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NAVIGATING INTERTEMPORAL CHOICE IN LARGE INFRASTRUCTURE PROJECT DELIVERY: A PROCESS THEORY APPROACH

Large infrastructure projects (LIPs) are delivered through temporary organisations that must respond to present-day demands while bearing responsibility for future needs. During delivery, the choices often evolve with different implications distributed across different time horizons, which is referred to as intertemporal choice. Yet the processes by which such choices emerge, are negotiated, and are resolved within temporary project organisations remain poorly understood. This paper addresses that gap by investigating how intertemporal choices are created, negotiated, revised, and resolved during the delivery stage of LIPs, and what are the implications for sustainability commitments. Drawing on process theory, the paper conceptualises intertemporal choice not as a discrete decision point but as a dynamic, evolving sequence of actor interactions. A process tracing case study design is proposed, using HS2 as an illustrative analytical context. The paper contributes to the understanding of how intertemporal choice as a unit of analysis is operationalised through process theory; identifies four generative mechanisms: emergence, negotiation, revision, and resolution; and outlines an empirical approach grounded in semi-structured interviews, focus group, observation, and longitudinal document analysis.

Keywords: intertemporal choice; large infrastructure projects; process theory; sustainability; temporary organisations; process tracing

INTRODUCTION

Large Infrastructure Projects (LIPs) adopt a paradoxical position in achieving sustainability. They are appointed to deliver future societal, economic, and environmental benefits, yet the choices that determine whether those benefits are realised are made by temporary organisations operating under intense present-day pressures (Brookes et al., 2017; Geraldi et al., 2020). This creates a structural temporal tension: the permanent organisation (PO) that initiates the project is oriented toward future strategic commitment, while the temporary organisation (TO) that is responsible for the delivery is eager to meet immediate contractual milestones, cost targets, and schedule demands (Lundin and Söderholm, 1995; Pemsal et al., 2020). When present demands might compromise the future needs during delivery, actors must make choices whose costs and benefits are distributed across time. This paper focuses on this type of choice, which the behavioural economics and organisational science literatures term intertemporal choice (Loewenstein and Thaler, 1989; Laverly, 1996; Slawinski and Bansal, 2015).

The High Speed 2 (HS2) railway project illustrates the intertemporal choice at two levels. At the programme level, the 2023 decision to cancel the northern legs of the network weighed immediate economic and political pressures against long-term regional connectivity and sustainability commitments. At the project-scope level, the Chilterns tunnel decision involved actors choosing between an open-section route that was cheaper and faster to deliver and a bored tunnel that was ecologically and socially superior but more expensive and time-consuming (HS2 Ltd, 2025). In both cases, actors confronted choices in which present and future considerations pulled in different directions. Neither choice was made at a single moment; both evolved through extended processes of framing, optioneering, negotiation, and political revision. Yet the processes through which such intertemporal choices emerge and are navigated during LIP delivery remain empirically and theoretically underexplored.

This under exploration reflects a gap at the intersection of two bodies of literature. Research on LIPs as temporary organisations has characterised their structural orientation toward present demands (Brookes et al., 2017; Geraldi et al., 2020; Vaagaasar et al., 2020) but has not examined the dynamic processes through which intertemporal choice arise and are managed. Research on intertemporal choice within organisational science has demonstrated that organisations often experience present bias (March, 1991; Slawinski and Bansal, 2015; Sun et al., 2024) but has predominantly treated choice as an outcome rather than a process. The result is that construction project management lacks the tool to study how intertemporal choice unfolds throughout the delivery stage.

This paper addresses that gap through the following research question: ‘How are intertemporal choices created, negotiated, revised, and resolved during the delivery stage of large infrastructure projects, and what are the implications of this process on sustainability commitments?’ To answer it, the paper adopts process theory as its analytical lens (Langley, 1999; Pettigrew, 1997), operationalises intertemporal choice as the unit of analysis, and proposes a process-tracing case study design capable of reconstructing events from documentary, interview, observation, and focus group evidence. HS2 is used as an illustrative analytical context to demonstrate how this design can be operationalised and to develop the related process framework.

