives and selecting the most appropriate one for implementation across sites. A distinct cycle of variation and selective retention occurs, for example, prior to large-scale replication when actors in operational units experiment with the new approaches and develop local versions of a routine.

Our research contributes to current research on variation and selective retention by empirically showing how broad types of routines (the patterns of action associated with EMAC and MAC contracts) are selected and locally adapted. We identify how variation and selection based on organizational adaptation (or 'plasticity') (Levinthal and Marino, 2015) depends on actions at two different levels of organization. First, actors working at the strategic level determine the broad scope of variation and selective retention generated through plasticity when they decide which types of routines will be selected for the operational trials. Second, actors working on the new types of routines at the operational level engage in a localized, narrower process of variation and selective

retention when they adapt their behaviours, generate new patterns of action, and share experiences with other units.

6.3   Future research

We adopted a capabilities perspective because we wanted to understand how new routines are created and replicated to achieve an organization's strategic objective to improve performance. Whilst capabilities research studies larger patterns of development, including the organizational structures and evolutionary processes shaping routine dynamics, it neglects to provide a close observation of how actors perform routines in a specific time and place. Our findings identify two areas where future research may build bridges between the previously separate capabilities and practice approaches to the study of organizational routines (Parmigiani and Howard-Grenville, 2011; Howard-Grenville et al, 2016)

First, in line with recent calls multilevel studies of routines (Salvato and Rerup 2011), future research might use a capabilities lens to 'zoom out' and study the organizational structures and processes within which new routines evolve and a practice lens to 'zoom in' and provide a finer-grained analysis of the interpretations and behaviours of individual actors performing routines at during each step in the process (Nicolini, 2009; Howard-Grenville et al, 2016). Capabilities research emphasizes that organizations undertake a variety of practices at a strategic level and deploy dynamic capabilities to modify, reconfigure and build new routines to achieve strategic goals. Conceived as an exogenous process of change, managers envision a desired end state and engage in deliberate process of variation and selection to develop a new and retain an improved routine. This perspective identifies how managerial interventions modify and create new lower-order routines in the operational units, but pays less attention to focus in practice research on the detailed processes of variation, selection and retention of occurring endogenously when the new routines are performed by individual agents.

Second, a capabilities perspective enriched by understanding how artifacts – including written documents, procedures and templates – provide context and shape the development of routines. The concept of a template in capabilities research is connect to a set of artifacts in the form of detailed documentation that guides the behaviour and actions of those responsible for replicating the routine.

33

In early studies of replication, templates played a one-sided role in the replication process by enforcing standardization and providing a stable basis for improvement once the transfer had been accomplished (Winter et al., 2012). More recent capabilities research recognizes that because these stable properties generally fail to furnish complete formulization, the set of practices and actions associated with a template have to be developed through a process of local adaptation (Jensen and Szulanski, 2007; Jonsson an Foss, 2011; D'Adderio, 2014).

The idea that artifacts shape but do not determine behaviour and patterns of action is developed much further in practice research which shows that artifacts may influence emergent patterns of action and provide the structure that hold routines together (D'Adderio, 2011). In our research, the contract was used by the strategic units to articulate the written procedures required to guide the performance of new road maintenance routines, whereas the operational units had to work out how to turn codified knowledge into functioning routines based on tacit knowledge and learned experience. The two alternative contracts provided a detailed description of the roles and responsibilities of parties, and performance criteria, but did not specify precisely how the processes could be enacted in practice. In this way, artifacts may help to balance stability and variation (Turner and Rindova, 2012), and efficiency and flexibility in routines (Cohendet and Simon, 2016).

In our study, artifacts helped the operational units "orient to absences" (Jarzabkowski, Lê and Feldman, 2012) by focusing their attention on what was missing and had to be addressed when developing the new routines. Only after working examples of the new routines had been developed in operational trials, could actors in the strategic units select and prepare a standardized representation of the new routine (the contract and written procedures) for large-scale replication. While prior studies have shown how artifacts enable stability and change (Turner and Rindova, 2012; D'Adderio, 2014) and support ecologies of routines (Seele and Grand, 2016; Spree et al, 2016), future research could explore the role of artifacts in the process of new routine dynamics across organizational levels, providing anchors or fixed points around which new patterns of action and routines emerge and stabilize over time (Birnholtz, Cohen and Hoch, 2007) and adapt to the local needs (Jonsson and Foss, 2011).

