Examining opportunities to improve the pre-construction schedule performance of Seattle Public Utilities scope in Seattle Department of Transportation capital projects

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Abstract

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This study discerns and analyzes opportunities to improve the schedule performance of the City of Seattle's water, sewer, and drainage improvements that are delivered through transportation capital projects. This issue is particularly salient, as Seattle's water, sewer, and garbage ratepayers are spending over $100 million each year on capital improvements that are a result of unprecedented transportation construction – which inevitably creates impacts and opportunities to below-grade infrastructure. This research takes the form of a multi-case

descriptive study, examining three projects with significant utility scope that was delivered through transportation contracts. Specifically, this thesis focuses on schedule performance during the initiation, options analysis, and design phases of the project delivery lifecycle.

As a result, this research found misaligned production systems between the utility and transportation agencies, as well as divergent policy drivers and mental models that reinforce the status quo. These findings and the following recommendation are derived from semi-structured interviews with project team members, observation of project delivery processes and artifacts, and pertinent theories, empirics, and literatures of practice. A recommendation to implement lean production – or a continuous improvement culture based on front-line empowerment and eliminating waste – is put forward from a limited policy analysis.

Acknowledgements

I owe my deepest gratitude to Professor **Jan Whittington**, a co-chair of the supervisory committee, not only for making this study a success, but for her rigor, thoughtful guidance, and breadth and depth of knowledge in infrastructure planning.

Special thanks to Professor **Joaquín Herranz, Jr.**, a co-chair of the supervisory committee, not only for the guidance in this research, but for countless engaging, relevant, and thought-provoking moments in the classroom. Your instruction has made me a better student, public servant, and global citizen.

I am much obliged to **the participants of this study** – the unsung heroes at the City of Seattle who make sure that the taps are flowing, that our water bodies are free of sewage pollution, that streets are clear of puddles and debris, that keep people and goods moving through our communities. I cannot express enough how much I have grown while working alongside you, as we tackle some of the toughest project management issues. The work you do – public service excellence, the forefront of sustainability policy, the journey for social justice – reminds me that there is a future worth fighting for.

Further gratitude to my **colleagues and friends**, for being by my side through this cluster of graduate school. "We are here to drink beer. We are here to kill war. We are here to laugh at the odds and live our lives so well that Death will tremble to take us." – Charles Bukowski, 1988.

Finally, I am forever indebted to **Rolando and Maria Herrera**, the best parents to ever exist. I never forget that you came from the bottom of the developing world. Having climbed the ladder of success to the American middle class, you have refused to step on anyone else. Through it all, you have remained dedicated to public service, our communities, and the places you came from. I stand on your shoulders. I owe it to you to keep fighting to make sure everyone can thrive as we have.

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Executive Summary

Background. Seattle is undergoing an unprecedented level of civil investment. The Transportation Levy to Move Seattle – which is the largest levy in city history – delivers over one billion dollars' worth of mobility improvements. Roadway construction presents impacts and opportunities for utilities that exist beneath the street. As a result, Seattle Public Utilities must protect, rehabilitate, or replace assets during the Seattle Department of Transportation's capital projects when it is technically or economically prudent. This work costs Seattle Public Utilities over $100 million in 2018 alone – a third of their capital budget.

Purpose. There is a gap between actual schedule performance and ideal schedule performance in Seattle Public Utilities' scope that are delivered in the Seattle Department of Transportation's capital projects. This research discerns, analyzes, and recommends opportunities to improve how these two agencies work together to concurrently plan, design, and build various infrastructure systems. Specifically, this thesis focuses on the initiation, options analysis, and design phases of the project delivery lifecycle, posing these three questions:

- What opportunities exist to improve the schedule performance of Seattle Public Utilities scope in Seattle Department of Transportation capital projects during initiation, options analysis, and design?
- What is the City of Seattle's 'production system' for planning and delivering drinking water, stormwater, and wastewater infrastructure improvements within their transportation capital projects?
- What mental models do Seattle Public Utilities' staff hold with regard to the planning and delivery of utility improvements in Seattle Department of Transportation capital projects?

Methods. This study uses a multi-case study approach, which gathers qualitative data from observations of processes and primary sources, as well as in-person interviews. Interview participants include 60% of staff whose day-to-day duties involve these interagency capital projects between Seattle Public Utilities and the Seattle Department of Transportation.

Findings. This study presents the production system for delivering utility scope within transportation projects. This research contends that the production system between the two agencies are misaligned, systematically putting Seattle Public Utilities behind the Seattle Department of Transportation's overall schedule. Moreover, this research notes that the two departments have conflicting policy drivers and funding sources, leading to an adversarial relationship – especially when disputes arise. This may be a secondary source of schedule underperformance. As a whole, staff tend to hold mental models that reinforce these findings.

Policy analysis and recommendation. Four policy alternatives are derived from in-person interviews, observations, and literature:

1. Status quo.
2. Implementing lean production.
3. Embedding utility planners into the transportation line-of-business.
4. Reorganizing the City of Seattle's public works lines-of-business to report to a unified governing body, such as a Board of Public Works.

After considering the required inputs of each policy alternative, as well as the projected outcomes and any tradeoffs, **this study recommends that Seattle Public Utilities and the Seattle Department of Transportation pursue lean implementation** in their cross-departmental partnership projects.

Implications. Seattle's annual utility rate escalations have recently increased, partially due to the quantity of capital improvements that are demanded by transportation projects. This is problematic, especially as Seattle grapples with an affordability crisis. Any opportunities to improve performance, and in turn, save costs, is undoubtedly aligned with the public interest.

Chapter 1: Introduction

As Seattle prepares to welcome one hundred thousand new neighbors in this decade alone, voters have shown generosity with regard to their mobility systems: in 2015, Seattle voters approved the largest levy in city history, totaling US$930 million over ten years for roadway, transit, and various multimodal mobility improvements. In addition, removal of the Alaskan Way Viaduct, replacement of the Elliott Bay Seawall, and reconstruction of the central waterfront adds another US$688 million to the equation. Together with regional transit investments, as well as federal and state funding, these various transportation portfolios total to over US$3 billion – an unprecedented level of civil investment within Seattle.

What is often forgotten about these right-of-way projects are their impacts to underground infrastructure: both public utilities and private franchises – like tap water and broadband, respectively. Any time a major transportation project opens up a roadway, utilities must (a) protect vulnerable infrastructure from construction impacts; (b) relocate their assets to make way for new infrastructure, like streetcar rails that are built on top of maintenance holes; or (c) take advantage of the opportunity to share costs, perform improvements, and reduce long-term community disruption.

Seattle Public Utilities – the part of the City of Seattle's executive branch that provides water, drainage, sewer, and solid waste services – is responding to transportation work with over US$100 million, or one third of their capital budget. To strategically manage water, sewer, and drainage assets in this age of massive public works construction, Seattle Public Utilities must coordinate closely with staff in other infrastructure agencies, especially the Seattle Department of Transportation.

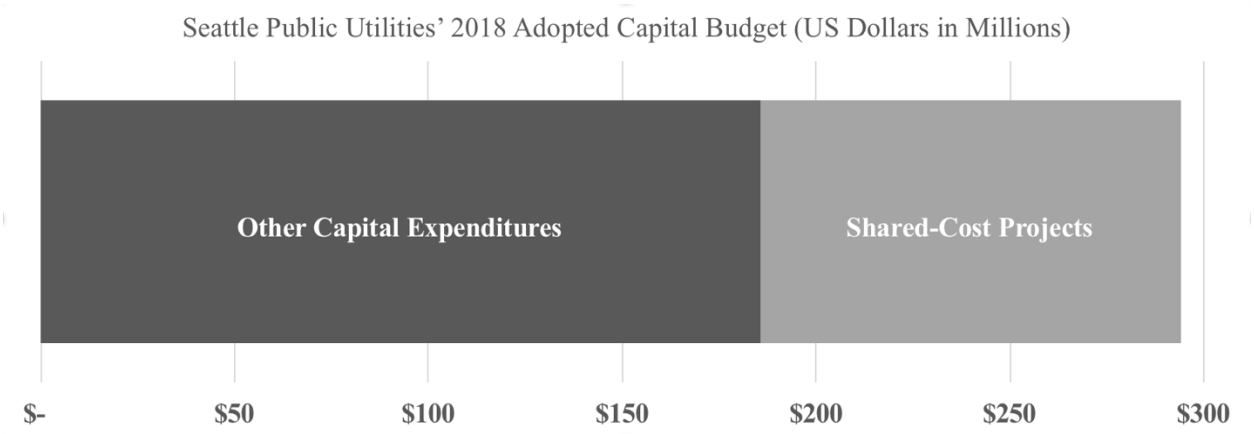

Figure 1. Seattle Public Utilities' allocation to interagency projects compared to the total capital budget, per the City of Seattle's 2018 Adopted Budget (City of Seattle 2017).

Seattle Public Utilities partners with the Seattle Department of Transportation to deliver utility improvements through their design and construction contracts (City of Seattle 2016). These cross-departmental projects involve convoluted planning, engineering, and policy processes between two organizations with different missions. This interconnection between utilities and mobility touches on complex matters related to engineering, management, law, among others. This master's thesis explores how these two public works agencies develop and deliver capital projects. More specifically, this thesis seeks and analyzes opportunities to improve Seattle Public Utilities' schedule performance in transportation projects prior to construction.

1.1 Issue Statement

Seattle Public Utilities and the Seattle Department of Transportation have misaligned processes for planning and delivering capital improvement projects. In addition, the two agencies have separate policy drivers that may lead to conflict. Moreover, staff tend to hold mental models that reinforce an adversarial relationship.

As a result of these issues, this study has found that there is a gap between Seattle Public Utilities' actual schedule performance and ideal schedule performance as it pertains to scope that

is delivered via the Seattle Department of Transportation's construction contracts. Systematic schedule underperformance has real costs on taxpayers and ratepayers, which is inconsistent with ideals related to public service excellence.

1.2 Purpose and Implications

Case studies of Seattle Public Utilities' response to the Seattle Department of Transportation's capital projects provides an examination of existing conditions in the utility's processes for developing and delivering scope in the transportation department's capital projects. This case study draws from theories, empirical research, and literatures of practice in public sector management, construction management, and other fields, which is described in the following chapter.

This thesis answers the question: "what opportunities exist to improve the schedule performance of Seattle Public Utilities scope in Seattle Department of Transportation capital projects?" In addition, this thesis explores the 'production system' of these interagency projects, as well as any deeply-held notions that are held by staff who deliver these capital improvements. Further description of research questions is available in the third chapter regarding methodology.

Public utilities and private franchises spend millions responding to the impacts and opportunities of transportation capital projects. Since utilities are inherently monopolistic, their rates are inelastic, and these costs are theoretically passed to the consumer (Perloff 2009).

As such, Seattle Public Utilities' ratepayers spend millions of dollars responding to impacts and opportunities from Seattle Department of Transportation construction projects, as well as construction from other public works agencies. Due in part to increasing transportation projects, Seattle City Council recently approved increases to utility rates to fund these efforts. This is especially salient, as Seattle has some of the highest water utility rates in the nation –

including the very highest rates out of any major American city in 2015 (Balk 2015; Walton 2018). These rising utility rates are noteworthy in the context of Seattle's affordability crisis, where nearly half of Seattle's renters are currently cost-burdened, with utility rates factoring into that equation along with rent (City of Seattle 2014). Any opportunities to improve the efficiency of interdepartmental capital project delivery are surely in the public interest.

1.3 Research Limitations

To answer these research questions, a case study design is implemented by this study. While case studies tend to "provide less desirable forms of inquiry than experiments or surveys" (Yin 2002, 10), this research design can still shine light on management processes and opportunities for improvement at the City of Seattle. Data collected from the case study feeds a policy analysis, which examines various alternatives to improve Seattle Public Utilities' pre-construction schedule performance in the Seattle Department of Transportation's capital projects. These alternatives are analyzed on three criteria: cost, effectiveness, and feasibility. The highest-scoring alternative is proposed as this thesis' recommendation. The policy analysis is limited in scope, given the case study design of this research, as well as the typical time constraints associated with a master's thesis.

Regardless of these reservations, this study triangulates trends, findings, and implications via in-person interviews with staff, observation of primary sources, and review of relevant academic and professional literature. This research design permits this thesis to tackle complex and ambiguous issues, where the distinction between circumstances and phenomena are unclear. This study's results and conclusions are well-founded in the context of the City of Seattle's public works improvement projects, but not necessarily applicable to other jurisdictions or private franchise utilities. While these interpretations may not be valid for other municipalities,

key insights may be useful to inform interagency project delivery in large cities that are experiencing rapid growth in civil construction.

This thesis integrates the curricula of two professionally-oriented master's programs: Public Policy and Urban Planning. As a result, this research does not take the form of a purely academic thesis, where theories may be presented and empirically tested. Instead, this thesis stands at the nexus of applied and academic research, focusing on practical issues at the City of Seattle rather than seeking to contribute to the larger body of knowledge.

1.4 Structure of the Thesis

The following chapter provides an annotated overview of pertinent literature. Specifically, the literature review provides a synopsis of relevant academic theories, academic empirical research, and literatures of practice related to the public policy process, organizational performance, and construction project management.

Research methodology is described in the third chapter. This chapter explains and argues for a case study research design, including data collection steps via semi-structured interviews, as well as observations of processes and artifacts. More, this chapter explains the policy analysis approach to determine a recommendation. The methodology concludes with ethical considerations: human subjects and conflicts of interest.

Results are found in the fourth chapter. Here, this thesis presents three hypothetical generalizable scenarios of cross-departmental coordinated project, given specific scopes of work: (a) a typical repaving project in a low-density arterial; (b) a transportation project with moderate magnitude; and (c) a high-profile megaproject. Finally, the results chapter ends with a detailed description of the project delivery production systems between Seattle Public Utilities and the Seattle Department of Transportation.

The fifth chapter is the discussion of the thesis. This chapter scrutinizes the two agencies' varying policy drivers and production systems. Thereafter, the discussion reports a policy analysis that examines (a) the status quo; (b) lean implementation; (c) embedded utility planning within transportation; and (d) reorganization. The policy analysis recommends that the City of Seattle pursue (b) lean implementation.

The sixth and final chapter summarizes the thesis and recounts thoughts on this research's contributions and implications. Afterwards, a bibliography and appendices are available for reference.

Chapter 2: Literature Review

This literature review serves as an intellectual foundation for this study, providing an overview of theories and empirical research from peer-reviewed sources, as well as literatures of practice. This chapter delivers a broad survey of existing research in the topics of (a) organizational management; (b) public works project delivery; (c) project partnerships; (d) City of Seattle interagency business; and (e) project management methodologies.

This chapter does not serve as a comprehensive review of literature pertaining to project delivery or intergovernmental relations. Rather, this literature review focuses on select works that are pertinent to this thesis' problem statement and research questions: namely, organizational management, lean production systems, and project delivery. This literature review's scope aligns with this thesis' function as a hybrid of academic and applied research.

An interdisciplinary lens from public policy processes, organizational performance, and project management provides a distinctive knowledge base for this study, enabling a lens that can best contribute to the City of Seattle's schedule performance matters.

2.1 Theory

From 'public administration' to 'public service'

Historically, management scholars have understood the civil service to be objective third-parties whom implement the intent of their elected leadership – and their elected leadership solely, disregarding the influence of bureaucrats and clientele (Denhardt and Denhardt 2000, 550–52). This framework, coined as 'old public administration,' is dismissive of the discretion that street-level bureaucrats and their managers possess (Denhardt and Denhardt 2000, 550–52), which is critical to delivering desired outcomes in the implementation of public policy. In addition, this 'old public administration' worldview neglects the role of community involvement

and grassroots democracy, as it delineates elected officials as the sole decision-maker in the policy process (Denhardt and Denhardt 2000, 550–52).

This thinking began changing towards the end of the last century towards a "new public management," which drew neoliberal values towards efficiency and customer service (Denhardt and Denhardt 2000, 551–52). This was driven by a belief that "government should be run like a business." This paradigm shift involved a focus on performance, outcomes, and overall efficiency. Management scholars and practitioners are quickly learning that private sector management isn't necessarily transferrable to the business of government, as market forces only produce efficient outcomes when (a) operations impose no costs or benefits to anyone but the producer and consumer; (b) there are little or no costs to enter the marketplace as a producer or consumer; (c) there are plenty of producers and consumers in the marketplace; and (d) producers and consumers have all the necessary information to make rational decisions (Perloff 2009, 35–36).

Today, 'new public management' is further transforming into 'new public service.' Where 'new public management' relies on the inherent profit-drivers of private enterprise – namely, self-interested decision-making – 'new public service' recognizes that government must operate for the broader, collective interest (Durant 2014). "New public service" is cognizant of competing interests within government, such as goals related to social equity, environmental sustainability, and service quality – goals and interests that aren't necessarily consistent with profit-drivers, and therefore, are not efficiently guided by market forces.

Both 'new public administration' and 'new public service' frameworks align with generally accepted practices in successfully managing organizational performance: (a) aligning the organization towards customers and the provisions of service (Miller 2006, ix); (b) deliberate

performance measurement and accountability (Behn 2014, 45–58); and (c) driving management along values and a quadruple-bottom line: economic, social, environmental, and cultural outcomes (Moore 2000, 197–202; Willard 2012, 4).

These broad public service frameworks should be at the core of any agency's governing philosophy. This study contends that any management system that isn't geared towards customer service, nor is rooted in the public interest, is likely ineffective in the increasingly complex business of government. In this research, analyses are informed by Seattle Public Utilities and Seattle Department of Transportation's alignments and deviations from 'old public administration,' 'new public management,' and 'new public service.'