The paper makes three main contributions. First, it operationalises intertemporal choice as a unit of analysis within process theory by identifying four main mechanisms: emergence, negotiation, revision, and resolution, through which such choices unfold. Second, it demonstrates how those mechanisms can be empirically traced through a combination of process tracing, semi-structured interviews, and longitudinal document analysis. Third, it advances temporary organising theory by showing how the structure of temporary organisations generates intertemporal choice that systematically shapes sustainability outcomes.

THEORETICAL BACKGROUND

Intertemporal Choice: Definition and Organisational Relevance

Intertemporal choice refers to choices in which the timing of costs and benefits is distributed across present and future time horizons (Loewenstein and Thaler, 1989: 181). At its core, it captures the tension between what is optimal now and what is optimal later (Laverty, 1996). In economics, this tension is typically modelled through discounted utility theory, which treats future outcomes as systematically less valuable

than present ones (Loewenstein and Thaler, 1989). In organisational science, research demonstrates that organisations exhibit a structural present bias: they tend to prioritise immediate performance over future resilience, even when long-term outcomes suffer as a result (March, 1991; Slawinski and Bansal, 2015; Sun et al., 2024). This bias is reinforced by financial markets, short-term incentive structures, and resource constraints that make it costly to commit present resources toward future benefits (Lavery, 1996).

Intertemporal choice is also inherent in the LIPs sustainability commitments, which the Brundtland Commission defined as meeting present needs without compromising the ability of future generations to meet their own (WCED, 1987). Sustainability, therefore, requires organisations to challenge present pressures and maintain commitment to future needs, a challenge that is amplified in contexts characterised by resource constraints, contractual obligations, and short delivery windows. These conditions define LIPs. Therefore, intertemporal choice arises when present demands differ from future needs (Smith and Lewis 2011).

Existing theoretical frameworks have treated intertemporal choice in two principal ways. Discounted utility theory frames it as a rational calculus producing a single, time-stamped decision (Loewenstein and Thaler, 1989). Paradox theory conceptualises it as an ongoing tension between competing demands that organisations must manage simultaneously rather than resolve (Smith and Lewis, 2011). Both perspectives share a limitation: they treat intertemporal choice as a static outcome rather than a dynamic process. In LIP delivery, however, intertemporal choices do not arise at a single moment. They emerge incrementally, are renegotiated as conditions change, and may be revised multiple times before any resolution is reached. A process-oriented framework is therefore required.

Large Infrastructure Projects as Temporary Organisations

LIPs have been theorised as temporary organisations established to deliver a defined task within a fixed timeframe and disbanded upon completion (Lundin and Söderholm, 1995; Brookes et al., 2017). Their temporary nature structurally orients them toward satisfying present demands, achieving milestones, and meeting contractual obligations, a position that often contrasts with sustainability needs that unfold over longer time horizons (Geraldi et al., 2020; Vaagaasar et al., 2020). This creates a fundamental tension: the TO operates in ‘finite’ time, while the PO that initiated it operates in ‘infinite’ time with accountability for the project’s long-term needs and value (Geraldi et al., 2020; Lundin and Söderholm, 1995; Pemsel et al., 2020).

This structural difference makes intertemporal choice more visible when LIPs are analysed as temporary organisations. When the TO is incentivised to meet present contractual milestones and the PO is accountable for future outcomes, the interface between the two organisations becomes a site where intertemporal tensions are generated, negotiated, and sometimes displaced. Yet existing research has tended to treat temporality in LIPs in conceptual terms, emphasising time and budget pressures (Dille et al., 2018; Pemsel et al., 2020), rather than examining how intertemporal tension is initiated as an evolving process over the delivery stage.

