Developing Routines in Large Inter-organisational Projects: A Case Study of an Infrastructure Megaproject

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Abstract

General management research has increasingly recognised the significance of routines in organisational performance. Among organisational tasks, megaprojects depend more on routines selected and created within the project than standard, small-scale projects do, owing largely to their size, duration, and uniqueness. Within this context, the present paper investigates how project routines were established and developed during the early design phase of an inter-organisational megaproject. A case study of a large public infrastructure project was conducted, in which data were collected during observations, semi-structured interviews, and project document studies over the course of three years. Results of analysis revealed that the client exerted the greatest impact on choice of routines and that the temporary nature of tasks limited efforts to fine-tune routines. Changes in routines were primarily reactive to new knowledge concerning project needs. The findings suggest that meta-routines to consciously review routines should be used to a greater extent and designed to capture supplier experiences as well.

Keywords: Projects, routines, learning, coordination, practice approach.

Paper type: Research article

Introduction

Although projects are temporary with limited lifespans, they are not necessarily short-term. For example, an infrastructure development project from its inception until completion can take decades. The budgets of large infrastructure projects may exceed USD $1 billion, and project organisations can involve hundreds of project workers. In important ways, these megaprojects are more similar to permanent organisations than to projects addressed in project management research, though they nevertheless retain the fundamental characteristic of being a temporary endeavour.

Managing large infrastructure projects is undoubtedly a challenge. They often affect urban areas and are mostly managed by government authorities, something which typically implies substantial influence from political entities and heterogeneous stakeholder groups. Project organisations involve a host of companies and tasks requiring the sophisticated coordination of dispersed, specialised technical knowledge. Given the lengthy timeframe and relative infrequency of large projects in any given local context, many project members will have limited experience with managing and working in such complex environments. Unsurprisingly, many megaprojects have historically been plagued by cost overruns, delays, technical complications, and negative media attention (Hertogh et al., 2008; Priemus, 2010; Lundman, 2011).

This paper focuses on the implications of megaprojects being temporary yet nevertheless lasting for long periods, particularly in terms of the role that routines play in this dynamic. In recent years,

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studies of organisations have elucidated how routines can define and shape organisational capabilities (Nelson and Winter, 1982; Zollo and Winter, 2002). In fact, routines are conceived to be central to coordination, a vital issue in organisations, especially those in which actors have little or no knowledge overlap (Becker, 2004). For these reasons, project routines are imperative to understand in order to improve megaproject performance (Davies and Brady, 2015).

Though project routines can derive from parent organisations, project-specific routines can also be developed and implemented to a greater extent in megaprojects, given their size and extended timeframes, than in more routine, small-scale projects. Within this context, this paper investigates how project routines are established and developed during the early design phase of megaprojects, during which project organisations expand on both the client and supplier sides, and many fundamental decisions are made that will affect not only subsequent phases but the final product as well. The paper reports on an extensive case study of an infrastructure project, the data for which were collected primarily through non-participant observations.

Characteristics and Roles of Organisational Routines

There are numerous, sometimes inconsistent, definitions of what organisational routines are (Becker, 2004; Parmigiani and Howard–Grenville, 2011). Perhaps most basically, Feldman and Pentland (2003, p.96) define a *routine* as "a repetitive, recognizable pattern of interdependent actions, involving multiple actors". In any case, it is the collective, *inter*active dimension that differentiates organisational routines from individual habits (Becker, 2004).

Another distinction separates the ostensive and performative dimensions of routines (Feldman and Pentland, 2003). Whereas the ostensive aspect refers to the structured representation, or "the abstract, generalized idea of the routine" (Feldman and Pentland, 2003, p.101), the performative aspect describes how routines are practiced and captures local variations (Jarzabkowski, Le and Feldman, 2012). Though routines may be documented and formalised, Feldman and Pentland (2003) do not conceive these aspects to be essential, only that the routine is recognisable as a pattern. On the ostensive level, routines may be transferred among contexts, including different organisations, but cannot exist without a performative aspect.

Routines impact organisations in four ways (Becker, 2004). First, routines enable coordination by establishing connections (e.g., face-to-face and electronic) and shared understandings, which creates benefits even without explicit outcomes or results (Feldman and Rafaeli, 2002). Second, they provide some degree of stability of behaviour by reducing uncertainty, as well as by helping individuals to understand what to do in particular circumstances (Feldman and Rafaeli, 2002) and by enabling them to predict the behaviour of others (Becker, 2004). Third, at times referred to as *habitual routines* (Gersick and Hackman, 1990), some routines are subconsciously executed and can thus economise with limited cognitive resources. This tendency can be an advantage—for example, if completing tasks becomes more efficient because everyone knows what to do—or disadvantageous, particularly if desirable opportunities are lost. Fourth and lastly, routines store both tacit and explicit knowledge in organisations (Becker, 2004; Pentland et al., 2012), which can help to clarify their structure and culture (Feldman and Rafaeli, 2002).