Based on discussions with engineering and project delivery staff at Seattle Public Utilities, there appears to be consensus that the Architecture, Engineering, and Construction industry relies on adversarial relationships. This is aligned with private-sector competition that drives innovation, performance, and guiding costs to a market equilibrium where the producer and consumer can both maximize their benefits from each transaction (Perloff 2009). If the competitive nature of the industry is transposed upon Seattle Public Utilities and the Seattle Department of Transportation, that would align with a 'new public management' framework. That may be problematic, given the sheer magnitude of partnership projects, where self-interested behaviors in one agency likely comes at the expense of the other. At the end of the day, Seattle Public Utilities' ratepayer is likely the same person as the Seattle Department of Transportation's taxpayer. A 'new public service' mindset, on the other hand, may take the form of the two agencies working in harmony, where they may settle disputes based on outputs and outcomes to constituents, rather than competitive attitudes.

Mental models

As ‘new public service’ and its preceding worldviews have provided this study with frameworks for understanding a public organization’s governing philosophy, ‘mental models’ serve a similar purpose for understanding the worldview of individuals. ‘Mental models’ are defined as deeply held beliefs of how the world works (Senge 1998, chap. 10) – notions, biases, and dispositions that individuals hold – either consciously or unknowingly. These ‘mental models’ can be as simple as “people cannot be trusted,” or as complex as the calculus that underlies supply-and-demand.

Peter Senge, a systems scientist at the MIT Sloan School of Management, argues that ‘mental models’ are critical to an organization’s ability to deliver results, since they fundamentally shape how staff and teams perform their work. As ‘mental models’ influences and drives employees’ day-to-day efforts, Senge contends that “the inertia of deeply entrenched mental models can overwhelm the best systemic insights” (Senge 1998, chap. 10). Senge notes that mental models – if powerful enough – have been shown to surpass the intuition of the best management intentions (Senge 1998, chap. 10).

This research intends to discern the mental models of City of Seattle staff, with regard to utility capital improvements in transportation construction projects. Understanding the preconceived notions of Seattle Public Utilities staff, especially as it pertains to the Seattle Department of Transportation, may be critical to uncovering successful practices, as well as opportunities for improvement, in the context of cross-departmental project delivery.

Any mental models held by staff from Seattle Public Utilities and the Seattle Department of Transportation may reinforce philosophies that are not aligned with ‘new public service,’ or other worldviews that may not be beneficial to schedule performance in these interagency

projects. Mental models may also do the opposite: positive mental models may underlie staff motivation, ethics, and values, which may support better performance and outcomes.

Ambiguity and complexity in public sector decision-making

Civil infrastructure – and related affairs in policy, planning, engineering, and more – are inherently complex. In Nikolaos Zahariadis' "Ambiguity and Multiple Streams," he offers a lens to analyze complexity and ambiguity within the public policy process (2014.) To do so, Zahariadis offers the 'Multipule Streams Framework,' which deliniates five elements of the policy process: problems, politics, policies, policy windows, and policy entrepeneurs (Zahariadis 2014, 31).

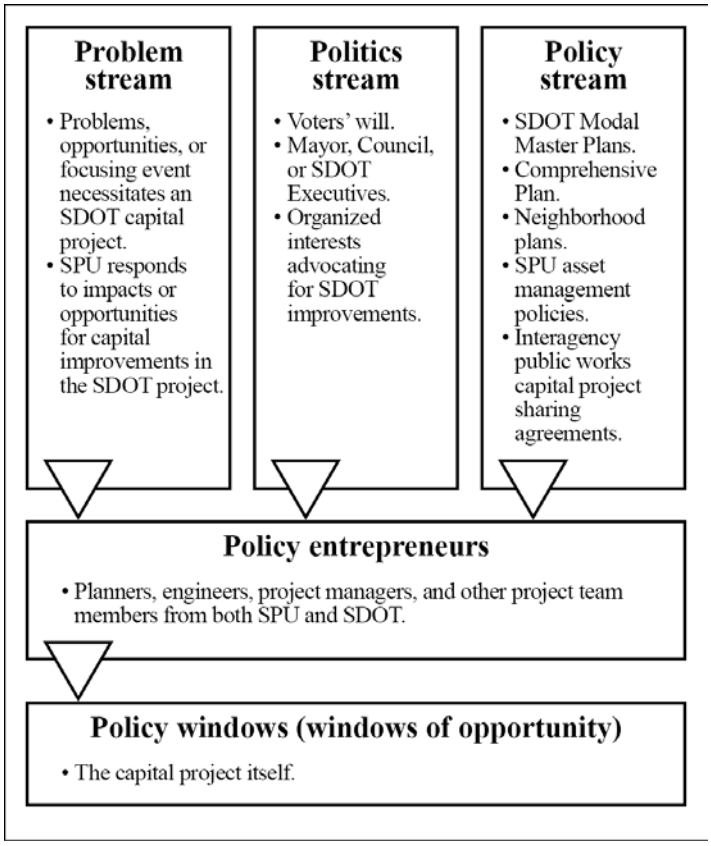

Figure 2. The "Multiple Streams Framework" applied to this thesis' context of interagency project delivery (Zahariadis 2014).

The five elements of the 'Multiple Streams Framework' refer to specific pressures from the public, bureacrats, policymakers, academics, technocrats, and other major stakehodlers. Together, this allows us to critically analyze how variying interests utilize 'windows of opportunity' in order to deliver policy outcomes (Zahariadis 2014, 36–40).

While the Zahariadis' unit of analysis ecompasses the entire policy system, I believe the "Multiple Streams Framework" can be transposed onto

Seattle Public Utilties' response to Seattle Department of Transportation capital projects. Zaharadis' work provides strucutral means for examining how technical, political, and bureacratic interests develop complex transportation projects – and in turn, how those interests shape the water, sewer, and drainage scope derived from the transportation project's impacts and opportunities.

Zaharadis' 'Multiple Streams Framework' stems from Cohen, March, and Olsen's 1972 article on "A Garbage Can Model of Oragnizational Choice." Cohen, et al.'s article provides another dissection on how the policy process operates within chaotic conditions (Cohen, March, and Olsen 1972, 3–4). Through the policy, politics, and problem streams, Cohen, et al. argues that problems are thrown into the policymaking 'garbage can,' where Zaharadis' streams are joined with these additional streams: public opinion, interest groups, and other policy stakeholders.

In the 'garbage can,' the various influencing streams throw problems and solutions back-and-forth, illustrating the true disorganizaiton and messiness of the policy process. At various points inside the garbage can, actors – like elected officials, bureacurats, and lobbyists – may attempt to solve a problem using oversight or accoutnability measures. Other times, these actors may disregard a problem all together, throwing it back into the garbage can's free-

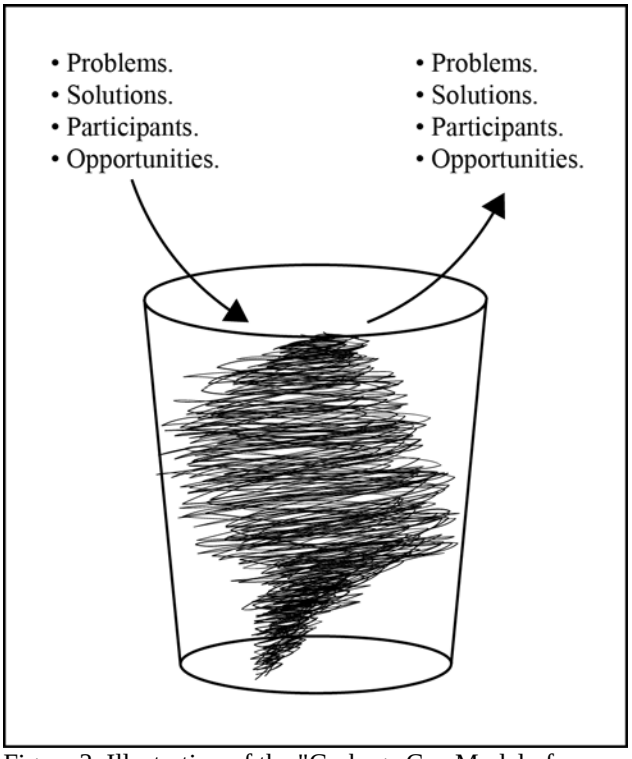

Figure 3. Illustration of the "Garbage Can Model of Organizational Choice" (Cohen, March, and Olsen 1972).

for-all (Cohen, March, and Olsen 1972, 16). Cohen, March, and Olsen note that these lackluster policy solutions aren't just due to the chaos of the 'garbage can,' but also due in part to individual actors' limited time and energy – especially considering the fast-paced demands of the United States Capitol, or even Seattle City Hall.

Cohen, March, and Olsen contend that this garbage can model is a useful means of understanding "the systemic interrelatedness of organizational phenomena" (Cohen, March, and Olsen 1972, 16). It is obvious that this model is not particularly effective at solving problems, but rather, it allows organizations to confront issues in the face of heavy workloads, as well as conflicting stakeholder interests (Cohen, March, and Olsen 1972, 16).

This framework is an excellent means of understanding the relationship of Seattle Public Utilities and their partnerships with the Seattle Department of Transportation: two agencies with intertwined physical assets, competing interests, and overlapping groups of decisionmakers and stakeholders. This study discerns points of friction within the two organizations' interrelated work, and may put forth reccomendations based on a understanding of this garbage can model.

Many complex matters that arise during project delivery – engineering, finance, real estate, human resources, and more – require negotiation and consensus from both agencies. Examples include cost sharing for community relations expenditures, as well as any operations and maintenance responsiblities of individual assets post-commissioning. Cohen, March, and Olsen's framework allows this thesis to critically analyze the obscure and convulted nature of the policy process as it involves Seattle Public Utilities and the Seattle Department of Transportation's multimillion-dollar partnerships.

Production systems and lean

While Zaharadis and Cohen, March, and Olsen provide useful analytical structures for understanding organizational choice, Miller's *We Don't Make Widgets* provides a way to analyze and improve the inputs, outputs, and outcomes of public organizations. Miller notes that many people hold the mental model that governments "don't make widgets," "don't have customers," and "don't make profits" (Miller 2006, vii). Under those assumptions, people may assume that government cannot be managed for efficiency, effectiveness, and customer service – painting a picture of an inherently ill-performing public sector.

Miller counters this narrative, contending that "government will radically improve" if public servants (a) acknowledge that government creates 'widgets,' or measurable deliverables; (b) approach the work from the framework of a factory production system, and use strategies from the manufacturing industry to improve the delivery of public services; (c) recognize that governments have 'customers,' and that customer satisfaction is key to the success of public servants in a mission-driven organization; and (d) become aware of our responsibility to deliver a 'return on investment' to our owners and shareholders: our constituents, citizens, and communities (Miller 2006, vii).

Miller describes an 'old public administration' worldview that fails to acknowledge the value and opportunity of well-run production systems, excellent customer service, and sustained profits (Miller 2006, 6). Miller argues that this outdated mental model provides little incentive to improve, since these worldviews engrain the public sector as an inherently inefficient enterprise. Miller says that the failure of public servants to recognize widgets, customers, and profits have resulted in "wildly ineffective improvement initiatives" (Miller 2006, 12). Among these failed measures are (a) blue-ribbon commissions; (b) politicians and managers who are dedicated to the

status quo; (c) arbitrary reorganizations that deliver no real value; (d) focus on individuals, and not outcomes; and (e) technology improvements that are not linked to performance (Miller 2006, 12–16).

Miller qualifies that he does not necessarily believe that government should be "run as a business," rather, he proposes that managers should approach public service as a 'system of work' where production processes can be analyzed and improved (Miller 2006, 38). This is largely consistent with 'new public service' and its rebuke of 'old public administration' and 'new public management,' as a production system worldview focuses on how an organization can provide deliverables to their customer with efficiency and quality. This is contrasted to 'old public administration,' where bureaucrats are done as their told. This is also dissimilar to 'new public management,' as the metrics of performance aren't just productivity and cost-effectiveness – rather, they include outputs, outcomes, and quality.

Under Miller's 'production system' framework, public servants can identify concrete opportunities to improve a process, and therefore, deliver better results for the customer. Ultimately, the sum of many small process improvements can add up to materially improve outcomes for citizens, constituents, and communities. Specifically, Miller's production system involves four linear items that drive program operations: the factory, widget, customers, and outcomes (Miller 2006, 31). As described in the previous chapter, Ken Miller's 2006 book, *We Don't Make Widgets*, translates those four linear items as the "How?, What?, Who?, and Why?" of a particular operation (Miller 2006, 31). His example of a food stamp distribution production system is shown below in Figure 4 below.

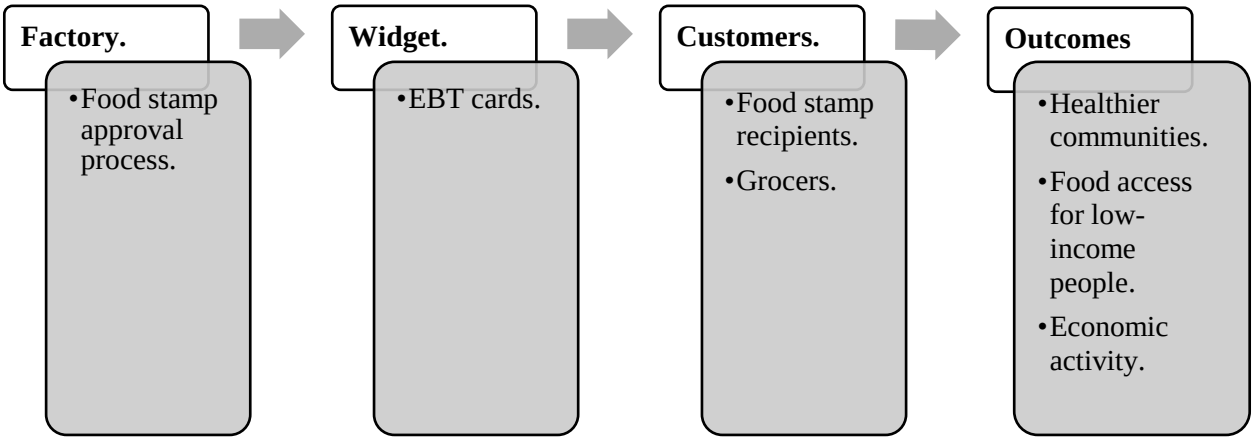

Figure 4. Example of a production system in the distribution of food stamps. Adopted from "System of Work for Food Stamp Distribution," *We Don't Make Widgets*, by Ken Miller. (Washington: Governing, 2006.), 29.

Miller's production framework ties in nicely with 'lean production' and 'concurrent engineering' principles. This is defined by Russel M. Linden – in his book, *Seamless Government* – as a system of operating procedures, where the 'production process' takes advantage of every team member's input in order to improve each step of delivery in the process, with a particular focus on eliminating procedures that waste time, effort, or money (Linden 1994, 76).

Lean production was originally created by Toyota for automobile manufacturing in 1937, though many principles of continuous improvement has existed prior to that date (Shah and Ward 2007, 787). Lean production empowers every worker to stop the production line in order to make improvements and eliminate practices that an individual has deemed wasteful (Linden 1994, 78). If one individual's improvement was successful, they were slowly implemented at a larger scale. Failure is nonetheless encouraged, as these experiences provides valuable institutional knowledge. In this continuous improvement approach, the risk of failure is minimized as compared to top-down initiatives, where executives push widespread initiatives across an organization, which has a much higher risk associated with failure, as that may affect

numerous points in the production system. Lean production, in contrast to a typical top-down approach, capitalizes on the expertise of lower-level staff who know the process more intimately than executives, giving all employees the authority, ownership, and freedom to solve problems creatively.

Russel M. Linden's 1994 book, *Seamless Government*, features a chapter on "Principles of Reengineering," where he delves into what is commonly known as 'lean' production. In this chapter, Linden suggests that lean implementation entails (a) organizing systems of work to focus on outcomes – outcomes to the customer, product, or process; (b) finding opportunities for work to be performed concurrently; (c) sharing information from the ends of the production process; (d) avoiding redundancy in communications; and (f) ensuring a continuous flow of work (Linden 1994, 80).

Specifically, Linden describes the following aspects as "Principles of Lean Production:"

- Use just-in-time methods throughout the assembly process, so that [widgets] are "pulled" through the line when needed rather than "pushed" through by predetermined production goals.
- Ensure continuous flow processing by locating related processes close to each other, using a simple plant layout, and processing [widgets] one at a time rather than in large lots.
- The goal is to reduce time from conception to consumption–eliminate idle time at every step of the [production system.]
- Foster close, synchronized, long-term relationships with a small number of suppliers, who are viewed as partners in the enterprise; assign whole components […] to them, not parts of the product.
- In manufacturing, use small production runs, quick product changeovers, small inventories, parts located in close proximity, and a simple plant layout. […]
- Organize around self-contained, multifunctional, self-scheduling teams of workers empowered to perform the key activities, make the key decisions, stop the line, and find defects.
- Treat information as the key variable: it must be exchanged in real time, face-to-face and electronically, with workers, suppliers, retailers, and customers.
- Use "stretch objectives," challenges so great they require totally new ways of thinking and organizing, in order to break down walls between departments and functions (Linden 1994, 78).

Seattle Public Utilities and Seattle Department of Transportation are two distinct agencies with separate production systems for 'widgets' that make up a capital project: widgets like scope statements, contract drawings, project management plans, and more. Examining how these widgets and the interconnected flow-of-information between departments may provide critical clues on how wasted time can be eliminated to improve schedule performance. The broader framework – empowered workers, smooth production systems, and continuous flow of work – provides bases for recommendations as to improve interagency project delivery. Moreover, Linden's principle regarding "long-term relationships with […] suppliers, who are viewed as partners in the enterprise" provides a critical nexus to mental models theory (Linden 1994, 78).

Local cases that demonstrate successful implementation of lean production are available below, in Section 2.2 pertaining to Empirical Research.

2.2 Empirical Research

Example cases of lean production implementation

The following examples of successful lean implementation are not empirically-tested claims, nor are they sourced from peer-reviewed literature. Rather, these cases serve as illustrative examples of lean's potential, especially in the context of public and nonprofit organizations in the Seattle area.