7 Conclusions

Drawing upon various strands of capabilities research, this paper showed how new routines are created and replicated across multiple sites within organizations. We argued that the development of a new routine can be conceptualized as process involving four steps – 'the long and winding road' – in a life cycle from initial creation to large-scale replication. As we showed, evolutionary processes of variation and selection occur during each step the process led by alternating actors in strategic and operational units. We suggested that our conceptualization of routine creation and replication offers a way of integrating capabilities and practice perspectives through multilevel research. Capabilities research shows how routines are created and performed by organizations in a search to achieve improvements in performance, whereas practice research provides a more thorough analysis of the behaviours and interpretations of people actually performing routines. We believe that by specifying the specific managerial actions undertaken by strategic and operational units, our research provides guidance for organizations and individuals seeking to navigate the difficult and challenging process of creating and replicating new routines across multiple sites.

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FIGURE 1

Data structure

1ˢᵗ Order Concepts **2ⁿᵈ Order Concepts** **Aggregate Dimensions**

| Responding to external pressure |

| Learning externally |

| Developing procurement principles |

| Envision novel practice |

| Transforming maintenance practice |

| Transforming working behaviour |

| Experiment with working example(s) |

| Exploring novel routines |

| Capturing knowledge |

| Standardizing the contract |

| Entrench a stable and standardized format |

| Sharing knowledge |

| Adapting the contract |

| Enact a standardized routine |

| Exploiting standardized routines |

41

FIGURE 2

The four-step process of new routine creation and implementation

STEP 1: ENVISION	STEP 2: EXPERIMENT	STEP 3: ENTRENCH	STEP 4: ENACT
Strategic units develop new principles to achieve desire outcome	Selected operational units develop working examples of routines	Strategic units select routine and stabilize standardized format for replication	Multiple operational units implement new routines across sites
• Explore alternatives • Search inside and outside the organization • Development of anchors (contracts) for the routines	• Explore how to adapt routines and create new patterns of action • Trials of new routines around the anchors (contracts)	• Evaluate trials • Define anchors for the routines • Prepare for replication across multiple sites • Develop knowledge sharing mechanisms	• Exploit opportunities to increase performance and reliability • Adjust routines to local conditions • Share knowledge and experience
• Off-line thinking	• On-line practice	• Off-line thinking	• On-line practice

Exploration	Exploitation

FIGURE 3
The new routine trajectory: the long and winding road

Strategic units

Step 1: Envision   Step 3: Entrench

Operational units

Step 2: Experiment   Step 4: Enact

Exploration   **Exploitation**
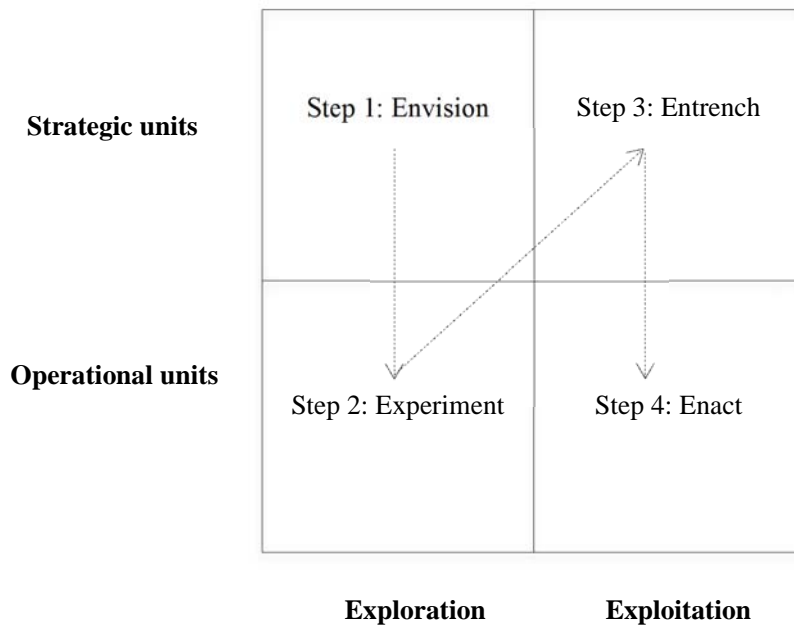
TABLE 1
Representative quotations