Stability and Change in Organisational Routines

As noted above, stability and recurrence are key aspects of routines that enable them to promote coordination and act as knowledge repositories. Nevertheless, recent research has increasingly emphasised that the performative aspects of routines change over time as a result of feedback mechanisms. Feldman and Pentland (2003), for example, have stressed the 'inherently improvisational' nature of routines, underscoring that routines are adapted to specific contexts and that individuals can choose to what extent they will reproduce or amend them. According to Becker (2004), empirical research more often conceives routines to be effortful accomplishments

and more dynamic than the mindlessness commonly attributed to them in conceptual papers allows. At the same time, change in routines is generally incremental and subject to strong path dependency (Becker, 2004).

Habitual routines can be introduced into a group in three ways: importation, creation at the beginning of group work, and evolution over time (Gersick and Hackman, 1990). *Importation* characterises routines that were not created by groups, but possibly derived from the parent organisation and taught to group members. Imported routines can also take hold when group members have shared experiences or norms about how group work gets done. Homogenous groups may even fall into routines without discussing them explicitly. Further, collective routines may originate from individual rules, interests, and activities (Becker, 2004).

The creation of routines at the first instance of group work occurs when there is a novelty in the task to be completed or group composition, or else if there are no prescribed routines. Strong, lasting, habitual routines are often formed quickly and without much discussion, often with the unrecognised purpose of relieving anxiety in the group (Gersick and Hackman, 1990). By contrast, the incremental evolution of routines resembles the improvisational processes described by Feldman and Pentland (2003) and typically occurs as members identify good and bad practices in the group. Habitual routines, such as tolerating late arrivals at meetings, may go unchanged though group members are unhappy with them (Gersick and Hackman 1990). In this context, social entrainment implies that early experiences prevail even if surrounding conditions change. Another cause for lingering routines may be anticipated costs of change, also in the sense that change could cost individuals advantageous positions.

Gersick and Hackman (1990) have identified five situations that can encourage change in routines: encountering either novelty in certain circumstances unfamiliar to group members or stimuli for action; experiencing failure; reaching a milestone as a group; being subject to an intervention initiated either internally or externally but usually involving external input; and coping with structural change, which can occur to the composition of the group, to the task design, or to the group's degree of autonomy.

In detailing how disruptions in routines induce new routines, Jarzabkowski, Le and Feldman (2012) have described a process of creating mechanisms of coordination, in which gaps in coordination are filled by creating elements of coordination that, over time, form stable patterns. With their emphasis on combining elements, Jarzabkowski, Le and Feldman's (2012) observations reflect those of Brady and Davies (2004), who have argued that innovative routines can be created by mixing existing reliable routines in novel combinations.

Routines and Learning in Megaprojects

Several authors have noted that most projects are not unique, while relying heavily on capabilities developed in their environments (Grabher, 2002; Engwall, 2003). Indeed, the notion of portfolio management implies that similarities between projects make establishing common, firm-level management routines more efficient. Organisations may also undertake cutting-edge projects and repeatedly use innovative solutions until they become standardised routines (Davies and Brady, 2015). By extension, inter-organisational projects are often seen as temporary enactments of a more stable industry-level regime, in which coordination depends significantly on institutionalised roles and standardised work processes (Kadefors, 1995; Meyerson, Weick and Kramer, 1996; Bechky, 2006). In this respect, megaprojects can be conceived as hybrids of projects and permanent organisations. Davies and Brady (2015) point out the need to study how combinations of dynamic and project capabilities are developed and assembled to manage large, unique projects.

Importing, mixing, and evolving routines (Brady and Davies, 2004; Gersick and Hackman, 1990) can also reflect managerial innovation. Inter-project learning, for example, may occur via reflective practices such as exercises about lessons learned, organisational learning tools, and word of

mouth—to borrow a phrase, as 'war stories' (Brady and Davies, 2004). These findings, however, are primarily based on projects within single firms and focused upon managing learning in the technical domain more than upon organisational or managerial issues (Hertogh et al., 2008).

Although aspects of coordination are central to project management, literature integrating research on routines and megaprojects remains scarce. In an extensive case study of the construction of Terminal 5 at London Heathrow Airport, Davies, Dodgson and Gann (2010) observed that project guidelines were codifications of tacit knowledge and experiences sustaining efficient project routines between projects. They identified that visualisation techniques, using proven technologies, and learning from past experiences support efficient routines and concluded that routines should not only address known risks, but also accommodate innovative approaches to deal with uncertainty in megaprojects.

This paper adds to research on the managerial aspects of routines and learning in megaprojects. Some features of the context of megaprojects can prompt specific conditions that influence the development of routines. Combined technical and organisational novelty is one such aspect; another is awareness about the impending dissolution of the organisation or its parts. In this paper, the discussion stems from three tentative propositions using Gersick and Hackman's (1990) terms, one relating to imported and created routines and two related to how routines evolve:

1. Project routines in megaprojects result from a combination of routines imported from participating organisations, including industry practice and project-level initiatives;
2. Since many routines in megaprojects are new and unfamiliar to both organisations and individuals, learning processes occur, as reflected in the change and adaptation of routines over time; and
3. The temporary nature of megaprojects limits investments in the development of routines and increases tolerance for dysfunctional routines.

Research Method

To gain insight into what project participants do during projects, for this research a case study with a qualitative perspective was chosen and a practice-based approach adopted (Cicmil et al., 2006; Blomquist et al., 2010). Micro-level developments in project practices and routines during the early design phase of a large project were studied, primarily those governing internal project relationships, and processual aspects (Becker, 2004) of routines and their setups were captured. Since studying specific processes is especially relevant in research on complex projects (Söderlund, Vaagaasar and Andersen, 2008), the present case study focuses on the 'internal workings of specific routines in a specific context' (Parmigiani and Howard–Grenville, 2011, p.421). The study was carried out during the final three of four years of the early design phase.