Case: Virginia Mason Medical Center

Virginia Mason Medical Center – a nonprofit hospital and research institute in Seattle – is a well-known example of effective lean implementation. This case is also credited as the first instance where a non-manufacturing organization has adopted lean production. In a 2016 presentation by Sarah Patterson – Virginia Mason's Executive Vice President and Chief Operating Officer – to the course *Managing Organizational Performance* at the Evans School of

Policy and Governance, she explained how Linden's five principles applied to her healthcare organization:

1. The patient is always first.
2. Focus on the highest quality and safety.
3. Engage all employees.
4. Strive for the highest satisfaction.
5. Maintain a successful economic enterprise (Patterson 2016).

Virginia Mason implemented lean in 2002, as the organization underwent a significant restructure to address financial losses and fading staff morale (Wang 2014; Patterson 2016). This transformation shifted production processes from doctor-driven to patient-focused. As the hospital improved their workflows and eliminated waste, Virginia Mason saw improved profits, safety, and patient satisfaction (Patterson 2016; Virginia Mason, n.d.). While these performance improvements may not be wholly due to lean, Patterson believes that lean deserves sizable credit for reshaping Virginia Mason from its struggling condition to a high-performing enterprise.

Case: Kitsap County Department of Community Development

Similar to Virginia Mason, Kitsap County's Department of Community Development was able to deliver results by implementing lean production into their single-family home permitting process. A manager, an inspector, and a recently retired director also presented their case to *Managing Organizational Performance* in 2016 (Rice, Roberts, and Keeton 2016). Faced with layoffs from the Great Recession, the Department of Community Development undertook lean implementation, including a forty-hour effort with all staff to analyze wasteful practices in the permitting process (Rice, Roberts, and Keeton 2016).

As a result of lean implementation workshops and ongoing process improvements, the Department of Community Development was able to process 33% more permits in 2015 with 30% less staff (Rice, Roberts, and Keeton 2016). In addition, a survey of staff members showed

that 95% of employees agreed that lean improvements were 'working' in their department (Rice, Roberts, and Keeton 2016). These improvements delivered a 15-day average timeframe for acquiring a single-family home construction permit, compared to a pre-recession average of 30 days: a two-fold improvement in schedule performance. A survey of developers – the Department of Community Development's customers – also showed a sizable increase of customer satisfaction (Rice, Roberts, and Keeton 2016).

Case: King County

Like Virginia Mason and Kitsap County, the Office of Performance, Strategy, and Budget (PSB) within the King County Office of the Executive is implementing lean production across the regional government. Michael Jacobsen, the Deputy Director of PSB, also shared his insights with 2016's *Managing Organizational Performance* course.

King County began exploring continuous improvement in 2002, when Governing Magazine awarded King County with a 'C' grade for 'managing for results' (Jacobsen 2015). Since then – through three different County Executives – PSB adopted strategic plans, lines-of-business frameworks, and performance measurement metrics across their jurisdiction (Jacobsen 2015). King County started implementing lean in the early 2010s, and has since delivered:

- *Improvements in the psychiatric observation of jail inmates.* Quicker and more accurate patient evaluations have reduced the number of inmates needing psychiatric check-ins every 15-mintues. Prior to lean, approximately 70 inmates required frequent checks at any given day. Today, that number stands at five.
- *Providing more coverage and care at Public Health centers.* Lean allowed Public Health-Seattle & King County to improve patient, doctor, and nurse scheduling. This delivered increased capacity to provide medical care to people facing

homelessness, low-income pregnant women, and at-risk families. Lean improvements also doubled the number of people able to enroll in Medicaid.

- *Faster elections operations.* Through lean implementation, King County Elections was able to speed ballot counting, save US$2 million, and maintain the same level of accuracy.
- *Reducing spare parts inventory for buses.* King County Metro Transit, through lean implementation, developed data-based formulas for determining the demand of spare parts for bus maintenance. Inventory was reduced by thirty percent, and savings were reallocated to provide more service hours (King County, n.d.).
- *Speeding-up project delivery by two years.* Especially pertinent to this thesis, King County Wastewater Treatment Division implemented lean into their capital project processes, including initiation, permitting, and property acquisition. Since capital projects do not provide benefits until completion, ratepayers benefit by realizing their returns-on-investment two years earlier (King County 2016).

Management literature and local applications clearly demonstrate the value of analyzing production systems – especially with the framework of lean production. This research grounds methods and discussion on how the City of Seattle's utility and mobility departments are aligning with, or deviating from, the concepts and practices discussed above. In understanding and scrutinizing the production system of utility scope in transportation capital projects, the literatures of Linden and Miller – as well as the cases from Virginia Mason, Kitsap County, and King County – is paramount to defending this thesis' recommendations.

Understanding megaprojects

Similar to Zahariadis' previously discussed theory regarding the 'multipule streams framework,' Bent Flyvbjerg's research uses "four sublimes" to illustrate the interests and processes as to how megaprojects are planned and delivered. These four sublimes are: technology, politics, economics, and aesthetics (Flyvbjerg 2014). Flyvbjerg defines a 'megaproject' as an infrastructure project that (a) has a total cost exceeding one billion dollars; (b) takes multiple years to plan and deliver; (c) involves several cross-sector stakeholders; and (d) impacts millions of people.

Based on performance data of megaprojects across the globe, Flyvbjerg claims that nine of every ten megaprojects will experience cost overruns, with a budget variance of fifty percent being common (Flyvbjerg 2014, 9–10). This claim is consistent with popular anecdotes from Boston's *Big Dig*, New York's *Water Tunnel #3*, Seattle's *Big Bertha*, among other high-profile megaprojects. Despite the hefty risk, Flyvbjerg's research explains why these endeavors are still pursued by governments across the globe.

Flyvbjerg argues that planners, engineers, architects, and other technocrats are drawn to the ambitous and monumental nature of megaprojects. As individual professionals, their work on high-profile projects may be beneficial for their résumés, while placing the blame for underperformance on the overarching systemic issue. This desire from technocrats to work on megaprojects is what Flyvbjerg describes as the 'technological sublime' (Flyvbjerg 2014, 8–9). Meanwhile, politicians who endorse megaprojects are awarded with media attention, as well as bragging rights for creating jobs, new infrastructure, and decades-long economic acitivity (Flyvbjerg 2014, 9). This is defined as the 'political sublime.' The 'economic sublime,' on the other hand, rests with companies who are eager to work on megaprojects: firms in engineering,

planning, public relations, law, among others. These industries can reap enormous profits from large projects (Flyvbjerg 2014, 9). Further benefits to for-profit enterprises include valuable experience for their staff members, as well as a boost to their public image. Flyvbjerg's final pillar is the 'aesthetic sublime,' which drives designers and community members to support megaprojects for their iconic value, rather than merit. Examples include San Francisco's *Golden Gate Bridge*, Sydney's *Opera House*, and even Seattle's *Big Bertha* (Flyvbjerg 2014, 9).

Flyvbjerg's article takes a global worldview. As such, none of Seattle Public Utilities' partnership projects with the Seattle Department of Transportation classify as megaprojects under Flybjerg's definitions. This is espeically true, as Flyvbjerg's definition of a megaproject requires that the project impacts one million people is difficult to achieve in a city of 700,000 residents. Despite that, Flyvbjerg's work is still useful to this project, as some projects analzyed in this study may be considered 'megaprojects' in the local context – projects like the Center City Connector Streetcar project, as well as Waterfront Seattle. These examples may be driven by Flyvbjerg's four sublimes. As this research examines three high-cost, high-risk, and high-visibility projects in Seattle, Flyvbjerg's sublimes is important to understanding the policy interests that drive planning, design, and construction.

Moreover, Flyvbjerg's methods and data analysis of major public works projects is useful to the research design of this thesis. Not only did Flyvbjerg examine key performance indicators – scope, schedule, and budget – he also examined the qualitative phenomena pertaining to social, political, and economic drivers.

The role of trust project partnerships

As this chapter explores the benefits of project partnering, the following section shines light on what drives a successful project partnership: namely, trust.

In 2017, researchers from Michigan State University synthesized 172 publications on project partnering in the Architecture, Engineering, and Construction industry. Their article from the *Journal of Management in Engineering* defines 'project partnering' as "a long-term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources" (Sparkling, Mollaoglu, and Kirca 2017, 04016033-1). Furthermore, Pertti Lahdenperä – in his 2012 article regarding project partnership – defines two distinct flavors of project partnership: 'project alliancing' and 'integrated project delivery' (Lahdenperä 2012).

Lahdenperä explains 'project alliancing' as a project delivery method where all team members – owner and non-owners alike – "work together in good faith, acting with integrity and making unanimous, best-for- project decisions, managing all risks of project delivery jointly, and sharing the outcome of the project" (Lahdenperä 2012, 58). On the other hand, Lahdenperä distinguishes 'integrated project delivery' as a partnership risks and rewards are contractually shared between all key stakeholders – such as the owner, designer, and builder. (Lahdenperä 2012, 58).

In both works by Lahdenperä and Sparkling, et al., the authors note that successful project partnerships may require trust between all parties involved, where trust is "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" (Laan et al. 2011, 99). The following two cases illustrate the role of trust in project partnering.

Case: design-build partnership for a rail project in the Netherlands

In a 2011 case study published in the *Journal of Purchasing and Supply Management*, Laan et al. provides clues on the creation and preservation of a trusting relationship for parties in

a design-build partnership (Laan et al. 2011). In this case study, a Dutch rail agency and three construction firms executed a design-build contract. Together, these parties delivered US$49 million worth of multimodal improvements in a medium-sized city (Laan et al. 2011, 103).

Design-build contracts differ from traditional bid-build contracting, where contractors are incentivized to bid the lowest possible cost in order to win the contract award. This results in "opportunistic, mistake-hiding, quality-shirking, extra work-claiming strategies," where contractors seek opportunities to file claims against their clients for omitted designs, specifications, and conditions that impede on their ability to complete contractual work (Laan et al. 2011, 103). Since the risks and interests of the client and contractor are conflicting, this status-quo relies on adversarial relationships.

In Laan et al.'s case, employees from both client and contractor noted that these trustworthy dynamics did not come naturally in the construction industry (Laan et al. 2011, 104). The slow development of trust forced team members to 'unlearn' competitive mental models, and reciprocate transparency, honesty, and trust between each party in order to maintain positive relationships (Laan et al. 2011, 105).

Case: impact of relationship history on successful project partnering.

As Laan et al. examined trust for one rail project in the Netherlands, Crespin-Mazet et al. analyzes the impact of previous client-contractor relationships as a variable in partnership success. Their case entails the construction of a Swedish cancer clinic featuring the first proton therapy facilities in the Nordic countries. Altogether, this project totaled US$104 million for construction and procurement of medical equipment (Crespin-Mazet, Havenvid, and Linné 2015, 8–9). Due to the large scope and complexity of this project – as well as a tight schedule – the owner decided to use a design-build contracting approach for the first time.

Crespin-Mazet et al. explained that despite this being the first design-build arrangement at the clinic, the client has had twenty years of experience working with their chosen contractor via traditional design-bid-build contracts (Crespin-Mazet, Havenvid, and Linné 2015). Through prior investments, the client and contractor have coordinated routines, implemented new solutions, and pursued other process synergies between the two organizations (Crespin-Mazet, Havenvid, and Linné 2015, 12). The client decided to enter a partnership because they knew that the two parties had complementary resources, which they perceived to be advantageous in this technically-challenging project (Crespin-Mazet, Havenvid, and Linné 2015, 12).

Once the project was completed, Crespin-Mazet et al. notes that the client can reflect on performance, savings, and coordination in a specific partnership, and over time, continue partnering with the same firm to build ‘economies of scale’ (Crespin-Mazet, Havenvid, and Linné 2015, 12).

Through the examination of mental models, this study looks at the role of trust between the City of Seattle’s utility and mobility departments over time. Though the preceding research from Laan et al. and Crespin-Mazet et al. focus on public-private partnerships, their insights can

still be useful in this interagency context, where the Seattle Department of Transportation can be portrayed as a de facto design-builder of Seattle Public Utilities scope.

Trust as a psychological construct is also closely related to mental models. The aforementioned literatures mention an adversarial state of affairs within the construction industry, creating seemingly inherent distrust within partnerships. The discussion on trust may provide insights as to how the two agencies perceive that their interests are consistent across departmental lines, and whether that affects the performance of project planning and delivery.

2.3 Literatures of Practice

Interagency agreements

Tri-Party MOA

In 2016, Seattle Public Utilities, Seattle Department of Transportation, and Seattle City Light executed a memorandum of agreement for "Public Asset Protection and Cost Sharing for Public Works Projects" (City of Seattle 2016). This agreement, known internally as the "Tri-Party MOA," memorializes principles for design and cost sharing for any department's wishing to deliver scope via another's capital project (City of Seattle 2016, 1). The Tri-Party MOA also outlines processes for how each department protects each other's assets, as well as how the three departments coordinates work across agency lines (City of Seattle 2016, 1). Specifically, the intent of the agreement is for…

> …each department to maintain quality in their constructed projects as well as to ensure the protection of all existing assets belonging to the other departments during the construction of Public Works Projects. The departments are also seeking to establish a consistent policy basis and process for allocating costs related to design and construction of Public Works Projects to improve the efficiency and predictability of project development and budgeting (City of Seattle 2016, 1).

When developing new capital projects, the Tri-Party MOA instructs all departments to find the "least-cost option or best value alternative that minimizes the total lifecycle cost to the public, regardless of which department initiates the project and which department is impacted…" (City of Seattle 2016, 2). During initial scoping of a particular project, the agreement allows other departments to participate in the lead department's initiation process, without reimbursement from the lead department (City of Seattle 2016, 2).

Further on, if one department pursues capital improvements in another department's project, the Tri-Party MOA states that each department is responsible for costs related to their own assets – even if the leading department's project is responsible for these costs (City of Seattle 2016, 3). For example, a sewer planner can participate in the scoping of a new electric substation. This sewer planner's labor costs from Seattle City Light-related work is still billed to the wastewater fund, rather than the power fund. Further on, if this hypothetical substation happens to restrict maintenance access to a sewer main, Seattle Public Utilities bears the costs for relocating or modifying that sewer – even if Seattle City Light directly imposed this need.

With regard to protecting existing assets of other public works agencies, the leading department is responsible for protecting the existing assets of other departments (City of Seattle 2016, 12–14). In the example of a new substation: if construction demands excavation near a brittle water main, Seattle City Light would have to pay for monitoring to ensure that excessive ground settlement and vibration do not occur.

There are many exceptions to the described cost responsibilities. For example, Seattle Public Utilities and Seattle City Light always pay for pavement in their capital projects, with no reimbursement from the transportation fund (City of Seattle 2016). Also, Seattle City Light publishes a separate policy for cost responsibilities related to street lights (City of Seattle 2016).

The Tri-Party MOA also includes cost-sharing prescriptions for common tasks and scenarios, such as project-wide cost estimating, interdepartmental plan review, construction inspection, and repairs to underground utility castings (City of Seattle 2016).

The Tri-Party MOA provides specific contractual means for delivering interagency public works projects in the City of Seattle. This agreement serves as a key document to understanding the relationship between Seattle Public Utilities and the Seattle Department of Transportation, as this agreement is the policy foundation for the phenomena that this thesis examines. In addition, this agreement begins to paint a picture of the cross-departmental production system.

Project-specific memoranda of agreement

Under the Tri-Party MOA, each individual project must execute an agreement that is specific to its scope of work. These project-level agreements are only between two parties, requiring two separate agreements if one department's project were to include capital improvements from both other departments. In keeping with the substation example, Seattle City Light would have to execute an agreement with both Seattle Public Utilities and the Seattle Department of Transportation if the latter two departments were to pursue capital improvements via their consultants and contracts. These project-specific agreements are necessary, as they provide as the contractual basis for a department to serve as a de facto design-builder for another departments' scope.

Project-specific agreements outline roles and responsibilities. Terms and conditions in these documents reinforce those that were agreed upon in the Tri-Party MOA, while memorializing any terms that were not covered in the larger agreement. Examples of specific terms include those related to public outreach costs, dispute resolution, and duration of the agreement. As the project progresses through its lifecycle, task orders are executed under the

project-specific agreement. Task orders are contractual authorizations to perform a specific scope of work. These documents define deliverables, scope exclusions, and not-to-exceed budgets. Execution of a task order serves as contractual authorization to exchange funds between departments. An illustration of this contractual structure is shown below in Table 1.

Tri-Party MOA *General partnership principles and public works construction responsibilities.* ↓			
Project-specific agreement *Terms, conditions, roles, and responsibilities for a particular project.* ↓			
Task order 1: *Defines design scope. Authorizes payment to lead department for design expenses incurred on impacted department's behalf.*	**Task order 2:** *Defines construction scope. Authorizes payment to lead department for construction expenses incurred on impacted department's behalf.*	**Task order 3:** *Defines agreed share of communications costs. Authorizes payment to lead department for public outreach expenses incurred on impacted department's behalf.*	**Task order 4:** *Defines agreed share of administrative costs. Authorizes payment to lead department for share of administrative costs.*

Table 1. Contractual structure of interagency public works projects at the City of Seattle. Task order titles and quantity are shown as examples only. Actual projects may further breakdown scope-of-work into more task orders.

Move Seattle and SPU Monthly Report

In the 2015 election, Seattle voters approved the largest levy in city history (Seattle Public Utilities 2018, 3). As mentioned in this thesis' introduction, the Transportation Levy to Move Seattle provides $930 million to the Seattle Department of Transportation over ten years. As the city government combines Move Seattle revenue with general fund allocations, federal and local grants, and other funding sources, programmatic spending is expected to exceed one billion dollars (Seattle Public Utilities 2018, 3). This increase in transportation capital investment is driving an increase for Seattle Public Utilities to deliver scope alongside these projects in order

to fulfill the intent of the Tri-Party MOA, as well as to proactively improve their assets via interagency partnerships when it is economically prudent.