Concepts	Envision
Responding to external pressure	"So there were two drivers [for the ideas for new procurement and contracts]. One was the Labour [Government] manifesto and then the other one was the Egan and Latham reports for innovation in the UK construction industry." (External consultant, 2008) "There was a very, very significant push towards privatization of as many of these services that had been previously carried out by central and local government. There was also, I think, lobbying on the part of the private sector, particularly the contracting side, and to a lesser degree the design consultancy world, to say, well, you know, you should be letting us do this, we could do a better job. So there was lobbying, but I think also within the Department of Transport, and also within the Highways Agency there was a realization that the unevenness of practice needed to be addressed." (HA interview, 2010)
Learning from external sources	"Sorry, that's untrue to say we hadn't watched other people. We'd seen some of the stuff British Airport Authorities had done." (HA interview, 2008) "Well, the OGC [Office of Government Commerce] provided useful examples as inspiration." (HA interview, 2009) "Also, a lot of new people joined the HA from various industries, public bodies as well as from the market. With their experience they brought in useful ideas." (HA interview, 2008)
Developing procurement principles	"Traditionally in government that's always been lowest price . . . but clearly that was flawed, because it just drove down tender prices until they were unsustainable, and then you'd got all the contractual claims. So how could you develop? Our thought process was how do you develop a whole series of processes that will give, in effect, the chief executive, the chief accounting officer, the assurances that you are appointing the best suppliers to carry out the outsourced work, and at the same time it will be affordable, and you will improve budgeting certainty? . . . So that, that was a huge challenge" (HA interview, 2008) "The envisioning from the HA was that InterRoute [prime contractors] was established as a new company, or a joint venture specifically aimed for serving the new HA market, for these new contracts whatever they turned out to be." (External contractor, 2008) " . . . have a clear vision, sort it out, and then drive it through the organization from the centre as you can't do it any other way." (HA interview, 2008)

	Experiment
Transforming maintenance practice	"We are getting innovations within the EMAC contract. There is something new called the 'innovation bonus,' which, if they persuade the agency to change its written standards, they get, I think it's 30% share of the benefit once they've done a business case. I'm not aware yet that we've actually had a successful one of those. So in terms of innovation under the innovation bonus we're struggling, but there certainly have been innovations from things like increased recycling. And a lot of those innovations that don't qualify for an innovation bonus are probably driven by our monitoring, the KPI type monitoring basis. We have what are called area performance indicators that . . . are identical across all the, what's now 12, I think." (HA interview, 2007)
Transforming working behavior	"I think there are certain things within contracts you can interpret without actually changing the letter of them, and that can translate through to quite a significant difference in approach out on the ground, but accepting, of course, you know, you only kind of do that if it's actually . . . fulfilling the outcome that you want." (HA interview, 2010) "A total new mindset and procedure had to be put into place moving from the local authorities and the HA relationship to the new MAC contracts." (Consultant, 2009)

	Entrench
Capturing knowledge	"I believe that the EMAC contract serves both as outcome of a learning process of improving the MAC contact internally in HA since the procurement unit collected HA experiences and transformed the contractual structure as well as an important test-bed facilitating learning processes, which can later be evaluated and its productive parts can be included in new contracts of both EMAC and MAC format. Also, the EMAC is facilitating local learning processes to occur more often due to the flexibility built into the contract in terms of the opportunity for contractor and client to stage minor pilot projects within the overall contract framework." (HA interview, 2007)

Standardizing the contract	"I think the ideas for standardization came from the experience on the MAC contract. So it was trying to roll out more of the early creation of the list of key principles we'd got. The early creation of the delivery team on a maintenance contract was seen to be as important." (HA interview, 2007) "I'd much rather have a sort of mechanistic approach of actually drawing a benchmark, drawing out best practice, and then taking the whole lot forward as one, rather than, oh, I can change that contract, because that's a good idea, but I have to change 13 others in 13 other different ways . . . I ought to be able to make a single change that will affect all 14." (HA interview, 2008)

Enact

Sharing knowledge	"So experience, the actual learning, was gained on the area level, so working with the contracts . . . ? the development of the contract then takes place at the more central level in the organization." (HA interview, 2007) "Lessons learned from the MAC contract [are] captured within the HA through two bodies: TOCCA (traffic operations contract compliance audit) and PRIDE (performance review innovation and delivery)—the latter is more focused on improvement of contracts, not so much managing contracts. . . . Also, in 2003 there is a maintenance community set up across the HA areas to distribute best practices." (HA interview, 2007)
Adapting the contract	"So what you've got is a degree of uniformity but I think what the HA head of maintenance would argue is that in rolling the contract out you've got more than enough scope within the areas in which you can achieve, to tackle and have innovation without undermining the basis of the contract." (HA interview, 2008) "You form a new contract and the agency staff who were managing the contract were suddenly faced, you know, they probably knew some of the concepts, but they'd had no involvement in developing the contract. They didn't know the thinking behind it. I try to make sure that the contract is going to deliver what we were looking for and that we understood." (HA interview, 2007)."