Process Theory as Analytical Lens

Process theory conceptualises organisational phenomena not as discrete outcomes but as unfolding sequences of events shaped by interactions between actors, structures, and temporal pressures (Langley, 1999; Pettigrew, 1997). Applied to intertemporal choice, process theory enables the study to treat each choice not as a fixed decision point but as an evolving process that is shaped, reshaped, and eventually resolved, or left unresolved, as the delivery stage unfolds. This is significant because it allows the researcher to ask not merely what choices were made, but how those choices were made and built: what triggered them, who was involved, what alternatives were considered, what pressures shaped the outcome, and what are the implications.

Process theory's emphasis on sequences of events over time is operationalised in this study through a dynamic framework. Drawing on process tracing logic (Beach and Pedersen, 2016) and on the broader process theory literature (Langley, 1999; Pettigrew, 1997), the framework identifies four generative dynamic mechanisms through which intertemporal choices unfold in LIP delivery: (1) 'choice emergence', in which a tension between present demands and future needs is recognised and framed as a choice; (2) 'negotiation', in which actors evaluate alternatives and advance competing temporal orientations; (3) 'revision', in which earlier choices or their framing are reshaped as delivery conditions change; and (4) 'resolution', in which a choice is made and its implications for sustainability commitments become concrete. The study will investigate whether these mechanisms are sequential stages; they may overlap, recur, or be bypassed. Their analytical value lies in providing a vocabulary for tracing how intertemporal choice is produced and managed across the delivery stage.

By positioning intertemporal choice as the unit of analysis and process theory as the analytical lens, this study advances understanding of how the interaction of permanent and temporary organisation shapes sustainability outcomes in LIPs, an intersection that remains underexplored in both project management and organisational literature (Geraldi et al., 2020; Pemsel et al., 2020; Slawinski and Bansal, 2015).

RESEARCH DESIGN

Research Question and Analytical Logic

The research question driving this study is: 'How are intertemporal choices created, negotiated, revised, and resolved during the delivery stage of large infrastructure projects, and what are the consequences of this process for sustainability commitments?' This question positions intertemporal choice as the focal phenomenon, the delivery stage as the temporal boundary, and sustainability commitments as the consequential outcome. To answer this question, an approach capable of tracing dynamic, interactive processes that unfold over time and produce specific outcomes is required, which points this study to utilise process tracing (Beach and Pedersen, 2016).

Process tracing (PT) is a within-case method for reconstructing the sequence of events, actors, and mechanisms that link initial conditions to outcomes (Beach and Pedersen, 2016; Mayntz, 2004; Goertz, 2017). It is particularly well-suited to causal explanation in complex, temporally structured phenomena because it allows the researcher to move from observing the choice mechanism ('how and why did it happen?') by constructing a chronological narrative that identifies the conditions

under which specific actors made specific choices (Beach and Pedersen, 2016). Applied to intertemporal choice in LIP delivery, PT enables the study to trace how present delivery pressures and future-needs considerations interacted at specific moments, which mechanisms were activated, and how choices were made, revised, or displaced as those conditions evolved.

The study adopts an inductive, qualitative single-case study design (Yin, 2018) with embedded units of analysis corresponding to individual intertemporal choices during the delivery stage. This design is appropriate because the phenomenon, intertemporal choice processes in LIP delivery, is poorly understood, theoretical concepts are emergent, and causal mechanisms can only be identified through in-depth analysis of a specific, information-rich case (Yin, 2018).