To provide an overview of Seattle Public Utilities' response to increased construction in the municipality's rights-of-way, the organization publishes a monthly report. The audience of the report includes internal team members, as well as managers, executives, and stakeholders inside the city government (Seattle Public Utilities 2018, 3). This report focuses on transportation projects that are driven by the Move Seattle, excluding projects related to Waterfront Seattle and Seattle Streetcar – which are not funded by the 2015 levy.

In the report's introduction, the planning process for Move Seattle projects are explained, and summarized below Figure 5 below. A working group to manage this program is composed of staff from the following organizational units within Seattle Public Utilities:

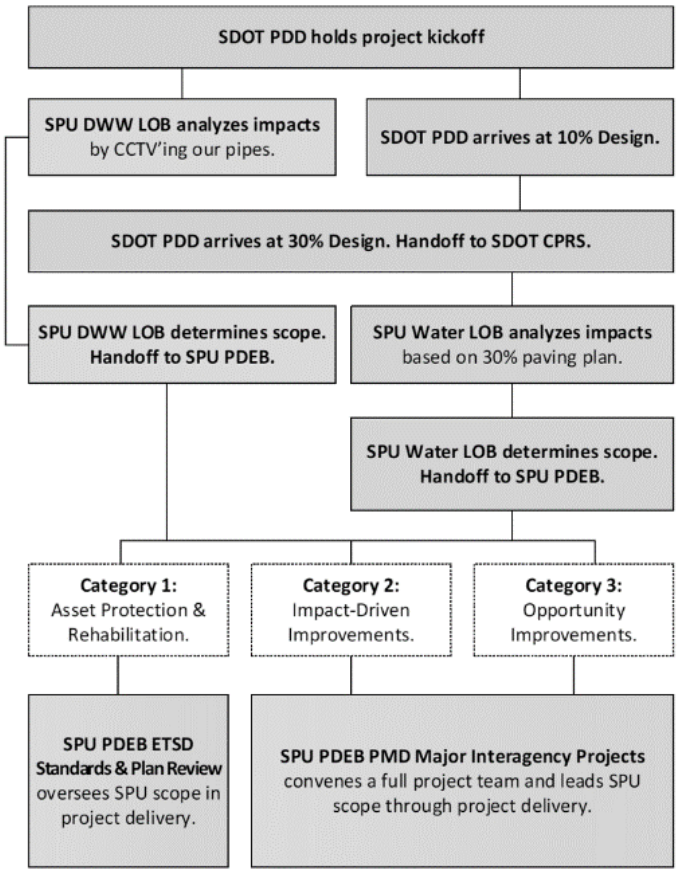

Figure 5. Seattle Public Utilities' planning process for capital improvements in Seattle Department of Transportation projects. From Seattle Public Utilities 2018, 3.

- *Project Delivery and Engineering Branch (PDEB)*. Project managers, project controllers, and engineers participate in the work group.
- *Drinking Water Line of Business (LOB)*. One water system planner participates in the work group.
- *Drainage and Wastewater Line of Business (LOB)*. One sewer system planner participates in the work group (Seattle Public Utilities 2018).

In the body of the report, there is a rundown of each Move Seattle project that are being analyzed for potential improvements to water, sewer, or drainage utilities. As of the March 2018 edition, eleven Move Seattle-funded projects were listed in this initiation phase (Seattle Public Utilities 2018). Also in the report are narratives and performance indicators for projects that are in delivery, which includes the options analysis, design, construction, and closeout phases of the project lifecycle. In the March 2018 report, twelve Move Seattle projects were under options analysis, design, or construction (Seattle Public Utilities 2018).

This report provides a broad overview of the majority of Seattle Public Utilities' partnership projects with the Seattle Department of Transportation, including staff assignments, actual costs, budgets, schedules, and narratives. To delve deeper into *how* Seattle Public Utilities delivers capital projects – rather than *what* – we examine project management methodologies in the following subsection.

Project management methodologies

Industry standard

The Architecture, Engineering, and Construction industry's standard for managing project scope, schedule, budget, quality, and risk are found in *A Guide to the Project Management Body of Knowledge* (PMI 2017), abbreviated as the *PMBOK Guide*. The *PMBOK Guide* – which is currently in its sixth edition – is published by the Project Management Institute (PMI,) the same organization that offers the *Project Management Professional (PMP)* certification.

The *PMBOK Guide* provides a common vocabulary for project managers, as well as 'good practices' for managing individual projects – 'good practices' being defined as means and methods that are generally accepted to increase the chance of success (PMI 2017, chap. 1). To

begin, the *PMBOK Guide* defines a project as "a temporary endeavor undertaken to create a unique product, service, or result" (PMI 2017, chap. 1).

In the introductory chapter, the *PMBOK Guide* discusses the relationship between project management and organizational governance (PMI 2017, chap. 1). Through governance mechanisms, organizations prescribe strategic direction and performance goals for their projects. Strategy includes the prescription of goals, objectives, performance expectations, and any actions to keep the project consistent with overall business objectives (PMI 2017, chap. 1). The *PMBOK Guide* contends that project management work should be aligned with the overall organization's strategic direction, arguing that consistency with the organization's strategy increases the likelihood of a project's success (PMI 2017, chap. 1). Moreover, projects are undertaken in order to support an organization's strategies, so it follows that organizational strategy should not conflict with project goals (PMI 2017, chap. 1).

Further, the *PMBOK Guide* presents an overview of project-based organizations, or organizational structures whose work entails the continual development and delivery of individual projects. Project-based organizational structure may reduce excessive rules and formalities, as success is more likely to be defined by final results in these structures, rather than politics or hierarchy (PMI 2017, chap. 1).

After transitioning from an organizational lens to an individual project-focus, the *PMBOK Guide* considers the role of a project manager to be similar to an orchestra conductor (PMI 2017, chap. 3). As a large project has many distinct roles, a large orchestra is composed of many musicians who play different instruments, who in turn play different parts. In both a project and an orchestra, the leaders are responsible for what the team produces, yet the outcomes have shared ownership across the whole team (PMI 2017, chap. 3). Additionally, the

two leaders are tasked with strategic direction, performance management, and motivating their teams – carrying out the mission and vision of their entire organization (PMI 2017, chap. 3). On top of that, conductors are not likely to know how to play every instrument, yet they are expected to have holistic musical expertise that understands the role of each instrument in a musical work (PMI 2017, chap. 3). Similarly, project managers need not know every discipline in their team, but should understand how the contributions of each team member fulfills project deliverables and outcomes (PMI 2017, chap. 3). Also, both conductors and project managers are responsible for schedule, written communications, and real-time problem solving with their teams (PMI 2017, chap. 3).

For project managers, specifically, the *PMBOK Guide* puts forth three competencies that are required to perform their work: technical project management, strategic and business management, and leadership (PMI 2017, chap. 3). 'Technical project management' refers to skills that are necessary for project managers to hold in order to be successful in their respective industries. For example, permitting is likely to vary depending on the specific field: where a sewer project manager needs different expertise than their petroleum industry counterparts (PMI 2017, chap. 3). The second competency is 'strategic and business management,' which refers to a project manager's ability to align the team's work with an organization's mission, vision, values, and overall strategy (PMI 2017, chap. 3). Finally, the last competency is 'leadership,' which is the ability of a project manager to "to guide, motivate, and direct a team" (PMI 2017, chap. 3). Leadership skills – such as optimism, inspiration, trust, and collaboration – are distinct from management skills (PMI 2017, chap. 3).

The *PMBOK Guide* also contains guidance and tools on how to manage the following aspects of a project:

- *Integration.* How to unify the various processes involved in project management. Tools include project charters, project management plans, among others (PMI 2017, chap. 4).
- *Scope.* Managing scope ensures that all, but no more than, the necessary work is performed (PMI 2017, chap. 5).
- *Schedule.* Managing the timely completion of a project (PMI 2017, chap. 6).
- *Cost.* Estimating, budgeting, and monitoring costs (PMI 2017, chap. 7).
- *Quality.* Defining and meeting the needs of a project, product, or outcome (PMI 2017, chap. 8).
- *Resources.* Identifying, managing, and controlling physical and human resources (PMI 2017, chap. 9).
- *Communications.* Developing widgets, activities, and processes that keep team members and stakeholders informed (PMI 2017, chap. 10).
- *Risk.* Identifying, quantifying, preparing for, and responding to risks (PMI 2017, chap. 11).
- *Procurement.* Acquiring physical products needed for the project, as well as widgets like contracts, permits, purchase orders, among others (PMI 2017, chap. 12).
- *Stakeholders.* Identifying people and organizations that will be affected by the project, and strategies to engage or inform them in the work (PMI 2017, chap. 13).

These elements set the foundational knowledge for the *PMBOK Guide's* "Standard of Project Management" (PMI 2017). Here, the *Guide* synthesizes these generally accepted

practices into a linear process with five phases: initiation, planning, execution, controlling, and closeout (PMI 2017). Throughout these five phases, the *PMBOK Guide* remains cognizant of the relationship between project management and (a) organizational strategy; (b) organizational governance; (c) portfolio management; (d) program management; (e) the project environment; and (f) project success (PMI 2017). This process is shown succinctly in Figure 6 below.

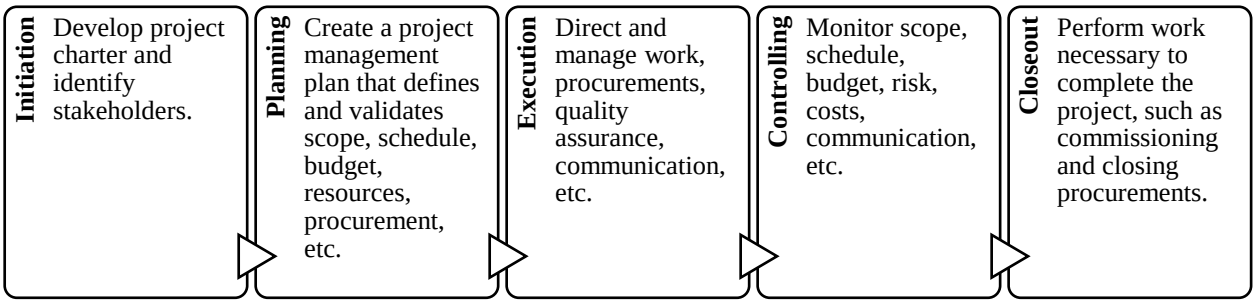

Figure 6. Simplified flowchart of the project management process, per the *PMBOK Guide* (PMI 2017).

Understanding the *Project Management Body of Knowledge* is important, as this *Guide* sets the basis for Seattle Public Utilities' agency-specific project management methodology. Moreover, the Project Management Institute's research into generally accepted practices illustrates a baseline for how the City of Seattle should be managing their billion-dollar array of capital improvement projects. Recommendations for improvements may be informed by any deviations from the *Guide* that are identified through this research's data analysis.

Seattle Public Utilities' methodology

Seattle Public Utilities has adopted their own project management methodology based on the *PMBOK Guide*. This 68-page document, hereto referred as the *Methodology*, sets the organization's vision for project leadership, and is intended to (a) guide project managers and planners; (b) document how the organization manages projects, including specific tools and

processes; and (c) refresh current staff and orient new staff to norms and expectations (Seattle Public Utilities 2017, 1).

In discussing the department's structure, the *Methodology* notes that Seattle Public Utilities divides their three utility services into programs, or lines of business: drinking water, drainage and wastewater, and solid waste (Seattle Public Utilities 2017, 2). Within each program, there is a group of projects that are aligned with the strategic direction of the organization (Seattle Public Utilities 2017, 2). The 'Project Delivery and Engineering Branch' serves as a de facto design-builder for the lines of business, with the lines of business staff being responsible for program management of their respective utility service. Together, staff from these organizational units work in teams to deliver capital projects (Seattle Public Utilities 2017, 2). The *Methodology* notes that on occasion, capital projects may be delivered by other City of Seattle departments, such as Seattle Information Technology or the Department of Finance and Administrative Services (Seattle Public Utilities 2017, 2).

The *Methodology* prescribes a five-phase lifecycle for Seattle Public Utilities' capital projects – similar to the *PMBOK Guide*. These phases are initiation, options analysis, design, construction, and closeout. Project managers are responsible for executing the *Methodology*, which entails (a) communicating with team members, management, and the community; (b) acquiring any necessary permits and property rights; (c) acquiring, leading, and controlling the team; (d) executing consultant contracts and memoranda of agreement; and (e) managing the scope, schedule, and budget approved under the governance process (Seattle Public Utilities 2017, 3).

The governance process involves acquiring approval from the 'Asset Management Committee,' which is comprised of the agency's Chief Executive Officer and their direct reports. The governance process is roughly aligned with the *Methodology's* five phases:

1. *Initiation.* A planner from one of the lines of business identifies a problem or opportunity that aligns with the organization's strategic plan. After consulting with subject-matter experts and project managers as necessary, the planner presents their case to the Asset Management Committee for approval to conduct options analysis (Seattle Public Utilities 2017, 4).
2. *Options Analysis.* Once initiation is approved by the Asset Management Committee, a project manager is assigned from the Project Delivery and Engineering Branch. With the planner, they assemble a project team of engineers, economists, and subject-matter experts. Tasks may include site evaluations, surveying, and geotechnical work. Options to address the project need are crafted and analyzed by the team. They produce a business case with economic, technical, and policy considerations are presented to the Asset Management Committee, who ultimately selects an option that sets the basis for design (Seattle Public Utilities 2017, 4).
3. *Design.* With the Asset Management Committee's direction, designs are developed along 30%, 60%, 90%, and 100% completion milestones. These are defined by checklists in Seattle Public Utilities' *Design Standards and Guidelines*. After cost and constructability estimates, the Asset Management Committee decides whether to advertise the designs in order to solicit bids from construction contractors (Seattle Public Utilities 2017, 4).

4. *Construction.* After working with the citywide contracting office to solicit bids from construction firms, the project team presents the lowest bidder's proposal to the Asset Management Committee for approval. Upon approval, construction begins (Seattle Public Utilities 2017, 4–5).
5. *Closeout.* Once the project is complete, the project manager ensures that as-built drawings are processed, all documentation is obtained, and no possible work is remaining. Once the Asset Management Committee approves closeout, the project fund is retired from the financial system, and artifacts are stored in accordance with the state's public records regulations (Seattle Public Utilities 2017, 6–8).

To guide key activities during these five phases, the *Methodology* instructs project teams to create project management plans. These plans are consistent with the *PMBOK Guide's* recommendations to include (a) project information; (b) goals, objectives, and success criteria; (c) baselines of scope, schedule and budget; (d) strategies for monitoring and controls; (e) change management; (f) quality management; (g) human resources management; (h) communications management; (i) risk management; (j) procurement management; (k) stakeholder management; (l) environmental review and permit acquisition; (m) health and safety; and (n) guidelines for artifacts, like file naming conventions and public records compliance (Seattle Public Utilities 2017, 9). The *Methodology* provides a chapter on each of these elements that outline the agency's relevant processes, as well as norms, expectations, and regulations.

The *Methodology* is an important literature for this research, as it defines Seattle Public Utilities' idealized vision for delivering capital improvements. In the case of partnership projects with the Seattle Department of Transportation, this document is unclear on policies for governing

and managing project work across two agencies. This thesis compares this document to actual findings on project delivery processes: data that is collected from observation and staff interviews, as discussed in the following chapter. The results and recommendations of this study is partially rooted in the *Methodology* as a baseline policy, process, and standard for project management.

Chapter 3: Methodology

This chapter explains theories, principles, and procedures that are used to answer this study's research questions. The following defines this study's sampling, research questions, hypotheses, research questions, ethical considerations related to human subjects research, and the researcher's conflict of interest.

This study examines the broad phenomenon of how Seattle Public Utilities plans and delivers scope within Seattle Department of Transportation capital projects. Specifically, this research focuses on three individual capital projects to corroborate trends. To do so, this research uses a qualitative research design that focuses on a particular space and time. Therefore, conclusions of this thesis are only generalizable to Seattle Public Utilities and the Seattle Department of Transportation in the present circumstances. This thesis' results may not be useful for smaller cities, who may rarely spend more than US$5 million on an individual capital improvement project. This research may be especially limited for private utilities – such as Comcast and Puget Sound Energy – who operate for the profit of their shareholders, under the governance of a private board, and with regulatory burdens well beyond that of a public agency. Despite that, this study provides valuable insights for other developed cities who own utility systems and are experiencing a high quantity of public works construction.

Three cases where Seattle Public Utilities improvements were delivered via the Seattle Department of Transportation's projects were chosen as units of analysis to illustrate project delivery processes at the nexus of utilities and mobility, especially with Seattle's unprecedented boom in civil construction. Moreover, Seattle Public Utilities was chosen since they are more likely to deliver scope via transportation projects, since this agency operates the city's drinking water, sanitary wastewater, and storm drainage systems. This is compared to other municipally-

owned utilities, such as Seattle City Light and Seattle Information Technology, who are only responsible for one infrastructure system.

Seattle Public Utilities was also chosen in this case study since they charge some of the highest drinking water rates in the nation (Walton 2018; Balk 2015). This is an especially salient issue, as the Seattle City Council recently approved increases to Seattle Public Utilities' annual rate escalations. During their deliberations, many stakeholders and policymakers expressed concern about higher utility costs in the midst of deteriorating affordability (City of Seattle 2014). Representatives of Seattle Public Utilities told the Seattle City Council that costs are increasing in part due to the high quantity of right-of-way construction, which inevitably leads to asset protection, rehabilitation, or replacement measures at the expense of the utility's ratepayers – as outlined in the *Tri-Party MOA*. In contrast, this issue is less important to Seattle City Light, since they maintain power rates below the national average, earning the slot of cheapest power rates in 2012 out of the top-25 largest American cities (City of Seattle 2012). Additionally, Seattle City Light invests a smaller amount and proportion funds to these interagency partnership projects: only US$44.16 million, or 5%, of their capital budget is allocated to externally-driven projects in the 2018 fiscal year (City of Seattle 2017, 475–78). This is compared to Seattle Public Utilities' portfolio of partnership projects, which totals to US$108.55 million, or 36% of their capital budget in the same 2018 fiscal year (City of Seattle 2017, 497–502).