The primary data collection method involved non-participant observations, semi-structured interviews, and the review of project documentation. Observations totalled approximately 450 hours and concentrated on meetings and workshops with client and consultant representatives at several levels of the project hierarchy. The most frequently observed meeting series and their participants appear in Table 1. Notes were taken on a tablet as summaries of ongoing discussions and strived to use the language of participants as closely as possible.

Access was granted to IT portals that contained meeting minutes, guidelines, presentations, and workshop outcomes, as well as the project calendar and project-internal newsletters. To verify and expand findings from observations and to collect opinions about project activities, informal discussions and formal, semi-structured interviews with project participants were conducted. Interviews were recorded and transcribed; see Table 2 for details.

Table 1: Meetings most extensively observed in the RailTunnel project

Meeting series	**Members**	**Observation period**
Client Top Management	Project Director, Head of Economy and Staff, Head of Procurement, Head of Communication, Agreements Manager, Design Manager, Production Manager, and Permit Process Manager	Apr. 2012 – May 2015
Client Design Group	Design Manager, Assistant Design Manager, Technical Design Leader, and Station Design Leaders (5)	Mar. 2012 – Aug. 2013
Cooperation Group	Design Manager, Assistant Design Manager, Technical Design Leader, and Station Design Managers (3), as well as consultant Assignment Managers (5) and (until Aug. 2012) facilitators (2)	Apr. 2012 – Jan. 2013
Rock Engineering assignment	Client rock engineering Technical Expert, Consultant rock engineering Assignment Manager, and Consultant specialists (0–2)	Mar. 2012 – Dec. 2014
Technical Coordination (before merger)	Technical Design Leader, Technical Assignment Manager, and Consultant specialists (0–3)	Apr. 2012 – May 2013
Internal Station Design	Assistant Assignment Manager Station, Consultant Investigation Coordinator, Consultant specialists (5–10), and Sub-consultant specialists (0–4)	Dec. 2012 – Mar. 2014

Analysis began with the researcher's listing project routines and their changes observed given close familiarity with the project. The list was verified and expanded with a search for keywords related to the routines (e.g. design review, presentation, bonus, and meeting schedule) and by studying field notes and project documents. A structured list of routines appears in the Discussion section of this paper.

Table 2: Details of semi-structured interviews with RailTunnel project members

Interviewee role	**Organisation**	**Date**	**Topics**
Technical Design Leader	Client	1 Sep. 2011	Descriptions and explanations of project organisation and routines
Former assistant Project Director	Client	18 Jan. 2012	
Consultant	Coordination assignment	21 May 2013	Reflections on project organisation, routines, and practices
Assignment Leader	Coordination assignment	5 Jun. 2013	
Consultant	Coordination assignment	17 Jun. 2013	
Ombudsman	Station assignment	17 Jun. 2013	
Assignment Leader	Rock Engineering	24 Oct. 2013	
Design Manager	Client	9 May 2014	Bonus system, cooperation, and innovation
Project Director	Client	27 May 2014	

The RailTunnel Project Organisation

The RailTunnel project is a railway project of the Major Projects Division of the Swedish Transport Administration (STA). The project is worth $2.4 billion, and construction is slated for 2017–2026. The ultimate goal of the project is to improve railway infrastructure in one of Sweden's largest cities. The early design phase of refining the selected preferred option commenced in 2011, officially ended in February 2015, and engaged approximately 40 STA employees and 900 consultants.

The client Top Management team was subject to major changes in 2011–2012, when the previous Project Director and Assistant Project Director were transferred to another project. When the newly appointed Project Director assumed responsibility in early 2012, staff groups supervised respectively by the Head of Procurement, Head of Economy and Staff, and Head of Communication already existed, as did work groups led by the Agreements Manager, Permit Process Manager, and Design Manager. Several members of these groups were newly appointed for this project phase, including the Design Manager and Head of Economy and Staff.

A year later, the organisation had swelled. Some groups had acquired additional members, and a Construction Manager oversaw a small, separate group, a role that was the only addition to client Top Management meetings during observations (Figure 1). Tilted boxes indicate staff groups that supported the work groups below. Two individuals were replaced due to retirement and sick leave.