Operationalising Intertemporal Choice as a Unit of Analysis

An intertemporal choice episode, as used in this study, is an identifiable sequence of events in which actors recognise, frame, negotiate, and enact a choice between options that differ in their temporal distribution of costs and benefits. This definition has four analytical components:

- A triggering event: a moment at which present delivery demands, and future needs come into different directions, prompting actors to identify alternative choices (Smith and Lewis, 2011; Pot, 2020b).
- A choice frame: providing set of alternatives that actors recognise (Kalis et al., 2013; Gurney et al., 2025), which are shaped by contractual constraints, resource availability, and institutional pressures (Salet et al., 2012; Giezen, 2012)
- A negotiation process: the evaluation of their preferred temporal directions, drawing on authority, expertise, contractual conditions, and driving external conditions (Clegg et al., 2006; Ninan et al., 2020; Slawinski and Bansal, 2015).
- A consequential outcome: the enacted choice and its observable implications for sustainability commitments, which may themselves become the triggering condition for a subsequent intertemporal choice episode (Cantarelli et al., 2010; Dille et al., 2018)

This operationalisation enables process tracing to identify causal chains. The guiding analytical question, ‘How did we get here?’, is not a retrospective summary but a structural mechanism for tracing backwards from an enacted outcome (a specific choice during delivery) to the sequence of events, actor interactions, institutional pressures, or external conditions that produced it. For each intertemporal choice episode, the researcher asks: What conditions triggered the recognition of a choice? Whose temporal orientations were in tension? What alternative choices were constructed? How was the choice landscape shaped by contractual or institutional constraints? What interactions produced the enacted choice? What are the implications of meeting the future needs? This chain of questions generates the empirical content for mechanism identification.

This study will utilise semi-structured interviews and focus group(s) with selected professionals to reconstruct specific episodes in which intertemporal choice arose during delivery. The semi-structured interview and focus group(s) will support the documentation of actors' understanding of how they framed and navigated those choices at the time. An observation will also be utilised to capture the triggers and the way the intertemporal choice episode is processed in real time. Whenever possible, the

research will aim to utilise the triangulated data alongside project documents, change records, value engineering reports, contract correspondence, and internal decision logs to reconstruct the sequence of events that constituted each intertemporal choice episode and to identify which mechanisms were activated at which moments.

Case Selection

The HS2 railway project is selected as the primary analytical context for this study. The selection is justified by four criteria relevant to the study's research question. First, HS2 exhibits pronounced intertemporal choice: it was commissioned to deliver future benefits in regional connectivity, carbon reduction, and economic development, while being subject to intense present-day cost, schedule, and political pressures throughout its delivery stage (HS2 Ltd, 2025). Second, it is interorganisational: the project involves complex contractual arrangements between the permanent client organisation (HS2 Ltd), joint ventures, and supply chain actors, creating different temporal orientations. Third, it has recognised future-oriented sustainability commitments that are formally documented and traceable in publicly available project documentation. Fourth, it offers sufficient documented evidence, through published independent reviews, parliamentary reports, contract documents, and media archives, to enable preliminary process tracing, with access to participants from the delivery stage to be sought through purposive sampling.

Two intertemporal choice episodes within HS2 serve as illustrative analytical stories. The first is the 2023 decision to cancel the Birmingham–Manchester and Birmingham–Leeds legs of the network, which involved a choice between maintaining future regional connectivity commitments and meeting immediate economic and political demands. The second is the Chilterns tunnel decision, which involved a choice between an open-section route (lower immediate cost and programme risk) and a bored tunnel (higher ecological and social sustainability but greater present-day cost). These episodes are not treated as finished cases but as preliminary evidence for potential framework development; this study might provide further evidence of intertemporal choice beyond the illustrative examples explained, and the empirical study will extend the analysis through the utilised primary data collection methods.

Data Collection

A longitudinal, multi-source data collection strategy will be adopted. Primary data will be generated through semi-structured interviews and focus groups with professionals involved in the delivery stage, including project managers, engineers, sustainability leads, client representatives, and supply chain managers. An observation method will also be utilised to observe the process starting from the choice emergence to the choice enactment. Interview and focus group guides will be structured around individual intertemporal choice episodes, asking participants to describe: the conditions under which present and future needs were unbalanced; the alternatives that were constructed and evaluated; the actors whose temporal orientations shaped the choice; how the choice evolved over time; and what they understood to be the consequences for sustainability commitments. This episode enables the reconstruction of process sequences rather than generic accounts of project experience (Lavrakas, 2008).