3.1 Sampling

To protect the anonymity of this study's participants, this case study research is presented in the next chapter as generalizable scenarios of projects given a particular scope of work. These scenarios are grounded in a selection of three actual projects with Seattle Public Utilities scope that are delivered through the Seattle Department of Transportation, out of a total field of

approximately 30 partnership projects that were planned and designed between 2008 and 2018. All results are presented as hypothetical scenarios, with trends that are corroborated from multiple interviewees and supported by in-house factual documentation. The contents of the scenarios are not based on the opinions of individual study participants.

To gather data on processes, management, and systems, all Seattle Public Utilities staff who are heavily participating in interagency project planning and delivery were invited to semi-structured interviews. 60% of this population participated in this study, or nine staff members out of the fifteen Seattle Public Utilities employees who have been assigned to at least three Seattle Public Utilities projects that was delivered through the Seattle Department of Transportation. Interviews were conducted at the time and place convenient for the subject.

Observation of interagency project delivery is subject to researcher access. All governance documents, design reviews, and agendas are available digitally, and are matters of public record. On the other hand, meetings, workshops, and briefings are restricted to project team members and invited personnel. Any observations of in-person meetings was conducted at the will and convenience of Seattle Public Utilities staff.

To synthesize this data, this research takes the form of a *descriptive* case study. This study describes the phenomenon of inevitable utility work in right-of-way construction, and in particular, work to Seattle Public Utilities' infrastructure in three Seattle Department of Transportation capital projects (Yin 2006; Baxter and Jack 2008). This study focuses on three of these partnership projects, delivering a comprehensive narrative of each project's delivery cycle in the Results chapter. This multiple-case approach allows this study to examine duplicate findings in various projects, where trends and contrasting results may be discovered (Yin 2006; Baxter and Jack 2008).

To further maintain the anonymity of study participants, the names of the specific capital projects that were examined are not disclosed in this thesis. Rather, a broad statement of the transportation scope is provided below. Seattle Public Utilities' scope within these projects are classified into the categories provided by the *Move Seattle and SPU Monthly Report*.

- **No action**. It is possible that one line of business would pursue partnership in a particular transportation project, while the other refrains. I.e. water pursues mainline replacement in a transportation project, while sewer does not engage. These projects are excluded from this thesis, since they do not involve any project delivery coordination from Seattle Public Utilities.
- **Asset protection and rehabilitation.** Projects in this class protect of any assets that may be damaged during construction. Included are replacements of small appurtenances, as needed (like pipe castings, maintenance hole covers, hydrants, etc.) For this work, a Seattle Public Utilities engineer simply conducts over-the-shoulder design review, without a full project delivery effort. Due to the limited interagency involvement, projects in this category were not excluded from this thesis.
- **Impact-driven improvements.** In addition to work that could be classified under the previous category, impact-driven projects relocate assets to avoid conflicts with roadway construction or future transportation operations. For example, maintenance holes that lie in the center of a future high-capacity transit corridor may warrant relocation. At times, asset relocation or replacement may be pursued under this classification when the cost to protect the existing assets exceeds the cost to replace those assets.

- **Opportunity improvements.** In addition to any work from the previous two categories, projects in this category construct new assets to increase the level of service. For example, water scope would fall in this classification if an existing six-inch diameter water main is replaced with an eight-inch diameter pipe to boost flow for fire prevention. This category also includes renewal of assets that are near the end of their useful life, especially when it is economically prudent to build new assets during the transportation project rather than postponing work for a separate utility-only project.

Each of Seattle Public Utilities' lines of business pursues distinct scopes of work, and therefore, have distinct classifications depending on what capital improvements are necessitated by the transportation project to the respective utility system. For example, water may pursue opportunity improvements if they have a water main nearing the end of its useful life. Meanwhile, sewer may simply undergo asset protection if there are no apparent issues with their older sewer mains.

Seattle Public Utilities' budgets for the examined interagency capital projects are also classified into three categories: small, medium, and large. These categorizations are inclusive of all water and sewer scope. Small-sized projects entail those with utility work under US$5 million. Projects with utility work costing between US$5 million and US$10 million are considered medium-sized projects. Finally, projects with utility work that exceeds US$10 millions are considered large.

The three projects examined to formulate the results are (a) a repaving of a residential arterial; (b) a complete multimodal boulevard in a rapidly growing neighborhood; and (c) a streetcar line serving a high-density corridor.

In the first case, residential arterial repaving, the Seattle Department of Transportation fully reconstructed about 20 blocks of roadway. Improvements include some traffic signal revisions, minor transit reliability enhancements, and infrastructure to support the potential development of future high-capacity bus transit. This was located along mostly single-family land uses, with some low-density multifamily housing and occasional low-rise commercial areas. Seattle Public Utilities' water line-of-business pursued impact-driven improvements, while sewer took no action. This project was chosen because of its somewhat limited utility scope, which entails only water work and no sewer work. Moreover, these routine major maintenance projects consist of 45% of the Seattle Department of Transportation's capital project portfolio between 2015 and 2025, per the voter-approved plan that is funded by the Levy to Move Seattle (Seattle Public Utilities 2018, 2). Within Seattle Public Utilities' capital budget for 2018, these types of projects account for roughly 15% of the Shared Cost Projects allocation, or about US$16 million (City of Seattle 2017). This case was chosen to illustrate potential trends in what may be considered a typical transportation project.

For the second case, the complete multimodal boulevard, the Seattle Department of Transportation rechanneled several arterials into a single complete street. This project delivered bike lanes, expanded sidewalks, added vehicle lanes, and adaptive traffic signals to connect several arterials and highways. In addition, this project constructed green stormwater infrastructure, an increased tree canopy, and public art for a rapidly-growing community to enjoy. This project is driven by reconfiguration of a major state highway, demand for non-motorized mobility infrastructure, and fast population and economic growth within the vicinity. Here, the water system made impact-driven improvements, while sewer made opportunity improvements, resulting in a medium-sized budget for Seattle Public Utilities. This project was

chosen as a case to exemplify larger transportation projects with a moderate amount of utility work, potentially demonstrating trends from projects that are somewhat large and complex, but not necessarily outliers. Projects of this magnitude account for about 10% of Seattle Public Utilities' capital allocation to Shared Cost Projects in 2018, or US$11 million (City of Seattle 2017).

Finally, the third case involves the delivery of modern streetcar service within several high-density nodes. The scope of work includes new vehicles, stations, trolley tracks, catenary wire, traction-power substations, and expansions of existing maintenance facilities. Here, the water system pursued opportunity improvements, while sewer undertook impact-driven improvements. Seattle Public Utilities budgeted over US$10 million for this project, falling within the category of 'large-sized.' This project was chosen to signify technically complex and large-budget scenarios, as new streetcar track slabs cannot have maintenance holes or access points, demanding relocation of all infrastructure within the alignment. In addition, streetcar slabs create stray currents that may corrode certain pipes. Moreover, project governance documents show that streetcar slabs are estimated to cost up to US$5,000 per linear foot to rebuild in the event that below-grade construction is necessary, compared to US$750 per linear foot for standard concrete panels. All these factors meant that it was physically necessary and economically prudent for Seattle Public Utilities to perform significant capital improvements prior to streetcar operations.

At-grade rail projects are rare, with only four total projects in the past ten years. On the other hand, projects of this technical magnitude are somewhat more common in present-day, as the public works construction boom has presented utilities with Bertha's SR-99 Bored Tunnel, the Elliott Bay Seawall Replacement, Link Light Rail Extensions, and the complete

redevelopment of Waterfront Seattle. Together, Seattle Public Utilities' ratepayers will spend $31 million on these large-scale projects in 2018 alone, or about 28% of the capital allocation for Shared Cost Projects (City of Seattle 2017). This was chosen as a case to signify the occasions where Seattle Public Utilities engages with other agencies to deliver what may be considered 'megaprojects' in the local context.

3.2 Research Questions

Through these interviews and observations, this study asks, "during initiation, options analysis, and design, what opportunities exist to improve the schedule performance of Seattle Public Utilities' improvements that are delivered through Seattle Department of Transportation capital projects?" To answer this question, this study capitalizes on primary-source artifacts and in-person observations. To supplement those, this study also uses interviews, which aims to capture some of the lived experiences and intimate knowledge of the project managers, engineers, and planners who develop, design, and deliver utility improvements in mobility projects.

In addition, this study explores a secondary research question: "what is the City of Seattle's 'production system' for planning and delivering drinking water, stormwater, and wastewater infrastructure improvements within their transportation capital projects?" As public agencies constantly face pressures to cut costs, improve customer experiences, expedite service delivery, and prove results and outcomes, it is important to view the business of government as a production system that is similar to a manufacturing process (Miller 2006).

An examination of the production system is a critical part of this thesis' policy analysis component. By understanding the intricacies of Seattle Public Utilities' and the Seattle

Department of Transportation's distinct, yet intertwined systems of work, this study can discover opportunity for improvement in the concurrent production lines.

As a tertiary research question, this study further asks: "what mental models do Seattle Public Utilities' staff hold with regard to the planning and delivery of utility improvements in Seattle Department of Transportation capital projects?" To supplement an analysis of the production system, this research explores the staffs' *perceptions* of processes and performance. As described in the previous chapter, mental models are deeply held beliefs of how the world works (Senge 1998).

This study is posing these three research questions to promote the public interest: (a) the ratepayers and taxpayers who fund these public works improvements; (b) the customers who depend on the city for clean water distribution, wastewater collection, and stormwater drainage; (c) people and goods who travel within and through Seattle; and (d) communities receiving capital improvements to their roads and utilities. Understanding and bettering the delivery of these projects would undoubtedly provide value to the communities, economy, and quality-of-life that relies on Seattle's civil infrastructure.

3.3 Hypothesis

Given these research questions, this thesis supposes that Seattle Public Utilities and the Seattle Department of Transportation have discrete missions, and that the adversarial nature of the Architecture, Engineering, and Construction industry influences a cross-departmental culture of rivalrous partnership, which may result in perceived and actual losses in schedule performance. Moreover, this study hypothesizes that the concurrent production systems for project delivery between these two departments are misaligned, which may lead to friction with expectations of work, and as a result, the two agencies experience schedule delays in their

coordinated capital projects. Further, this research hypothesizes that mental models exist in Seattle Public Utilities staff which reinforce the previous two assumptions.

3.4 Data Collection

Interviews

This research conducted semi-structured interviews with planners, engineers, project managers at the City of Seattle who were willing and available to participate in this study. Collecting data through interviews allows this study to take advantage of the expertise and intimate knowledge of individual team members (Harrell and Bradley 2009). Semi-structured interview controls provide consistency in data between different sources, ensuring that the researcher includes all the prescribed questions and topics (Harrell and Bradley 2009). The somewhat conversational nature of semi-structured interviews further allows the researcher some flexibility to delve into complex matters related to the planning, design, and construction of major public works (Harrell and Bradley 2009). Interview questions are listed below in Table 2.

#	*Interview question*	*Research purpose*
1	Overall, what are the biggest challenges to planning and delivering SPU scope in SDOT projects? How do these challenges affect our ability to stay on schedule?	Identify opportunities for improvement. Potentially identify areas needing improvement in the existing production system.
2	With regard to SPU/SDOT interagency projects, are there any procedural aspects that you think is working well?	Identify successful practices.
3	If you were the Mayor, what would you do to improve these processes? In an ideal world, how would these processes work?	Identify expectations for a high-performance production system. Identify areas needing improvement in the existing production system.
4	Are there any specific challenges to schedule performance in SPU/SDOT interagency projects?	Identify opportunities for improvement.
5	What do you think of the relationship between SPU and SDOT in the context of capital project delivery?	Identify mental models related to organizational structure.
6	Tell me about specific procedures in SPU/SDOT project delivery that you find onerous?	Identify mental models related to production systems.

Table 2. List of interview questions and purpose related to research questions.

Observation

As stated, there are ethical concerns with utilizing government employees' limited time for the purposes of this research. To supplement in-person interviews, data collection for this study includes (a) observation of planning and delivery processes; (b) analyses of governance documents, such as business cases, budgets, and financial statements; and (c) any relevant reporting from popular media, including, but not limited to, *the Seattle Times*, *the Daily Journal of Commerce*, and *Seattle City Council Insight*. Observation of primary sources allows the

researcher to view credible artifacts, while remaining minimally intrusive to the day-to-day business of the government. Examples of observed items are listed below in Table 3.

Observed source	***Research purpose***
Business cases for the five aforementioned projects.	Analyze production process leading into design and construction.
Design review circulation at 30%, 60%, 90%, and 100% design submittals, as available.	Corroborate management matters that relate to specific technical issues.
Pertinent memoranda of agreement between Seattle Public Utilities and the Seattle Department of Transportation.	Identify memorialized expectations, roles, and responsibilities. Analyze gaps between this and staff perception.
Reports on the five aforementioned projects from popular media.	Corroborate internal narratives with the reports of journalists.
Project team meetings re: options analysis, design, lessons learned, etc.	Identify mental models related to organizational structure.

Table 3. List of sources of observation and purpose related to research questions.

3.5 Data Analysis

Results, in the following chapter, sets the foundation for preliminary policy recommendations. These recommendations are formulated through a limited policy analysis approach, which compares policy options against the status quo using criteria on costs, effectiveness, and feasibility, providing relevant data trends to corroborate the recommendation. Costs are examined as a very rough estimate of direct costs, such as labor, consulting, supplies, etc. Opportunity costs are explored in the scenario where the City of Seattle takes no action. Effectiveness is defined as the extent of a policy alternative to improve the pre-construction schedule performance of Seattle Public Utilities' scope in the Seattle Department of

Transportation's capital projects. Finally, feasibility is evaluated through estimating the technical and political capability of the City of Seattle to implement a particular policy.

Through these three metrics, the best apparent alternative becomes this thesis' policy recommendation. A tabular illustration of this method is displayed in Table 4 below. The policy analysis component of this thesis, as well as the resulting recommendations, are formulated under limitations that are previously discussed in this thesis. The data used in this policy analysis stems from the case studies and the literature review. It follows that additional research is required to validate the claims set forth by this policy analysis.

Policy Option	***Criteria***	***Criteria description***	***Basis***
(Policy option 1, informed by data and literature)	**Cost**	Based on rough estimates, how much money does this option cost the city in comparison to other options?	*(Trends from data sources)*
	Effectiveness	To what extent does this option improve actual schedule performance prior to construction?	
	Feasibility	To what extent is this option technically and politically possible?	
(Policy option 2, informed by data and literature)	**Cost**	Based on rough estimates, how much money does this option cost the city in comparison to other options?	*(Trends from data sources)*
	Effectiveness	To what extent does may this option improve actual schedule performance prior to construction?	
	Feasibility	To what extent is this option technically and politically possible?	

Table 4. Concise display of policy analysis method. Policy options are presented in the discussion and are not necessarily limited to two alternatives.

3.6 Human Subjects

The University of Washington Human Subjects Division has determined that this study is exempt from federal human subjects regulations, including approval and continuing review by an Institutional Review Board. As a condition of this exemption, all items that may reveal a research participant's identity – such as name, job title, specific project titles, etc. – are codified. The reference matrix that correlates actual identities to theses codes was stored separately from the rest of the study materials, and this reference document has been destroyed upon publication of this thesis.

In addition, all materials that inform observation and interviews – including those above in Table 3. List of sources of observation and purpose related to research questions.' – are public records, and subject to disclosure upon request. Very limited matters in public works business are confidential: matters related to attorney-client privilege, customer billing, and hiring, to name a few. Any confidential items are explicitly excluded from data collection and data analysis.

3.7 Conflicts of Interest

Aside from human subjects, another ethical consideration is the researcher's financial conflict of interest, as he has been employed by Seattle Public Utilities as a Graduate Student Engineering Intern since June 2015. The researcher's job responsibilities include the business of interagency capital projects at Seattle Public Utilities. To manage this conflict, the scope of this research project has been clearly delineated from the researcher's regular job responsibilities, and time spent conducting this study is not billed to the City of Seattle. Moreover, no City of Seattle resources is provided to support this study. This thesis is produced entirely in the researcher's role as a private citizen fulfilling degree requirements at the University of Washington.

Chapter 4: Results

This chapter delivers a synopsis and explanation of this thesis' findings. This chapter presents three hypothetical generalizable scenarios of projects with particular scopes of work. As explained in the prior chapter, these scenarios are grounded in actual cases of three Seattle Department of Transportation projects with Seattle Public Utilities scope. The three scenarios are presented theoretically as to protect the anonymity of staff who participated in this study. The contents of this chapter are not based on the opinions of individual participants. Rather, the following results are derived from data provided by multiple interviewees, which is further supported by primary source artifacts. The three scenarios are (a) a typical repaving project; (b) a moderately-sized transportation project that is relatively uncomplex; and (c) a technically challenging and large-magnitude transportation project.

After presenting the three scenarios, this chapter concludes with a description of the factory production system. This narrative, supported by flowcharts, displays the concurrent project development and project delivery workflows at Seattle Public Utilities and the Seattle Department of Transportation.

4.1 Typical Arterial Repaving Scenario

In this scenario, the Seattle Department of Transportation reconfigures and reconstructs an arterial corridor within residential or low-density neighborhoods. Since only portions of existing asphalt and concrete are at the end of their useful life, it may not be prudent for Seattle Public Utilities to replace all assets along the project alignment, resulting in a budget less than $US 5 million. Engineering and management challenges are relatively easy, especially given the small magnitude of the project's impact.

Seattle Department of Transportation holds a project kickoff meeting with a small number of team members, where the geographic extents are quickly identified. Seattle Public Utilities' sewer planners order a closed-circuit video inspection of assets within the project extent, which may take two or three months to complete a full inspection and analysis. Meanwhile, the Seattle Department of Transportation develops their 10% complete designs, showing early conceptual plans.