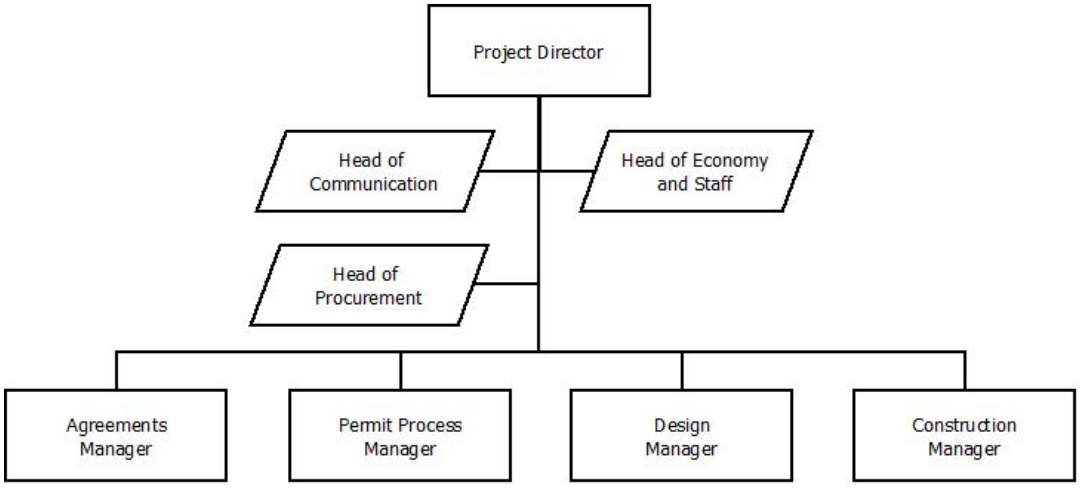

Figure 1: The client Top Management group

In 2012, numerous consultants were contracted, and consultancy assignments and their responsibilities were distributed in a way considered non-traditional by practitioners. There were two principal groups of assignments, in which 10 technical assignments involved initial investigations and defining requirements in addition to three much larger station design assignments for developing early designs. A coordination assignment was additionally created to merge the other consultants' outputs, and consultants in technical assignments provided station design assignments with input, which was also considered a novel practice. The objective was to generate thoughtful technical requirements uniform along the entire infrastructure, though client members remained apprehensive that outputs from the three design assignments would not be aligned with levels of greater detail.

All consultant assignments had either one or two STA Technical Experts or Design Leaders who managed the contract. Technical Experts reported to a Technical Design Leader at the same hierarchical level of three Station Design Leaders. In the Design Group, four Design Leaders were supervised by the Design Manager and Assistant Design Manager, the latter being responsible for the Coordination assignment.

The contracted suppliers were often joint ventures of local consultancy firms using specialist sub-consultants. All organisations and many individuals within the assignments had experience with working for the STA and were therefore accustomed to using some basic tools, models, and work modes required by the client. The aspects that most clearly affected project routines in this case were document templates, IT portals, developing a 3-D model, client project management reflection workshops, and monthly reports on time, costs, and contents. Even if the structure of the project organisation was the responsibility of the Project Director(s), most roles and responsibilities were considered standard across STA and its projects.

Project Routines

With 14 consultant assignments and a client project organisation consisting of nearly 40 members in seven groups, numerous interactions characterised the project. Formal meetings were frequent, and an extensive conceptual schedule for the meeting series in the project was followed; see Figure

2 for a simplified version. Green boxes signify client-only meetings, blue ones signify consultant involvement, and brown ones indicate client meetings with external stakeholders. There were also other repeated, yet infrequent interactions in which project participants congregated. The present section of this paper describes meeting routines and other routines, such as those governing design output and a bonus system. Space restrictions do not allow a full account of the details of each routine.

Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Design Group	Top Management	Consultant coordination	Theme	
Rock and soil	System coordination			
L	U	N	C	H
Design Group + Technical Experts	Construction Group	Design Coordination	Economy and staff (monthly)	
Design + Construction Groups	3D model coordination	Municipality and Regional Public Transport Comp	Theme	
Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Assignments individually (any time)				
Design Group		EIA		
Procurement	IT coordination			
L	U	N	C	H
	Construction Group operational	Technology coordination	Municipality	

Figure 2: Simplified biweekly meeting schedule for the RailTunnel project

Meeting Routines

Meetings in the project's different meeting series were generally similar. Most followed the meeting chart, had a fixed agenda beginning with confirming the notes of the previous meeting, and kept close to their initial meeting practices throughout the phase. Details of the meetings, however, reveal differences among groups. Participants in larger meetings tended to use PowerPoint presentations, whereas smaller meetings relied more heavily on printed meeting minutes. Top Management meetings more often inspected time plans and made technical decisions based on text documents, and the presence of consultant technical specialists often implied a higher occurrence of 3-D models.

Formation of meeting routines

As already mentioned, set schedules for meeting series were in place when consultants entered the project, all with a policy of no Friday meetings, and it was agreed that additional meeting series should not be introduced. Meeting series implemented initially included Top Management client meetings, client group meetings for all seven groups, assignment meetings for all 14 consultant assignments, coordination meetings for technical and design assignments (i.e., both separately and together), the client Design Group meeting with Technical Experts, and client meetings with external parties (e.g., the municipality and regional public transport company). Compared with other projects in this phase, the number of meeting series was high.

The Technical Design Leader who participated in developing the initial schedule sought stringency in meetings, as well as to keep meetings to a minimum. These principles were recorded in an extensive handbook, while the technical assignments had formal rules for requesting non-routine

meetings and about what decisions to prioritise. Decisions were always to be noted in meeting minutes, and consultants were expected to adhere to templates and produce only necessary reports. The Technical Design Leader repeatedly brought attention to these intents throughout the project and later often contrasted the order apparent among the technical assignments to the relative chaos among the design assignments.

The station design assignments commenced work somewhat later, and their meetings were less streamlined than those of the technical assignments, both in terms of documentation and practice. One interviewee referred to 'the kingdoms' of the Station Design Leaders, implying the heterogeneity of cultures and practices in those assignments, a term that he also used in project meetings.