Whenever possible, collected data will include project briefs, contracts, delivery plans, change records, value engineering logs, independent review reports, and parliamentary select committee evidence. These documents capture the formal expressions of both

present constraints and future commitments at specific moments during delivery, enabling temporal triangulation with interview accounts. 3.5 Data Analysis

Analysis will follow a three-stage process tracing procedure (Beach and Pedersen, 2016). In the first stage, a chronological narrative of delivery events will be constructed for each intertemporal choice episode, sequencing key actions, interactions, and decision moments against the project timeline. This narrative answers the descriptive question: what happened, when, and who was involved?

In the second stage, the four-mechanism framework (emergence, negotiation, revision, resolution) will be applied inductively to identify which mechanisms were activated at which moments. Coding will be conducted inductively from the interview and documentary data, using language that reflects how actors referred to present demands and future needs. The analytical objective at this stage is to identify the specific conditions under which each mechanism was triggered and the actor interactions through which it operated.

In the third stage, once the sequence of intertemporal choice is reconstructed, it will link the triggering conditions, the activated mechanisms, and the consequential outcomes for each episode. The research will test whether the mechanisms identified were vital to choice enactments by imagining their absence through counterfactual reasoning (Tetlock and Belkin, 1996).

THE FOUR-MECHANISM PROCESS FRAMEWORK: ILLUSTRATION FROM HS2

This section illustrates how the four-mechanism framework applies to the HS2 case, using publicly available evidence to develop the analytical categories. This illustration serves both to validate the framework's conceptual coherence and to demonstrate how empirical data can be coded to each mechanism.

Mechanism 1 – Choice Emergence

Choice emergence refers to the process by which actors recognise and frame a tension between present demands and future needs as a choice that requires deliberate action. In the HS2 Chilterns case, the triggering condition was the emergence of social and political opposition to an open-section route through the Chilterns Area of Outstanding Natural Beauty during the delivery stage. This opposition framed the choice: proceed with the open section (lower present cost, higher future social and ecological risk) or pursue a tunnel (higher present cost, lower future social and ecological risk). The choice was not predetermined; it emerged from a process of problem recognition, stakeholder pressure, and institutional framing (Kalis et al., 2013; Salet et al., 2012). The construction of the choice landscape was itself a political and technical act shaped by contractual arrangements, environmental impact assessment obligations, and the PO's accountability to future sustainability commitments.

Mechanism 2 – Negotiation

Negotiation refers to the process through which actors advance, contest, and revise competing temporal orientations. In the Chilterns case, negotiation involved engineering teams (oriented toward present costs and programme certainty), environmental leads (oriented toward future ecological and social sustainability), and political actors (responding to both present public opinion and future legacy

commitments). Each actor brought a different temporal orientation, defined by their role, contractual incentives, and accountability structure. The negotiation process involved optioneering analyses, public consultations, and internal escalation; a sequence of interactions through which the relative weight attached to present and future considerations was contested and revised. Paradox theory (Smith and Lewis, 2011) frames such negotiations as the management of competing demands rather than their resolution; process theory enables the researcher to trace the specific interactions through which the balance was struck.

Mechanism 3 – Revision

Revision refers to the process through which earlier choices or their framing are reconsidered as delivery conditions change. In the HS2 programme-level case, the original commitment to a full Y-shaped network was revised through successive spending reviews, changes in government, and accumulating cost pressures. Each revision point involved a new framing of the intertemporal trade-off: what future sustainability commitments could be maintained given present fiscal constraints? Revision is analytically distinct from negotiation because it involves reconsidering an already-enacted choice rather than deliberating over an emerging one. It is triggered by changed conditions — new cost estimates, political shifts, changed stakeholder configurations — and produces a revised choice landscape that may differ substantially from the original. Tracing revision processes empirically requires longitudinal data: interview accounts of specific moments at which actors revisited earlier commitments, triangulated against documented evidence of formal decisions and their antecedents.