Later on, when the Seattle Department of Transportation has completed 30% design completion, Seattle Public Utilities' water planners begin their analysis. Using historical records of water system work orders in the project's extent, water planners identify which assets require capital improvements. Specifically, water planners focus on assets underneath portions of roadway that will be fully reconstructed, which presents a cost-saving opportunity to Seattle Public Utilities, as they can share the cost of pavement restoration. Where the grade won't be demolished – such as asphalt that will be milled and overlaid – water planners avoid necessitating further roadway scope. Both water and sewer planners arrive at an initial scope between Seattle Department of Transportation's 30% and 60% design completion milestones.

This means that Seattle Public Utilities must expedite their options analysis and design processes to align with the Seattle Department of Transportation's completion milestones before the 100% design completion, in order to avoid delaying bid solicitation for the overall project. For projects of small magnitude, planners, engineers, and project managers may catch up with the transportation schedule by 90% design – around nine months to complete utility contract specifications – without any delays to the overall project schedule.

4.2 Medium-Scope Transportation Project

This narrative entails a project by the Seattle Department of Transportation that reconstructs a major arterial, delivering a larger-magnitude project than a typical residential repaving job, while still remaining relatively uncomplex. Between project kickoff and 10% completion of transportation designs, the geographic extents of this project may very well change. Planners and engineers from the Seattle Department of Transportation will examine the extent of their improvements at intersections and perpendicular streets, with considerations such as traffic signals, lane configurations, and safety for nonmotorized travelers. Due to the uncertainty, Seattle Public Utilities' sewer planners cannot begin analysis and scoping until the project adopts a 10% conceptual design – likely to take around six months.

Once the transportation scope reaches 30% design completion, water planners begin analyzing assets underneath portions of roadway that will be fully reconstructed. Planners will have to consider conflicts with future above-grade assets, as to preserve functionality for operations and maintenance. For example, a water main lying under the center of the street would have to be relocated if a new median were to be built. Tree roots would present a risk to the water main. Moreover, it would be difficult to integrate new vaults and valve chambers within a planted median, while the new median would also create an obstacle for crews who need to tap the water main in the future.

As with the previous project, water and sewer planners would likely complete a project delivery scope between the transportation project's 30% and 60% design milestones – approximately one year after project kickoff. This scope may take the form of a medium-sized budget, between US$5 million and US$10 million in total utility investment. Seattle Public Utilities would have to pursue an accelerated process to complete their design in time to

advertise in the conformed contract documents. This may be problematic if technical, managerial, or bureaucratic conflicts arise, as these matters may require at least one month of executive-level negotiations. This project may experience delays between two and six months prior to bid solicitation.

4.3 High-Profile Megaproject

For this hypothetical framework, this thesis illustrates a one-of-a-kind project that affects the mobility or public realm of at least 100,000 people. These projects may be located in high-density urban cores, where the crowded rights-of-way – both at-grade and below-ground – pose hefty engineering challenges.

As with the prior two scenarios, sewer planners begin their review between project kickoff and 10% design completion. Meanwhile, water planners conduct their analysis at 30% design completion. Project delivery specifications are completed between 30% and 60% design completion milestones, cornering Seattle Public Utilities into a rushed design process, in order to advertise their designs and specifications with the Seattle Department of Transportation's conformed contract documents.

Unlike the last two scenarios, these megaprojects involve many interagency actors. Due to the large magnitude, the inevitable construction conflicts with power, gas, steam, communications, and other infrastructure systems must be resolved during the design process. Moreover, negotiations related to costs, roles, and responsibilities between various agencies may sum up to months of executive-level problem-solving. As such, these types of projects may expect a schedule delay between six months and two years, depending on technical, political, and bureaucratic matters that may arise.

4.4 The Production System

The Seattle Department of Transportation develops a capital project in accordance with their bicycle, pedestrian, transit, and freight master plans. Projects are sometimes born out of neighborhood planning efforts, as well as the comprehensive planning process, both of which are led by the Office of Planning and Community Development – a separate executive department at the City of Seattle. When constituents are well-organized, community and political pressures may also influence the Seattle Department of Transportation's capital portfolio.

Once the Policy and Planning Division of the Seattle Department of Transportation identifies a capital project need, the project delivery lifecycle begins. Here, transportation planners convene a project kickoff meeting, which gathers a team of policy analysts, planners, and engineers. Sewer planners from Seattle Public Utilities may participate in these kickoff meetings if there is a desire from either department to pursue green stormwater infrastructure, which are drainage systems that treat stormwater through biological means. During project kickoff, the team may determine preliminary geographic extents.

After project kickoff, the Project Development Division within the Seattle Department of Transportation works towards a 10% design submittal, which solidifies geographic extent and broad concepts of work. For example, a 10% design submittal for a high-capacity transit project may include preliminary lane markings, station placements, and reconfiguration of traffic signals, among other things. After 10% design is adopted by the appropriate governing body – which is the Seattle City Council for high-profile projects – these same transportation planners and engineers continue to work towards 30% design, which entails survey data, structural plans, and other early technical details. Staff have noted that other agencies are required to provide a complete survey base map of below-grade infrastructure at 30% design, as that is a requirement

for receiving a right-of-way construction permit. Despite that, the Seattle of Department of Transportation exempts itself from that requirement, and their 30% designs do not show below-grade infrastructure systems.

After completion of 30% design, the Project Development Division transfers the project to the Capital Projects and Roadway Structures Division, who provides project management, construction management, engineering, outreach, and other project delivery services. This division is responsible for leading this project through the end of its lifecycle. Broadly, they are responsible for finishing design, soliciting bids and awarding the contract, performing construction inspections, and commissioning new infrastructure.

The Project Development Division's staff holds recurring meetings with planners, engineers, and project managers from Seattle Public Utilities. Once a project's geographic extent is solidified and communicated, sewer planners place a work order for a closed-circuit television inspection of sewer pipes within the project limits. Videos from these inspections are reviewed by sewer planners, where they determine the condition of these assets based on any cracks, worn-down surfaces, and flow rate, among other considerations. This process varies in duration, potentially taking months to develop a scope, depending on the availability of crews or contractors.

Meanwhile, Seattle Public Utilities' water planners do not engage until the roadway designs have reached 30% design completion. At 30%, the Seattle Department of Transportation has determined which sections of street they plan to demolish, rather than rehabilitate or leave as-is. Where the grade is expected to be fully reconstructed, water planners examine the condition of their pipes underneath those particular sections. Water planners consider leak history, pipe material, pipe installation date, and flow rate for fire prevention, among other

things. This process also varies in duration depending on the workload capacity of water planners. Typically, a scope statement can be expected one month after the roadway designs reach 30% completion. On occasion, the Seattle Department of Transportation communicates that they plan to fully reconstruct the entire project extent. During those circumstances, water planners begin scoping prior to 30% design.

Once both water and sewer planners have finished their scope – which rarely happens at the same time – they propose utility improvement specifications to Seattle Public Utilities' Asset Management Committee, in accordance with the agency's *Project Management Methodology*. Upon executive blessing, the scope is transferred to the agency's Project Delivery and Engineering Branch, who leads the project through options analysis, design, construction, and closeout. The planners and the project manager convene a team of engineers and economists. They may also invite subject-matter experts for issues related to real estate, climate change, and cathodic protection, to name a few.

This team immediately begins options analysis. Based on the specifications provided by the planners in their scope-of-work, engineers develop various options to respond to capital improvement needs that are presented by the transportation work. These options are estimated for lifecycle costs, with an economist performing discounted cash flow analyses to determine the present-value costs of each option. This team is also responsible for incorporating the racial equity toolkit and a climate analysis into their deliberations. Using a business case format, this work is presented to the Asset Management Committee, who chooses a preferred alternative and allocates funds to undergo design and construction. The duration of this process varies significantly, depending on project magnitude and complexity.

While options analysis is underway, the utility project manager engages the agency's Contracts and Procurements Division to develop a project-specific memorandum of agreement with the Seattle Department of Transportation, consistent with the *Tri-Party MOA*. Here, signature approvals from the entire chain-of-command is collected before pursuing an agreement. These agreements include roles and responsibilities, preliminary cost sharing terms, and ratification or revisions to the conditions that are spelled out in the overarching *Tri-Party MOA*.

At the direction of the Asset Management Committee, Seattle Public Utilities' project team develops drawings and specifications for utility work, which is later conformed into the Seattle Department of Transportation's contract. Completion milestones are defined at 30%, 60%, 90%, and 100% design, using checklists of specific items as described by Seattle Public Utilities' *Design Standards and Guidelines*. In the majority of projects, Seattle Public Utilities completes design using the Seattle Department of Transportation's consultants, who serve as the Engineer of Record. This is facilitated via utility-specific work assignments under the overall consultant contract. Utility engineers coordinate closely with the consultants, in addition to formal over-the-shoulder critiques at 30%, 60%, 90%, and 100% milestones.

Once design is complete, these partnership projects deviate from the Seattle Public Utilities *Project Management Methodology*. When a typical Seattle Public Utilities project solicits bids from contractors, the Asset Management Committee must provide approval to advertise, as well as approval to execute the contract. In the case of interagency projects, the plans and specifications for utility work is collated into a single contract document, which is ultimately managed by the Seattle Department of Transportation. Therefore, the Asset

Management Committee has no authority over the bid process, so they are not involved in the decision to enter construction.

Project-specific plans and specifications are placed for advertisement, soliciting bids from construction firms. In addition to these documents, the City maintains *Standard Plans for Municipal Construction* and *Standard Specifications for Municipal Construction*. With these plans and specifications, individual items – such as parts, mobilization activities, tree protection, etc. – are listed for a construction firm to offer their prices, which is submitted to the city as a bid. The Seattle Department of Finance and Administrative Services facilitates contract solicitation, bid evaluations, and contract award. These contract officers ensure that the advertisement process conforms to all applicable rules and regulations, such as utilization of women and minority-owned businesses, quality control of contract language, fair and unbiased bidding, among other matters.

Typically, the contract is awarded to the firm who offered the lowest total price. Upon award, the contractor must submit their plans for mobilization, safety, traffic control, and other pre-construction items to the Seattle Department of Transportation. Office engineers and construction managers from the Seattle Department of Transportation then solicit feedback from the appropriate personnel and departments. Upon approval of these pre-construction items, the City issues a notice for the contractor to proceed with the work. On the ground, staff from both the Seattle Department of Transportation and Seattle Public Utilities perform field inspections and construction management activities. The construction manager from the Seattle Department of Transportation serves as the lead point-of-contact between the contractor and the City. Therefore, all formal communications between the contractor, the utility, and any other parties are funneled through the Seattle Department of Transportation's construction team.

Upon construction completion, project managers from both departments begin the closeout phase. At Seattle Public Utilities, the project manager must ensure that (a) as-built markups from the field have been processed into Computer-Aided Design record drawings; (b) information from record drawings have been synced with Geographic Information Systems and asset management systems; (c) any Seattle Public Utilities-owned vegetation have been established; (d) all conditions of permits and certificates have been met; and (e) all expenditures to the project have been paid. After these closeout activities have been performed and documented, the project manager must acquire signatures from executives who oversee operations and maintenance functions. Once these executives have concurred that the project shall be closed, the project manager orders that any pertinent accounts be terminated in the financial system. Documents and artifacts are sent to the Office of the City Clerk, where they are retained and destroyed in accordance with public records regulations.

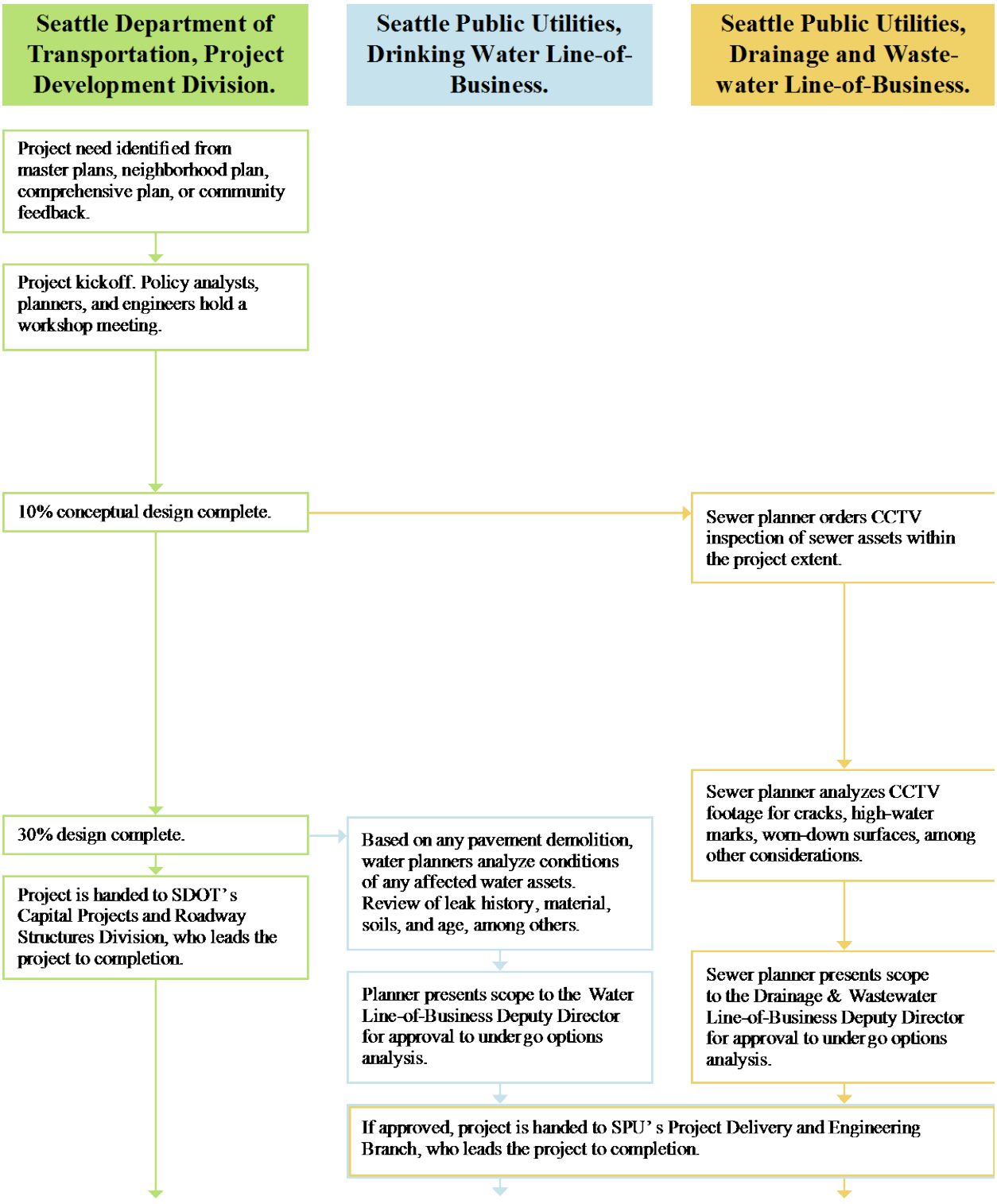

Figure 7. Simplified factory production process for early planning and phases at SDOT, while SPU completes initiation. This highlights the systemic tardiness of between the two agencies. This is not an accurate representation of task durations, which varies depending on project complexity, magnitude, politics, among other attributes.

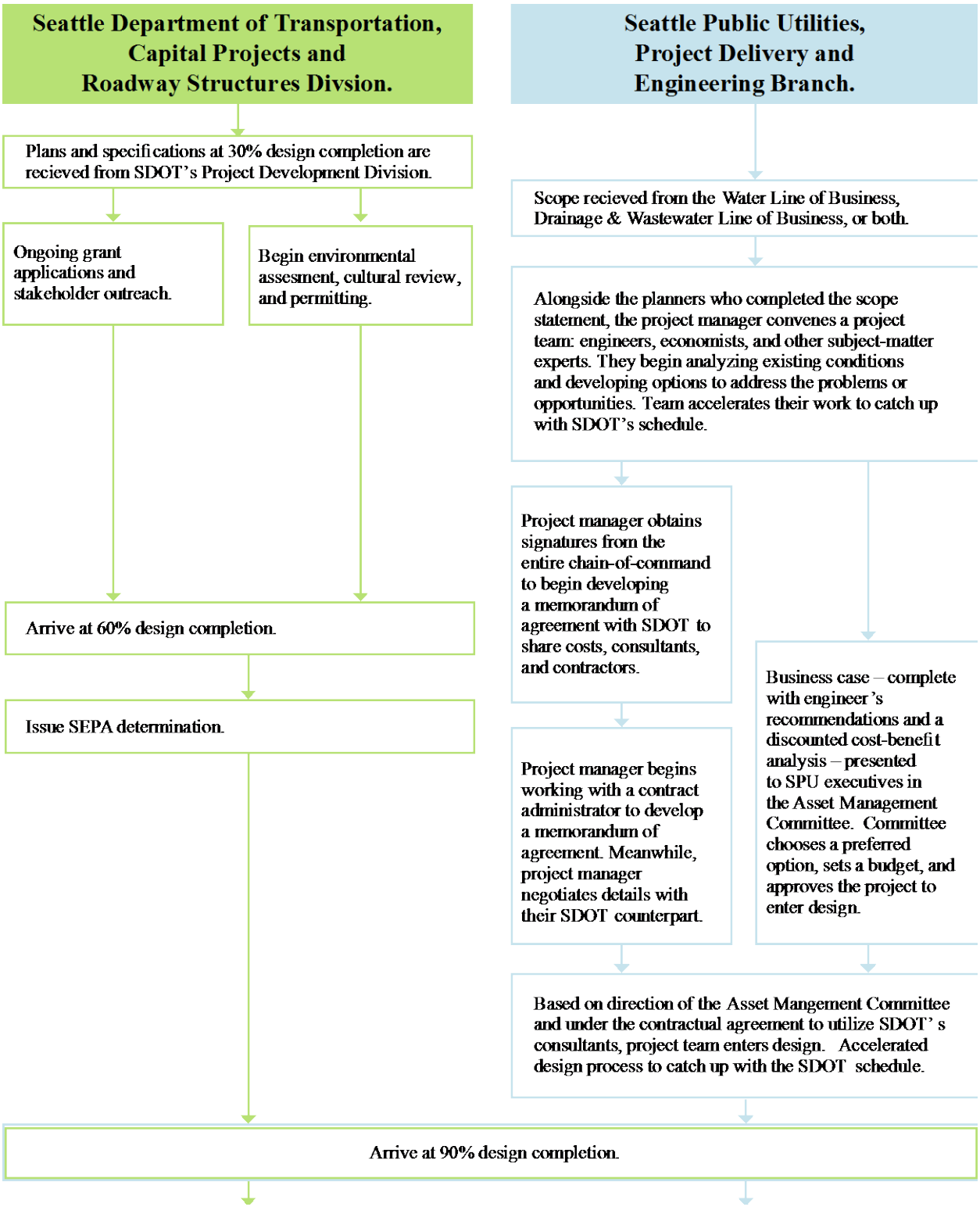

Figure 8. Simplified factory production process during the design phase. This illustrates SPU's need to accelerate their work to catch up with the SDOT schedule. This is not an accurate representation of task durations, which varies depending on project complexity, magnitude, politics, among other attributes.