The introduction of a partnering approach called Increased Cooperation initiated a few routines. First, a Cooperation Group was created to develop relationship-enhancing activities and routines. Despite few guidelines presented upfront, written instructions mentioned including participants from the client and a few representatives from both kinds of consultancy assignment, the latter exchanged every half year to stimulate fresh input. The novel Cooperation Group held an *ad hoc* meeting roughly every month. Second, cooperation workshops were established for each assignment's consultant and client representatives, a standard procedure in contractor relationships and the Cooperation Group posed no objections to implementing it similarly in consultant contracts. This routine was never codified, and its execution was irregular and depended on the Design Leader in charge. At least one consultant objected to that no cooperation activities included all assignments together; this opinion was discussed, though dialogue did not induce any noticeable changes and was motivated by difficulties with managing such large workshops.

Incremental changes

There were frequent, minor changes to meetings. After all consultants were procured, the client project organisation was expanded in both planned and unplanned ways, which led to changes in actors' participating in meetings, workshops, and presentations. Adding client members did not, however, stimulate any changes regarding meeting types, meeting frequency, and other practices already established.

Approaching deadlines prompted minor changes—for instance, reduced meeting frequency to allow time for individual work. Other changes included merging several meetings into one, updating agendas, and changing participants if expertise in other areas was needed. In all assignments, these changes were made independently. Otherwise, resources and mundane practices (e.g., the organisation responsible for documenting meeting minutes) remained the same. Examples of observed changes and their causes appear in Table 3.

Table 3: Categories of causes and performative changes to routines

Cause	**Change(s)**
Increased workload	Reduced meeting frequency and cancelled meetings
Decreased workload	Reduced meeting frequency and cancelled meetings
Approaching or imminent deadlines	Added or changed participants, changed meeting frequencies, merged meetings, and updated agendas
Reflection on purpose of group or meeting series	Updated agendas, change in meeting frequency, and change in meeting duration
Redundant meeting content within same or different meeting series	Reduced meeting frequency and cancelled meetings
Perceived lack of communication	Added participants, meetings, and meeting series
Newly recruited client members or newly contracted consultant members	Added or changed participants
Group member absences	Meeting postponement, use of ICT solutions, and meeting chairperson's relaying reports and messages

During Top Management meetings, the team occasionally reflected upon the goals and practices of their meetings, which usually resulted in the rearrangement or addition of mostly project-wide topics to the fixed agenda. The agenda's initial focus was the reports of all client groups, as the number of activities increased in the project, the focus shifted to deviations, even though the habit of reporting lingered. Another shift in focus underscored strategic issues in the project and made policy decisions when necessary external input was missing—for instance, assuming that an existing intermodal terminal next to the central station would be moved when construction commenced. To make all experts base their work on the same assumptions, these decisions regarding strategy and policy were listed on an STA web portal.

Disruptive changes to routines

As project work progressed, the consultant design coordination meetings identified a need to coordinate technical necessities at the expert level. A new routine for communication among several technical disciplines was created that included specialists in both technical and design assignments, which led to adding 'theme meetings' to the meeting chart. Themes, meeting conveners, and participants were decided in consultant design coordination meetings. Another development stemmed from a lack of dialogue concerning the client functions of Permit Process and Agreements, which resulted in the Permit Process Manager and Agreements Manager's participation in design coordination meetings.

The novel Cooperation Group experienced drastic changes in its membership during initial meetings, not due to any instructions about rotating participants for fresh input, but as a consequence of a re-evaluation performed by group members. To be able to start cooperation activities early, representatives for the first contracted technical consultants participated at the outset. After all assignments were contracted, it was decided that all the larger design assignments should participate in the group, while the minor technical assignments would be represented by the Technical Design Leader and Coordination Assignment representatives. After finalising partnering tasks, the group focused on reporting progress and prioritising general relational issues in the project. The members found that similar issues were discussed in the design coordination meeting series and expressed concerns; in response, the client discontinued the Cooperation Group and reallocated its responsibilities to other groups—chiefly, the client Design Group.

Other Project Routines

An imported routine stated that consultant work should be divided into four stages: for technical assignments, the stages of planning, prerequisites, requirements, and delivery, and for design assignments, the stages of planning, investigating, designing, and delivering. This routine was developed by an industry-level workgroup consisting of STA and consultant representatives and had recently been used in another large STA project during the early design phase, which made the routine familiar to some project members, though entirely new to most. It was unclear how the new routine should be interpreted in practice, and client members were unsatisfied with results from the planning sub-phase.

In a client-imported routine called the cascade model, project information was disseminated throughout the hierarchy. During observations, it was clear that cascaded information was not deemed satisfactory. Project members complained that they lacked a holistic view of the project and were sometimes unsure whether they had received enough information. Top Management argued that project members would have to learn to trust the model and that their superiors would supply them with necessary information. However, in practice, monthly breakfast meetings and short lunch presentations for client members and biannual kickoffs for the entire project were used as supplementary routines to provide overviews on project status.