TABLE 2
Types of maintenance contracts

Maintenance contract	Managing Agent/Term Maintenance Contract (MA/TMC)	Managing Agent Contract (MAC)	Enhanced Managing Agent Contract (EMAC)
Contract structure	Contract with two organisations	Single-operator with one organisation	Contract with one organisation
Reimbursement	Lump sum	Lump sum. Target costs	Target cost plus fee
Management role in contract		Project sponsor	Project manager
Sustainability of scheme size	Thresholds are set to allow TMC to open up new work areas but at a level to promote a smooth workload	The threshold values are generally higher than those for the MA/TMC	The provider carries out all routine service works and renewal schemes of any value and improvement work up to £2 million
Contractors' key roles and responsibilities	MA: Planning, programming, design supervision and administration TMC: Routine maintenance and some capital works	Act as contractor as well as supervisor and management of design	Client and the provider form a totally integrated team that is motivated, responsible, incentivised and empowered to achieve the aims of the client
Programme budget control	MA: Responsible for forward planning & supervision. TMC: Responsible for managing the programme and budget within lump sum activities	Forward programming progresses through value management process	The provider assists the client in achieving its objectives, including budget management
Incentives for improvement and innovation	Long contract period allows for incentives	Longer contracts allow greater investment in staff. Focus on higher level activities to promote innovation	Efficiency share bonus. Innovation bonus. Continuous Improvement bonus
Risk management	Shared risk register Risk is managed and minimised.	Risk is spread between client and provider.	Risk is spread between client and provider. Provider takes on more risk

TABLE 3
Ten Principles of delivery of Best Value (from 2001 HA procurement strategy)

1.**Early creation of delivery team –** early contractor involvement for more scope in innovation, better risk management, and forward planning of work programmes and resources.

2.**Integrated and incentivised supply chain** – early contractor involvement with its specialist knowledge, incentives for innovative ideas to give best value solutions.

3.**Maintaining a competitive and sustainable supply chain** – maintaining a good quality supplier base motivated and incentivised to work with the Agency.

4.**Clear points of responsibility, no unnecessary layers of supervision** – clarifying roles and responsibilities to reduce contractual interface problems, eliminating resource wastage from unnecessary layers of supervision.

5.**E-procurement** – to make tender processes, communications and performance measurement more efficient.

6.**Selection of suppliers on the basis of best value –** identifying aspects of quality which add real, affordable value, using reality checks to confirm quality submissions and promises.

7.**Fair allocation of risks –** risks will be allocated to the party best able to manage them and the Agency will accept risks where suppliers are prepared to work in partnership to manage them and control the consequences.

8.**High quality design** – design solutions will be based on whole life value, assessed by reviews integrated with the Office of Government Commerce gateway review process. We are committed to achieving the principles of good design set out by the Government Strategy for Better Public Buildings.

9. **Partnership approach based on long-term partnerships –** moving from short-term project partnering arrangements to long-term relationships for retention of skills and better resource and work programming.

10. **Performance measurement with continual improvement targets –** establishing a five-year programme of improvement under the Clients' Charter scheme to confirm benefits in the form of cost and time-savings, reduced defects and accidents, and improved whole life value and satisfaction with the product.

TABLE 4
Contrasting cognitive and behavioural logics

	Strategic units	Operational units
Approach	• Teleological vision • Achieve standard results across areas • Achieve demonstrable results quickly	• Evolutionary adaptation • Stabilize routines within the contract • Reach a reasonable level of performance
Logics	• Offline, cognitive From vicarious experience (other industries, operational units) • Movement of personnel • About the contract	• Online, experiential From direct experience through experimentation • Through stable teams • Maintenance communities • About the routines
Mindset	• Radical change, but the operation level "knows how to do it"	• Experience helps to fills the gap and guides interpretation of the contract

Appendix: Secondary Source Documents

Contract Journal. (2004) MACs to be extended, 8 September 2004.

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