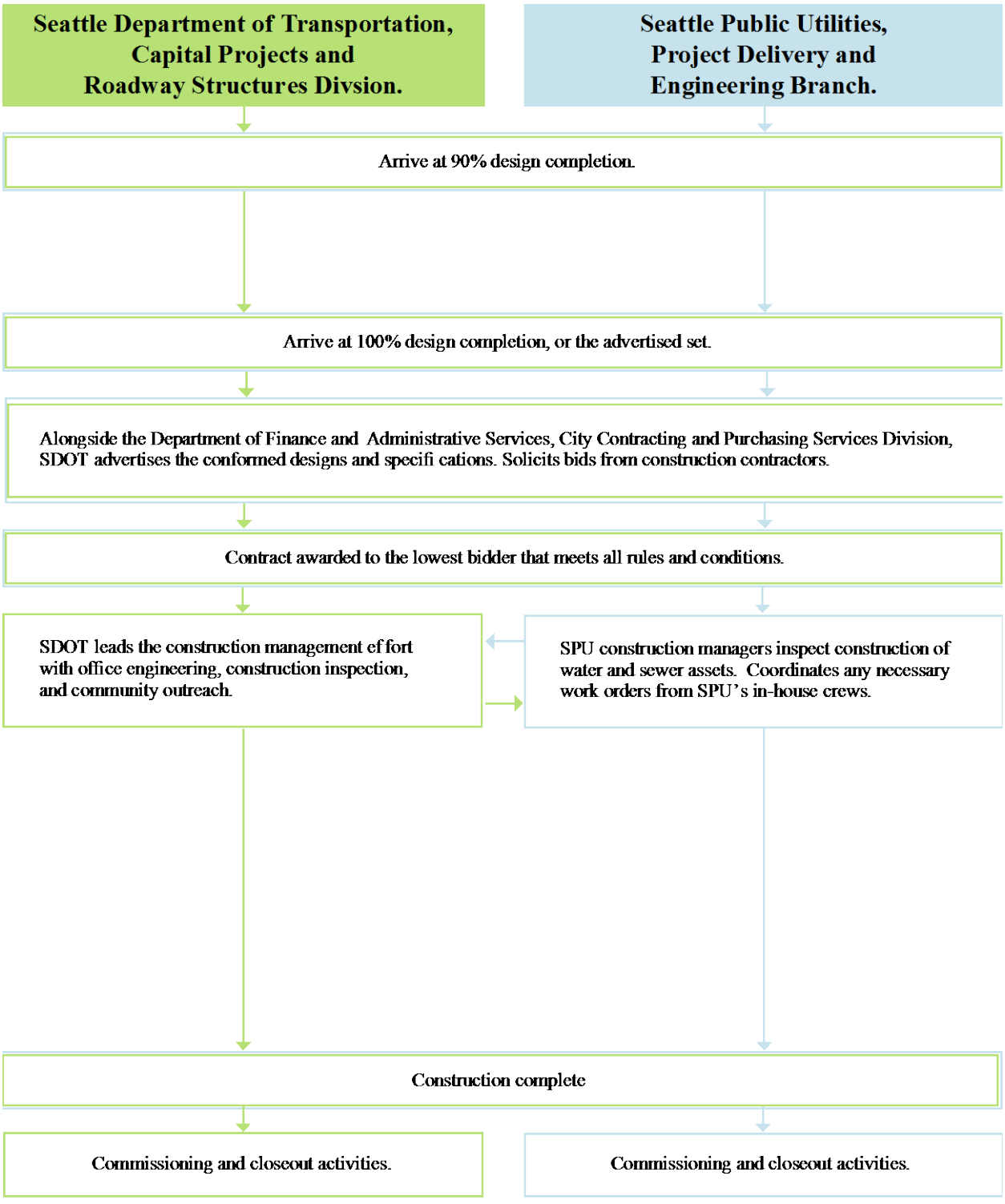

Figure 9. Simplified factory production process during late design, construction, and closeout. This is not an accurate representation of task durations, which varies depending on project complexity, magnitude, politics, among other attributes.

Chapter 5: Discussion

The purpose of this chapter is to synthesize this study's findings as they relate to this study's research questions, hypotheses, and literature. This chapter discusses findings related to policy drivers, as well as findings related to the production system. Finally, a policy analysis is presented. This policy analysis examines four options to improve schedule performance: (a) no action; (b) lean implementation; (c) embedding utility planners into the transportation line-of-business; and (d) consolidating the governance of all of the City of Seattle's public works functions.

To reiterate, this thesis asks three research questions. First, what opportunities exist to improve schedule performance during initiation, options analysis, and design for Seattle Public Utilities improvements in Seattle Department of Transportation capital projects? Second, what is the City of Seattle's production system for planning and delivering water and sewer scope in Seattle Department of Transportation capital projects? Third, what mental models do Seattle Public Utilities staff hold with regard to planning and delivering water and sewer scope in Seattle Department of Transportation capital projects?

This thesis hypothesizes that the two public works agencies have different missions, and that the adversarial nature of the construction industry has led to rivalrous tendencies between the two agencies. Moreover, this study theorizes that the production systems between Seattle Public Utilities and the Seattle Department of Transportation are misaligned, and therefore creates perceived and actual delays. Finally, this research presumes that Seattle Public Utilities staff hold mental models that reinforce the prior two hypotheses.

5.1 Findings

Findings on policy drivers and schedule performance

Several staff members across all three cases have noted that Seattle Public Utilities and the Seattle Department of Transportation have different priorities, which may be a source of conflict. For example, transportation staff tend to prioritize schedule performance and public outreach – especially with highly-visible projects, as well as any projects that receive federal funds. On the other hand, utility staff are primarily concerned with quality, which is referred to as the inherent ability of a project and its resulting assets to perform its responsibilities throughout its lifecycle (PMI 2017, 228). These competing prioritizations have been cited by staff as a primary driver of friction between the two departments, which is evident across all three cases.

By applying both Zaharadis' multiple streams framework, as well as Cohen, et al.'s garbage can model of organizational choice (Zahariadis 2014; Cohen, March, and Olsen 1972), one can discern the political and policy pressures being placed on the Seattle Department of Transportation: namely, community involvement and schedules dictated by federal grants. Meanwhile, Seattle Public Utilities becomes involved, and their policy process is heavily influenced by from stringent water quality regulations – as well as internal quality assurance measures for contracting, governance, and other widgets. Seattle Public Utilities' quality-first production system makes accelerated schedules particularly onerous. This is prominent in Case B and Case C, where the projects experienced actual schedule delays prior to construction that may be partially attributable to Seattle Public Utilities' time-consuming processes.

In addition, many staff members expressed concern that the Seattle Department of Transportation as a whole tends to seek excessive payment from Seattle Public Utilities,

especially when they experience funding shortfalls from grants and the general fund. Meanwhile, Seattle Public Utilities staff acknowledged that utility work – especially major water and sewer scope – tends to put a strain on the schedules of transportation projects. These stand only as mental models – they are only corroborated by anecdotal experience and not empirical analysis. Despite these organizational-level mental models, the majority of Seattle Public Utilities' staff cited good working relationships with their counterparts in the Seattle Department of Transportation. Projects where the interdepartmental staff had especially strong camaraderie were more successful in avoiding pre-construction delays, which is consistent with empirical research regarding the role of trust in project partnership (Sparkling, Mollaoglu, and Kirca 2017; Laan et al. 2011).

On a similar note, many team members mentioned that the two departments have separate funding mechanisms. The Seattle Department of Transportation must compete for tax revenue during the City budget process, which they supplement with federal, state, and local grants. Seattle Public Utilities, on the other hand, is fully funded by its three distinct enterprises: water, sewer, and solid waste. Firm regulations state that funds from one enterprise can only be used for that specific enterprise. This means that revenue from water bills can only be spent on the water system, and so forth for sewer and solid waste. When cost disputes inevitably rise, each team member rightfully defends their own budget. This further aligns with the multiple streams framework and the garbage can model of organizational choice (Zahariadis 2014; Cohen, March, and Olsen 1972), since these two organizations are undertaking myriad complex engineering ventures, where disputes from competing lines of business may be inevitable.

Findings on the production system

As mentioned by staff, and exemplified in the results chapter, Seattle Public Utilities' production system for planning and delivering capital projects is rooted in quality-first values. The previous chapter's description of the production system shows how Seattle Public Utilities' projects are subject to continuous oversight by the Asset Management Committee, as well as strenuous quality controls – especially in project management and contracting. On the other hand, several staff members noted that the Seattle Department of Transportation – especially during planning and early design – did not face any similar quality management structures, which may allow their agency to better meet aggressive schedules. For example, prior to 30% design, the Seattle Department of Transportation does not pursue project management planning. Meanwhile, at Seattle Public Utilities, project management plans are expected from the start.

Seattle Public Utilities' production system is not well-suited to partnership projects, where the Asset Management Committee's strenuous governance is powerless to the schedule and scope set forth by the Seattle Department of Transportation. Seattle Public Utilities' governance processes become problematic when the utility teams have to accelerate their work in order to meet the overall project schedule – which occurred in all three cases. Preparation, management briefings, and formal presentations to the Asset Management Committee demand significant time investments from utility planners, engineers, project managers, and their leadership.

In alignment with Seattle Public Utilities' quality-first values, much of the production system is focused simply on governance oversight – rather than any measures to ensure flow, efficiency, or outcomes. For example, the process to execute interagency agreements can span several months, as an array of quality controls measures dictate specific language, mechanisms,

reviews, and formats for these agreements. In addition, signature concurrence requirements – all the way up the chain of command to the Chief Executive Officer – prior to and during agreement development can take up to two weeks to process. Many staff have criticized these measures, especially since interdepartmental agreements have no legal muster. This is because both parties in the agreement are technically the same municipal corporation, meaning that any legal action would be between the City of Seattle and itself. As shown in Case B in particular, these burdensome processes can hamper the financial duties of the project team, where Seattle Public Utilities' staff were focused on day-to-day design issues, forcing agreement development to become a secondary priority.

This study contends that the disjointed production systems between the two agencies are inherently inconsistent with 'new public service' ideals (Denhardt and Denhardt 2000). The onerous and rigid production systems may be unintended consequences of decisionmakers who created oversight measures as simple means of addressing past project delivery issues within the utility agency: the premise for the garbage can of organizational choice (Cohen, March, and Olsen 1972).While quality and accountability are critical values in public service, a production system that focuses exclusively on oversight – overlooking efficiency and effectiveness – imposes opportunity costs to Seattle Public Utilities' ratepayers. Moreover, these opportunity costs are passed on to Seattle Department of Transportation taxpayers when they are actualized onto project items with shared costs.

Aside from arduous governance and quality measures, Seattle Public Utilities and the Seattle Department of Transportation have sharply misaligned production systems during planning and early design. Utilities begin design only after the Seattle Department of Transportation has completed their 30% design milestone. This results in constant expedited

design processes, which many staff members claim to directly impact quality. On certain occasions, staff have noted that the communications between utility and transportation planners may lapse, forcing Seattle Public Utilities to pay for costly change orders once the contract has already been awarded.

Specifically, sewer planners begin their analyses once the project extents have been determined and communicated to Seattle Public Utilities. Despite that, they suffer from fluctuating availability of crews who perform video-camera inspections of sewer facilities. Adding to the project planning difficulties, water planners contend that they must receive a 30% design submittal from the Seattle Department of Transportation before they can begin their work. This is because water planners only analyze portions of the project where the roadway is fully reconstructed.

While staff understand the limitations of the utility project planning process, some team members are concerned with the ability for Seattle Public Utilities to continue their interagency asset management duties, as outlined by the *Tri-Party MOA* (City of Seattle 2016). Staff perceive that the discrepancy between the two agencies' production systems hampers schedule, budget, and quality performance in the midst of today's civil construction boom – especially since Seattle Public Utilities' project management, engineering, and planning units already exceed peak workload capacity.

To address these planning shortfalls, some staff members suggested that sewer planners should increasingly rely on contractors to perform video inspection. Additionally, some staff have proposed that water planners do their analysis once the transportation project extent has been determined. Here, water planners can create preliminary specifications, which are finalized pending the Seattle Department of Transportation's determinations on which portions of

pavement to reconstruct. These suggestions align with lean production frameworks, as they may allow the agency to ensure a continuous flow of work throughout the production process (Linden 1994).

In line with both the literature and the responses of interviewees, Seattle Public Utilities may benefit from implementing lean production processes. Dissolving process innovation responsibility to the front-lines results empowers planners, engineers, and project managers to capitalize on their lived experiences (Linden 1994). Moreover, holding lean production workshops with staff from both Seattle Public Utilities and the Seattle Department of Transportation – with executives, leadership, and lower-level staff – may serve as an excellent start to a lean culture. These workshops were suggested by this study's interviewees, and is consistent with successful lean implementation at Virginia Mason and Kitsap County (Patterson 2016; Rice, Roberts, and Keeton 2016).

5.2 Policy Analysis

This section of the thesis examines available options to improve the pre-construction schedule performance in Seattle Public Utilities scope in Seattle Department of Transportation capital projects. This brief policy analysis defines the issue, states the objectives, and analyzes policy alternatives to determine which option may best improve schedule performance in these interagency projects.

Structure of the policy analysis

This policy analysis section begins by defining the problem and diagnosing underlying causes. Next, the thesis presents four policy alternatives, which are derived from recommendations of staff who participate in this study. These four alternatives are (a) the status quo; (b) lean production implementation; (c) embedding utility planning into the transportation

project development process; and (d) reorganizing the City or Seattle's public works lines-of-business to report to a single governing body, such as a Board of Public Works. After explaining these four options, this thesis follows by analyzing estimate outcomes against the criteria that was described in the Methodology chapter: cost, effectiveness, and feasibility. After the alternatives analysis, a policy recommendation is presented. This section concludes with an examination of tradeoffs between the policy recommendation and the other alternatives. Since this policy analysis is not comprehensive, the projected outcomes and the following recommendation should be corroborated with further research.

Problem definition and diagnostic

Based on staff interviews and observations, this study asserts that there is a gap between actual schedule performance and ideal schedule performance with regard to initiation, options analysis, and design of Seattle Public Utilities scope that is delivered through the Seattle Department of Transportation's capital projects. This gap has serious implications on the budgets of both agencies, as delays lead to higher labor costs for all team members. This is an especially salient issue, as Jenny Durkan and Goran Sparrman – the current Mayor and Interim Director of Transportation, respectively – are currently stating that they cannot meet the ambitious promises of the Levy to Move Seattle. Moreover, Seattle Public Utilities rates are increasing in the midst of an affordability crisis, partially due to increasing costs imposed by partnership projects during today's boom in public works construction.

Based on the data collected in this study, it is clear that the nonlinear production systems – which composes of separate processes in different agencies that are often incongruent – is a primary driver of schedule delays. In all three cases, the initial planning phase for utility work happens while roadway designs are already well-under development. This delay forces the

project team to expedite their design work in order to catch up with the overall project schedule, as to avoid delaying contract advertisement.

This study also finds conflicting policy pressures between the two agencies. While these divergences may not be a direct cause of schedule delays, the varying mission, priorities, and funding sources of the two organizations shine light on underlying conflicts between how these agencies conduct their business. This matter exists in the broad organizational context. At the staff level, relationships and trust between the agencies are strong, with all team members committed to 'new public service' principles.

To address this problem – the gap between actual and ideal schedule performance – the following four policy alternatives have been formulated from the input of staff members, observation of primary sources, and relevant literature.

Policy alternatives

Status quo. Here, this thesis examines schedule performance outcomes if Seattle Public Utilities were to take no action to improve the schedule performance of their partnership projects with the Seattle Department of Transportation.

Lean production. Here, this study proposes that staff, managers, and executives from both departments implement lean production principles. In this study's interviews, several staff members have identified the need for process improvement, waste elimination, and improving the flow of widgets through project planning and delivery. This is largely consistent with literature on re-engineering public sector business, as well as theories of new public service.

Lean implementation may begin with all-staff workshops. Team members may need training to understand lean principles and achieve buy-in. In these workshops, staff from both departments – at all levels – can work together to identify each component of the interagency

production systems. Collectively, staff can use their diverse lived experiences to propose means of eliminating wasteful practices and policies. After these initial workshops, staff can meet occasionally to disseminate information, collectively problem-solve, and ensure that lean culture is being adopted in these project teams.

Under this policy alternative, leadership in both departments must empower their staff to make process-improving innovations, welcoming both successes and failures as critical learning opportunities. Any process improvement ideas must be approved by an immediate supervisor, as to sustain accountability, and also to ensure growth of institutional knowledge.