As stated in the contracts, the Cooperation Group created a novel routine by which consultants

could receive bonuses for cooperation and innovation, an idea imported from the industry and STA, despite a new manner of designing the process and a new context in which bonuses were provided. Essentially, consultants nominated themselves for exceptional performance, nominations were evaluated by the Cooperation Group or, later on, the client Design Group, and finally decided upon by Top Management. This routine was only codified briefly in meeting minutes, possibly because the routine changed half a year after its development when the Cooperation Group was discontinued. This routine never took hold, and client members nominated most recipients of bonuses. Nevertheless, no substantial attempts were made to adjust the routine.

When discussions of chosen technical solutions matured, project members sought to exchange works in progress with external collaboration partners, yet remained unsure how the exchange would work. Since the STA and municipality are public institutions obligated to comply with the principle of public access to official records, documents sent to external parties probably became accessible to the public. Due to negative media attention, project members became uneasy about sending preliminary documents with incomplete notes or early drafts that could be misinterpreted, accidentally or otherwise. Despite the conclusion that sharing documents labelled 'working material' might not be required, in effect neither organisation denied access requested by the public, which prompted an understanding that documents would not be exchanged unless easily identified as works in progress, though perhaps substantially elaborated and more carefully proofread than initially intended. Top Management also issued a formal decision about accommodating public requests for such material; the requester would be invited to the STA office, given a presentation about work practices, and then able to inspect documents.

The setup of the two types of consultant groups and coordination assignment was considered innovative and led to new practices. Some participants expressed in interviews and during observations that consultants were unaccustomed to consultant-to-consultant deliveries but used to detailed governing by the STA. For example, the Rock Engineering assignment based its models on statistics instead of experience and expert judgment given the novel organisation and development responsibilities.

In line with an STA policy intended to increase consultant responsibility, a less extensive reviewer process was developed based on consultant self-monitoring with selected spot-checks and in place by September 2013. After deciding to perform a spot-check review, a client review manager was appointed to assemble a team of reviewers from the client organisation and technical assignment consultants. All members conducted individual reviews before a joint session that the review manager summarised and delivered to the Design Leader in charge. This routine depended on the availability of project members and resulted in varying reviewer comments. Though Top Management discussed the differing levels and number of comments from reviewers, the issues went unresolved.

Given the interdependence among technical and design assignments, it was necessary to communicate results. Documents were available via STA web portals, and attempts to follow complicated folder structures and labelling guides were often successful. To encourage dialogue and shared understanding and possibly communicate tacit knowledge, infrequent presentations of output also occurred that were decided and structured in an *ad hoc* manner, though client-governed presentations occurred only rarely.

Additional project activities were intended but not prepared upfront, including kickoffs and planning for the handling of rock and soil masses. Although the handling of masses is always a debated issue in large tunnel projects, no routine for planning was imported. When the responsibility of handling masses was finally settled after numerous reassignments, client members began to think outside the project scope, and the planning process was developed to include other projects and external stakeholders. Similarly, routines to plan for following phases were also not considered upfront, though as the project progressed it became clear that routines for including

maintenance aspects in tunnel design were missing. Although maintenance is an issue relevant to all infrastructure projects and most consultant assignments, it never initiated any comprehensive observed routines.

Discussion

The data used in this study do not reflect the entire project, since it would have been impossible to achieve for one observer. Detailed insights on many aspects were achieved, however. The structure of the discussion is based on the three propositions defined earlier that, in turn, are based on the classification of Gersick and Hackman (1990) distinguishing importation, creation, and evolution.

Proposition 1: *Project routines in megaprojects result from a combination of routines imported from participating organisations, including industry practice and project-level initiatives.*

Important routines in the project are summarised and classified in Table 4, which shows that explicitly imported routines were codified and primarily imposed by the STA. The routines are classified according to Gersick and Hackman's (1990) categories; routines in italics did not influence consultants, routines in bold were partially developed by consultants, and routines in normal text were decided by the client project organisation. Most were mandatory—for example, those of reporting and delivering documents to the client. Administrative routines imported from the STA were also the most stable and unchanged routines in the project, which is unsurprising since the project organisation lacked the formal discretion to depart from those routines. Furthermore, these routines had been applied in many earlier projects and were therefore more easily accepted by several project members.

In projects, it is not trivial to differentiate imported and created routines, especially since experiences and norms (Gersick and Hackman, 1990) are sources for importation that may be difficult to distinguish from creation. In the project studied, several innovative routines were created by combining elements of routines applied in other projects (Brady and Davies, 2004). In the project-based construction industry, meetings are an important coordination component, and to coordinate the complex organisation in the project examined, a considerable number of meeting series were imported and created by the client. Project members easily adapted to attending meetings, although the differences among all meeting types were not initially clear to everyone. As discussed below, more innovative and unusual project routines were not as smoothly adopted, though imposed by the STA. A conceptual model of the origin of some routines perceived by project members as innovative is found in Figure 3.

Furthermore, the two groups of consultants were assigned partly different ostensive routines—for example, the routine to divide consultant work according to four sub-stages had different steps. Consistent with Feldman and Pentland (2003), the performative aspect of the same ostensive routines also differed by assignment. It may be unsurprising that informal routines that did not appear in any guidelines varied, including the arrival and departure of guests. Yet, the formal details as templates for meeting minutes differed as well, as did the implementation of partnering activities. These differences seemed to depend much on the individuals in charge of the observed groups (Becker, 2004). For instance, the Technical Design Leader explicitly directed all technical assignments to have stringency in reporting, setting up meetings, and communicating deliverables. The three Station Design Leaders likewise executed routines in their own ways. Thus, the impact of personal experiences and opinions on routines (Becker, 2004) was in some cases substantial.