Mechanism 4 – Resolution

Resolution refers to the enactment of a choice and its consequential implications for future commitments. In the Chilterns case, resolution occurred when the decision to proceed with the tunnel was formally adopted and incorporated into contractual and design commitments. This resolution preserved future social and ecological sustainability commitments but imposed present costs in construction complexity and programme delay. In the programme-level case, the cancellation of the northern legs was resolved by sacrificing future regional connectivity commitments to satisfy present fiscal constraints. Resolution is not always final: enacted choices may become triggering conditions for subsequent intertemporal choice episodes if their consequences create new tensions between present demands and future needs. This recursive quality is one of the distinguishing features of intertemporal choice processes in LIP delivery and distinguishes the process framework from static decision models.

DISCUSSION

The paper's central argument is that intertemporal choice in LIP delivery is best understood not as a discrete decision but as a dynamic process constituted by four generative mechanisms: emergence, negotiation, revision, and resolution. This reframing has three implications for theory and research in construction project management.

First, it extends process theory to a new empirical domain. Process theory has been applied extensively in organisational studies (Langley, 1999; Pettigrew, 1997) and has begun to inform project management research (Dille et al., 2018; Geraldi et al., 2020), but its application to intertemporal choice as a specific phenomenon is novel. By operationalising the four mechanisms as the analytical units through which intertemporal choices are produced and managed, the framework provides a vocabulary that is applicable across LIP contexts and testable through systematic process tracing.

Second, it deepens the theoretical understanding of how temporary organisational structures shape long-term commitments within the permanent organisation. Existing research has noted that LIPs' temporary nature exhibits a bias toward present demands (Geraldi et al., 2020; Vaagaasar et al., 2020) but has not explained the mechanisms by which this bias translates into specific patterns of intertemporal choice. The framework proposed here provides that explanatory essence. The finite time frame of the TO is not merely a context for intertemporal choices; it is utilised as a temporal mechanism that shapes when choice emergence is triggered, which temporal orientations dominate in negotiation, and what conditions make the negotiation.

CONCLUSIONS

This paper has addressed a gap in construction project management research by examining how intertemporal choices, choices between present delivery demands and future sustainability needs, are created, negotiated, revised, and resolved during the delivery stage of large infrastructure projects.

The paper contributes to the development of a four-mechanism process framework that operationalises intertemporal choice as a dynamic sequence of actor interactions, rather than a static decision outcome. The mechanisms, emergence, negotiation, revision, and resolution, provide an analytical vocabulary for tracing how intertemporal tensions are produced and managed across the delivery stage. The framework is grounded in process theory (Langley, 1999; Pettigrew, 1997) and operationalised through a process-tracing research design (Beach and Pedersen, 2016) that generates causal explanations by reconstructing the sequences of events, actors, and mechanisms linking present-day delivery pressures to sustainability outcomes.

The HS2 case illustrates how the framework applies in practice. The Chilterns tunnel decision and the northern legs cancellation represent distinct intertemporal choice processes, each involving different configurations of triggering conditions, negotiating actors, revision dynamics, and resolution consequences. This illustration demonstrates the framework's conceptual coherence and provides an empirical foundation for the proposed primary data collection, which will extend the analysis through semi-structured interviews and longitudinal document analysis with delivery-stage practitioners.

By shifting attention from outcomes to processes, this research advances temporary organising theory by foregrounding how the structural finiteness of temporary organisations generates intertemporal tensions that systematically shape sustainability commitments. It responds to calls for more dynamic treatments of temporality in project studies (Geraldi et al., 2020; Vaagaasar et al., 2020) and contributes to a more nuanced understanding of how delivery-stage choices shape the long-term value and legitimacy of major infrastructure investments.

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