It is interesting to note the dominance of the client project organisation on imported and initially created routines, as well as those governing client and consultant interactions. However, consultants also have experience with working in megaprojects, and among all of their companies, good practices and routines to import should abound, though no such examples or conscious efforts were detected in the project studied here.

Table 4: Routines in the project

Origin of routines	**Routine**
Imported from STA with specific instructions	Consultants' reporting to financial IT system
	Model of four sub-stages for design work
	Cascade model
	Delivering drawings to IT systems
	Client project organisation's reporting to STA
Concept imported from STA or industry without specific instructions and created by the project organisation	*Top Management meetings*
	Project management reflection workshops
	Technical assignment guidelines
	Design assignment guidelines
	Importing drawings to a 3-D model
	Uploading documents to an administrative web portal
	Assignment meetings
	Increased Cooperation meetings in assignments
Created early	**Internal Station Design Consultant meetings**
	Cooperation Group meetings
	Bonuses for consultants
	Consultant-to-consultant delivery
Created later (considered upfront) / evolution	Design review process
	Presentation of outputs
Created later (not considered upfront) / evolution	*Breakfast meetings (starting Feb. 2013)*
	Cross-assignment technical meetings (starting Dec. 2012)
	After-work activities (starting Sept. 2013)
	Planning the handling of mass and soil

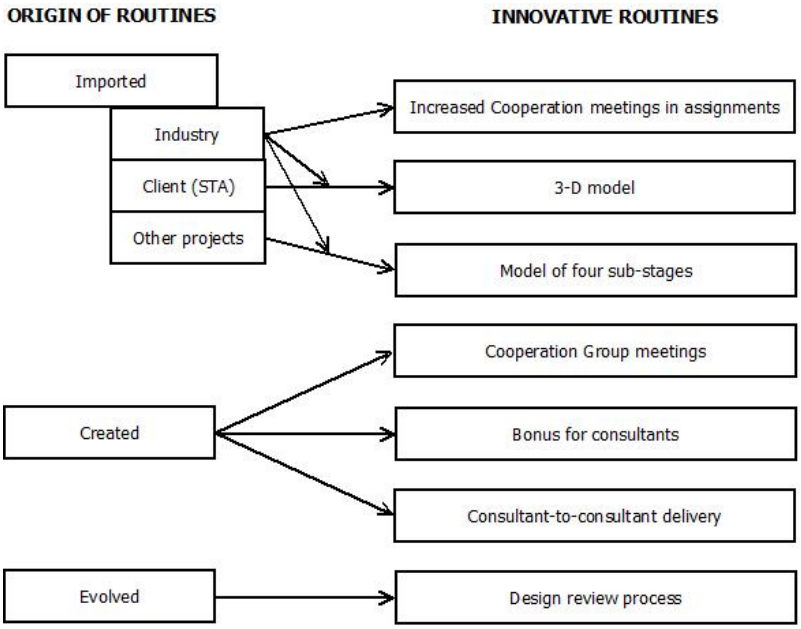

Figure 3: Origins of innovative project routines

Proposition 2: *Since many routines in megaprojects are new and unfamiliar to both organisations and individuals, learning processes occur, as reflected in change and adaptation of routines over time.*

Much research on routines focuses on learning processes, in which especially performative aspects of routines change over time due to feedback mechanisms by which group members identify good and bad practices (Gersick and Hackman, 1990; Feldman and Pentland, 2003). *Evolution* may refer to routines that emerged over time and were not set at the beginning of group work or the project phase (Gersick and Hackman, 1990). In this paper, *evolution* refers to routines that emerged later in the project and to evolutionary changes to existing routines, since both indicate that learning has occurred.

As previously described, many new, project-specific routines were introduced early in the project, primarily by the client. These routines were subsequently subject to change to varying degrees and for various reasons. Table 3 summarises typical changes and their causes.

More generally, an important cause of change in routines was perceived lack of coordination (Jarzabkowski, Le and Feldman, 2012), which often prompted interventions (Gersick and Hackman, 1990). For example, consultants experienced that a technical discussion forum across disciplines and assignments was missing, a gap caused by the novel situation (Gersick and Hackman, 1990) of numerous consultancy assignments for this phase and filled by introducing technical theme meetings. The novel client organisation also involved separating Agreements and Permit Process from the Design Group and consultant design coordination meetings, which caused disadvantages in coordinating consultant activities, another perceived missing routine. In this case, it was also the consultants who intervened to include managers for the noted areas in coordination meetings. A third example of perceived lack of coordination occurred when client members expressed that they lacked a holistic view of the project when relying on information provided via the imported cascade model. Top Management stood firm by the model, yet responded by adjusting other routines, including adding short presentations on the current state of the project, for example, during breakfast gatherings. In the case of the Cooperation Group, by contrast, group members perceived discussions as redundant of another meeting series, and the group was discontinued.

Absences and redundancies in coordination were most often identified as project members' understanding of project tasks increased and that they had learned more about the needs and restrictions of interaction (Becker, 2004; Brady and Davies, 2004; Pentland et al., 2012).

One routine more proactively created was the internal intervention prompted by the external context of negative media attention coupled with the principle of public access to official records. This routine reflected learning, for project members anticipated future consequences of intended routines. Most changes, however, were reactive and usually implemented in an *ad hoc* manner, often when individuals had questioned the appropriateness of different routines. This practice shows that routines reflected learning and were changed in response (Becker, 2004; Pentland et al., 2012), although in an unstructured manner.

Proposition 3: *The temporary nature of megaprojects limits investments in the development of routines and increases tolerance for dysfunctional routines.*

Research on organisational routines focuses on development and subsequent changes to routines. Obstacles to development and learning are less discussed, though path dependency, social entrainment, and costs are mentioned as impediments to change (e.g., Gersick and Hackman, 1990; Becker, 2004). In the project examined here, routines were in some cases never developed or lacked comprehensive instructions despite that their need had been identified; such was the case also for some issues relevant in all underground construction projects, including the handling of soil and rock masses and aspects of maintenance. Excepting the discontinuation of the Cooperation Group, it was also unusual that dysfunctional routines were dissolved or subject to substantial or disruptive changes. Often, competent and perceptive individuals compensated for missing routines with informal, *ad hoc* communication and coordination initiatives.

For several activities, routines were established to some extent yet never updated or fine-tuned to perform better, even if improvement possibilities were implied in discussions and complaints. The bonus system, Increased Cooperation activities, planning stage of consultancy assignments, and design review process are all examples of such cases, all of which were in some sense imported as concepts though without a clearly defined or evident performative aspect (Feldman and Pentland, 2003). They were innovative routines that could also cause discrepancies in expectations between their creators and executors. In the case of the planning phase and design review system, these

activities occurred for a limited period of the project phase. Though the project was large, there was little time during the execution of each task for thoughtful feedback and adjustment. In the case of the bonus system, guidelines were perceived to be vague, and nomination was voluntary; as a result, bonus activities were easily neglected when workload increased. Increased Cooperation was partly implemented though largely voluntary at the assignment level. In all of these cases, the need for a more proactive planning, communication, and follow-up system for managing this kind of new routine was underestimated. There was no meta-routine to scrutinise and to regularly develop inter-organisational project routines.

Another limitation concerns codification and ostensiveness. Some changes were codified and altered in ostensive routines (Jarzabkowski, Le and Feldman, 2012), though most were not. For example, incremental changes such as decreased meeting frequency in assignment meetings were not reflected in the conceptual meeting chart. At the same time, guidelines for consultant assignments were updated infrequently, especially when deliveries were due. The Cooperation Group operated differently than initially intended, which made the performative aspect diverge substantially from the written, ostensive aspect of the routine (Feldman and Pentland, 2003).

Altogether, the temporary project context can increase tolerance for suboptimal routines and limit willingness to invest in developing and codifying well-functioning routines. It is not easy to forecast how much and what kind of communication and guidance are needed, yet when activities start, there is clearly little time for evaluation and adjustment. For many project routines, there is thus little room for the stabilisation phase of Jarzabkowski, Le and Feldman's (2012) model or for the incremental change process described by Feldman and Pentland (2003).

Conclusions

Routines are pivotal to permanent organisations and help to shape organisational capabilities. In this paper, routines in the context of megaprojects are investigated and three propositions posed to explain how routines are developed in megaprojects, which exhibit characteristics of both temporary and permanent organisations. The conclusions are based on an extensive case study of an infrastructure development project and an analysis of organisational routines in research.

The first proposition concerned the origin of megaproject routines; routines being influenced by industry practice, routines in the permanent organisations involved, and the individuals involved in the project team. Industry practice and individuals proved influential; in the case study, the megaproject's routines were primarily imported from the client organisation. The client dominated especially at the start of the observed project phase, though this influence persisted throughout the phase. Nevertheless, routines may be imported also from other participants, provided that these are seriously involved.

The second proposition assumed that new and unfamiliar megaproject routines would prompt learning displayed by updating and adding routines. Many routines were planned in the project studied, though some were not settled until later. The new way of organising early design work called for new routines to be supported and adjusted over time, although the ultimate task, personnel involved and resources, mostly remained unchanged. Learning occurred *ad hoc*, and there were few formal occasions for feedback.

The third proposition suggested that improvements to routines are limited due to time restrictions in a megaproject. In the project investigated, few changes to routines were made proactively. Furthermore, on several occasions, the project did not invest in developing routines though unsatisfactory outcomes had been discussed. Especially routines that were new, and/or limited in time, remained suboptimal.

Although it should be acknowledged that *ad hoc* adaptation may often be efficient, there are benefits to employing conscious, deliberate management strategies to enable learning processes in

relation to routines in the context of megaprojects. Given their size and unique context, megaprojects promote the development of a greater proportion of project-specific routines during a brief period, which increases the risk of suboptimal routines compared to the risk faced by small, short-term projects or permanent organisations. Proactive meta-processes for developing and evaluating routines can help clients to identify the most critical routines to introduce in a specific project and capturing supplier experiences with routines. Project management should be especially cautious when introducing routines that are new in the industry context. Future research should explore relationships between attention to the development of routines, especially meta-routines, and the performance of megaprojects.

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