Embedded interdepartmental planners. The largest issue to schedule performance in these interagency projects are the disjointed production systems for initiating capital projects. Time and time again, Seattle Public Utilities transitions from planning into design once the Seattle Department of Transportation nearing their 60% design milestone. To address this problem, some staff members have suggested that two full-time planners – one from both water and sewer – be embedded into the Seattle Department of Transportation's project development processes.

As some staff members cited poor communications between the two departments' planning efforts, a full-time liaison may address these issues. If these employees were embedded into the various multimillion-dollar transportation investments, they may be better-acquainted with the intricacies of each project, and therefore, better-able to develop utility scope. These utility planners can also develop close relationships with transportation counterparts, and in turn, foster trust and positive relationships. As utility staff are immersed in transportation business, they may be better equipped to specify utility scope – earlier in the process, and faster than the status-quo.

Reorganization. Nearly all interviewees suggested that the central problem with these interagency projects are the conflicting missions, priorities, and funding sources. When asked for innovative solutions to improve interagency project planning and delivery, many staff members suggested reorganizing the City of Seattle's public works departments. Several staff did note that reorganizations are expensive and not necessarily effective – which is corroborate by the literature. Despite that, many staff members suggested that unified governance may better provide policy direction that balances the interests of utilities, transportation, and the divergent funding sources.

Here, interdepartmental disputes over cost sharing, maintenance responsibilities, technical standards, and other issues can be elevated to a shared leadership, who has equal interest in mobility, utilities, and other matters like parks, power, and construction administration. This contrasts with the status-quo, where each department acts in a territorial manner during disputes in order to protect their respective budgets. This proposed reorganization eliminates this adversarial relationship through shared leadership between the various infrastructure lines of business. This model is similar to the City of Seattle's model prior to the turn of the century. Then, a Board of Public Works was responsible for directing all of Seattle's public infrastructure business.

Alternatives analysis

Status quo. If the City of Seattle was to pursue no action in response to schedule performance and production system issues that are identified in this thesis, the City would incur an opportunity cost. This opportunity cost is continuously actualized in each Seattle Department of Transportation project, where aggressive and accelerated schedules result in delays. These

delays inevitably lead to avoidable costs for staff time, while loss of quality may lead to costs incurred during construction from change orders.

On another hand, the status quo alternative would not impose any direct cost burdens or risks. Staff morale and productivity would also remain at the current levels, given that all other considerations remain equal.

Aside from costs, this alternative may be the least effective in addressing schedule performance in Seattle Public Utilities interagency projects with the Seattle Department of Transportation. While ongoing incremental efforts – such as recurring planning meetings between the two departments – may marginally improve schedule performance, the status quo may not result in any notable improvements.

In examining feasibility, this policy alternative ranks highest out of the four options. This is due to the relative lack of resistance to the status quo – no additional political risk, no additional loss of staff morale, and no additional budget burdens.

Lean production. To implement lean production, all-staff workshops with both departments are necessary in order to explain the paradigm, collectively map the production process, and brainstorm initial implementation steps. This is consistent with the previously discussed cases at Virginia Mason and Kitsap County.

To provide a rough estimate of costs, this thesis uses a 2017 agreement with Sound Transit (the transit authority serving the Seattle metropolitan region) for the City of Seattle to provide technical support to their latest capital projects. In this contract, they determined the average cost of a City of Seattle capital project team member. Together with overhead, payroll contributions, and wages and benefits, a capital project team member averages to US$167 per

hour. If at least 30 staff members are present for three all-day workshops, that would result in approximately US$110,000 for three workshops.

It may be beneficial to bring lean experts to facilitate implementation, which was done by Virginia Mason and Kitsap County. Referencing the City's most recent consulting contracts, this thesis roughly estimates that an experienced management consultant may charge an all-inclusive hourly rate of US$225. For a pair of consultants facilitating three workshops, that would total to a rough estimate of US$5,000. Together with in-house labor costs, three initial lean workshops may cost the City of Seattle about US$115,000.

Lean does not stop there – the success of this management framework rests on a culture of ongoing improvement. As all three cases in the literature review suggest, the continuous improvement mechanisms must be embedded into daily business. Time related to ongoing small-scale continuous improvement can easily be absorbed into the existing overhead and project budgets. Aside from that, the City of Seattle may benefit from quarterly meetings after the initial workshops. These quarterly meetings can be a forum for sharing ideas, airing frustrations with certain processes, and reporting on relevant performance indicators. Assuming that the same consultants would facilitate these meetings, and that the agenda comfortably fits in two hours, these quarterly meetings would lead to an annual cost of US$22,000.

In summarizing these preliminary cost estimates, initial lean implementation workshops may cost the City of Seattle US$115,000. Meanwhile, quarterly ongoing workshops may cost US$22,000 each year.

While these costs are not pocket change, they are relatively miniscule in the context of the two agencies' combined operating budgets that total to US$1.6 billion. Based on these rough cost estimates, the City of Seattle would only 653 billable hours to break-even. If these lean

processes were to be more ambitious, such as the scale of Virginia Mason or Kitsap County, the resulting streamlined production system may improve quality issues that the city routinely encounters. Staff noted that a reduction in change orders during construction would reconcile the costs of lean implementation within years, as staff roughly predict around a 30%-50% markup per bid item delivered via change order – easily exceeding the cost of implementation.

Regarding effectiveness, lean implementation has significant potential, given what was accomplished at Virginia Mason, Kitsap County, King County, and countless other organizations. Literature and practice suggest that there may be a positive correlation between lean investments and the extent of process improvements. Though these cases are promising, their results and implications are not universally generalizable, and do not necessarily mean that the City of Seattle would experience similar results. Lean is not a silver bullet. This study contends that effectiveness would be contingent on the depth and breadth of lean implementation. The willingness of executives, managers, and staff to implement lean principles may be the key to this policy alternative's success. Further research is necessary to concretely determine lean's potential to improve schedule performance in Seattle Public Utilities scope within Seattle Department of Transportation capital projects.

Preliminarily, this study contends that lean implementation is very feasible. This is endorsed by literature, as well as successful implementation in local public agencies. Moreover, staff have expressed willingness to pursue lean principles, as there appears to be a consensus that there is a gap between Seattle Public Utilities' actual and ideal schedule performance in transportation projects. While organizational paradigm shifts are inevitably difficult, given the ambiguous and complex nature of government decision-making, lean nonetheless presents a ripe opportunity for the agencies to close their schedule performance gap.

Embedded interdepartmental planners. This proposal entails assigning two Seattle Public Utilities planners – one for water, and another for sewer – to the Seattle Department of Transportation. There, these planners are able to represent the utility's interests through all phases of the project delivery lifecycle. To predict costs, this study found that most of Seattle Public Utilities' planners hold the job classification of 'Strategic Advisor 2.' Based on project cost estimating data, employees in this job classification have a fully-burdened billing rate of US$154.31 per hour when charging to the capital budget in 2018. This rate is inclusive of wages, benefits, payroll contributions, overhead, and other variable costs that are attributable to labor. This translates to an annual cost of US$642,000 for two full-time staff assigned solely to utility scoping and coordination in the Seattle Department of Transportation's capital projects.

Placing two utility planners within the Seattle Department of Transportation may not inherently result in efficiencies and effectiveness. The central issue appears to be disjointed production systems, with a secondary problem of conflicting policy influences. New personnel – without any authority to make sweeping changes to the production system – do not seem to have a direct nexus to the underlying problems. Instead, new employees may serve as a tool to identify and implement process improvements across departments. Further research is necessary to fully analyze the effectiveness of this policy alternative.

While the effectiveness of this strategy is somewhat unclear, the feasibility is more certain: this alternative has poor feasibility. Hiring new full-time employees requires the approval of Seattle City Council, as workforce oversight is one of the checks-and-balances provided to the legislative branch by the Seattle City Charter. An increase in a department's staff would require negotiations with councilmembers during the budget season, or through an ordinance. To avoid a legislative process, the Mayor or a chief executive may reallocate labor

within their existing workforces, which may be problematic, as it reduces the capacity of another public service.

Reorganization. By far, reorganizing the City of Seattle's public works functions to report to a central governing body would be the most expensive policy alternative examined by this thesis. Millions in staff time, consulting work, and office refurnishing would be required to support a new hierarchy across all public works lines-of-business. In addition, this option may overburden the City's policy analysts and management, as a reorganization demands their time on top of their existing duties. Moreover, new reporting structures have inherent risks related to change management: staff morale, confusion, and over- or under-managed functions resulting from unintended consequences of new leadership.

The majority of staff interviewed in this study were hesitant to support reorganization, as that would entail a highly-visible political process that may not produce the intended results. These employees cited the recent consolidation of the City of Seattle's information technology and human resources functions. In these reorganizations, staff members were quick to point to local media sources that are reported dysfunctional management, low staff morale, and lackluster efficiency improvements. Despite that, other staff members who support reorganization have pointed to these recent cases to showcase the feasibility of reorganizations in the city's present political climate. One interviewee added that Seattle Public Utilities and the Seattle Department of Transportation were created in the 1990s, resulting from the reorganization of the Engineering Department and the Water Department.

From this input, this thesis argues that reorganization is largely unfeasible. For this policy alternative to be actualized, it would require the sponsorship of elected officials and department directors, who may be discouraged by the lackluster results of recent reorganizations.

In addition, leaders may be hesitant to embark on widescale reorganization while they are facing significant cost and risk burdens from the existing large-scale capital improvement programs. Regarding effectiveness, Linden notes that reorganizations typically do not result in material efficiency improvements. This may be true in this policy alternative, since a reorganization does not directly address the underlying conflicts in production systems, rather, it focuses solely on reducing the overarching policy drivers by consolidating leadership.

Policy Option	*Criteria*	*Criteria description*	*Basis*
Status quo	**Cost**	No direct costs. Only opportunity costs.	No action adds no cost, risk, and morale burdens.
	Effectiveness	Very ineffective, since this option does not address the schedule performance gap.	
	Feasibility	Very feasible.	
Lean implementation	**Cost**	Roughly $115,000 for three workshops, plus $22,000 annually for ongoing meetings. Efficiencies may recover these costs.	Costs derived from payroll data. Effectiveness and feasibility derived from staff interviews and literature.
	Effectiveness	Likely to be very effective, contingent on management and staff buy-in.	
	Feasibility	Very feasible, since staff have shown a willingness to embark on production improvements.	
Embedded interdepartmental planners	**Cost**	Two FTEs, or $642,000 annually based on 2018 wages, payroll contributions, and overhead for capitalized labor costs.	Costs derived from payroll data. Effectiveness and feasibility derived from staff interviews and literature.
	Effectiveness	Unclear. No clear linkage between new personnel and underlying schedule performance issues.	
	Feasibility	Relatively unfeasible, as it entails legislative, mayoral, or chief executive-level action.	
Reorganization	**Cost**	Potentially millions in staff time, consulting, management systems updates, and office rearrangements.	Costs derived from payroll data. Effectiveness and feasibility derived from staff interviews and literature.
	Effectiveness	Likely to be moderately effective, addressing the issue of conflicting policy pressures. Reorganizations alone have not been shown to necessarily result in efficiency or effectiveness improvements.	
	Feasibility	Relatively unfeasible, since public works lines-of-business are currently overburdened with current capital programming. May be reluctant to risk cost, image, and morale with large-scale change. Also, this would require buy-in of City Council, the Mayor, and chief executive-level directors.	

Table 5. Concise policy analysis matrix.

Policy recommendation

Based on the examination each policy alternative's potential costs, effectiveness, and feasibility, this study recommends that Seattle Public Utilities and the Seattle Department of Transportation pursue lean production implementation. This study's data and the limited policy analysis has determined that lean implementation has the most desirable benefits and tradeoffs in costs, effectiveness, and feasibility.

In terms of costs, a conservative estimate of three kickoff workshops may cost approximately US$115,000 in upfront labor and consulting, with ongoing work totaling to about US$22,000 yearly. This is meager, compared to the $145 million combined overhead allocation for the following three control levels in the 2018 budget: the Seattle Department of Transportation's Corridor Development unit, Seattle Department of Transportation's Engineering Services unit, as well as Seattle Public Utilities' Shared Cost Projects unit (City of Seattle 2017). Moreover, the investment in lean production may result in cost savings from process efficiencies and reduced change orders. These benefits have the potential to exceed costs.

Effectiveness and feasibility, as discussed above, ranks fairly high. Through staff interviews, many employees were eager to implement lean concepts, such as production system workshops, developing a culture against waste, and empowering all workers to experiment with creative ideas. While lean is promising, it is not a guarantee of success, and is subject to a strong culture of continuous improvement. Further research should corroborate these findings. In addition, any resulting studies should focus on implementation and evaluation procedures.

Tradeoffs of the policy recommendation

Costs. Should the City of Seattle pursue lean implementation, there would be a direct upfront cost of US$115,000, as well as recurring costs totaling to US$22,000 each year. This is the lowest cost out of all policy options except for the status quo, which has no direct costs. When factoring opportunity costs from the status quo, this option may still fare as the lowest-cost alternative, since the City of Seattle may recover the costs of lean implementation from process improvements and a reduction in change orders during construction.

Meanwhile, hiring two new utility planners may cost around US$642,000 in fully-burdened labor costs, while a reorganization effort likely costs millions. Therefore, lean implementation is the best apparent policy alternative with regard to costs.

Effectiveness. Based on the estimated outcomes and effectiveness of these four policy options, lean implementation ranks the highest. Effectiveness is defined as the extent that a particular policy alternative may improve schedule performance. Lean principles directly address the primary reason for the schedule performance gap: disjointed production systems. In contrast, the other policy alternatives do little to tackle the root cause. The status quo does nothing to improve schedule or align production systems. Hiring new utility planners to work within the transportation line of business may build better relationships, while fostering greater understanding of the cross-departmental policy drivers and processes. Despite that, embedded planners do not directly confront schedule underperformance. Finally, reorganizing the City of Seattle's public works also fails to have a clear strategic nexus to process improvements or schedule performance.

Therefore, lean implementation is the best apparent alternative to improving the pre-construction schedule performance of Seattle Public Utilities' scope in the Seattle Department of Transportation's capital projects.

Feasibility. Lean is the second-most feasible option that is considered by this policy analysis, followed by the status quo. The status quo is determined to be more feasible since it entails no action, no risks, and no actual costs.

Meanwhile, hiring new utility planners for transportation projects would require approval from the Seattle City Council. This can be avoided by executive action via re-purposing an existing position, which is also unfavorable, since that would inevitably reduce the capacity of another municipal function. Lean implementation is much more feasible than reorganization, since reorganization demands the buy-in of the Mayor and the Seattle City Council. Not only is it prudent to involve all elected leadership in this a major consolidation effort, but any new chief executives, board members, or commissioners would likely need appointment by the Mayor, followed by confirmation from the Seattle City Council.

Lean, on the other hand, only requires action from staff, management, and relevant executives. Given the small-to-moderate magnitude of costs, embarking on lean implementation would likely not require any approval past the departments' chief executives. Moreover, staff appear to be enthusiastic about principles that underlie lean, adding bottom-up support to these considerations.

In concluding this policy analysis, lean implementation appears to be the most cost-effective and practicable strategy to improve the schedule performance of utility scope that is delivered via transportation capital projects – especially during the initiation, options analysis, and design phases of the project delivery lifecycle.

Chapter 6: Conclusion

As the Seattle Department of Transportation continues to invest hundreds of millions into mobility infrastructure, Seattle Public Utilities must respond with prudent protection, rehabilitation, and replacement measures for their infrastructure that are affected by roadway construction. This study found that the cross-departmental means of planning and delivering capital projects have ample room for improvement: fragmented production systems, inconsistent policy pressures, and separate funding sources may be origins for persistent schedule delays.

To recall, the purpose of this thesis is to explore opportunities to improve the pre-construction schedule performance of Seattle Public Utilities' scope in Seattle Department of Transportation capital projects. Incidentally, this research also mapped out the production system for how utility improvements are delivered in mobility projects, while also identifying any potential mental models that exists within staff, such as the belief that conflicting funding streams leads to friction and adversarial dispute resolutions.

With these findings, this thesis offered reflections on policy processes and the production systems, which informed a policy analysis. To improve schedule performance, this thesis evaluated the following policy alternatives: (a) taking no action, (b) implementing lean production, (c) embedding utility planners into transportation project delivery, and (d) reorganizing the city's public works functions to report to a unified governing body. Given the projected outcomes and expected tradeoffs, this thesis recommends implementing lean production into both department's capital project planning and delivery.

This chance for both agencies to improve their project delivery methods and relationships is well-advised, especially as they collectively invest hundreds of millions of dollars into public works construction. Any inefficiencies have real cost burdens – monetary and otherwise – to the

taxpayers and ratepayers who make up the communities that the City of Seattle serves. Eliminate waste, center processes on outcomes, and improve overall performance are consistent with the paradigm of public service excellence.

Furthermore, lean production can be seen as a replication of ecological systems. In Nature, there is no waste, since every organism plays their role in consuming inputs and producing outputs that are critical to the well-being of the entire ecosystem. Embodying Nature through lean is aligned with our communities' values on sustainability, outdoor exploration, and ecological preservation.

6.1 Contributions

As this study explored Seattle's utility and transportation project delivery processes – and the interconnectedness between them – this thesis presents an actual account of the multiple streams framework and the garbage can model of organizational choice (Zahariadis 2014; Cohen, March, and Olsen 1972). This thesis further exemplifies the role of trust in project delivery, as well as the function of mental models within public administration, more broadly. The thesis also operationalizes factory-production system frameworks, and in particular, lean production within the policy analysis.

This thesis is not grounded in an all-encompassing literature review of a single topic, such as interagency coordination or project partnering. Rather, this research presents a distinctive interdisciplinary lens that is rooted in the public policy process, organizational performance, and project management. With this framework, this thesis ascertains opportunities to improve interagency project delivery that are well-suited to Seattle's unique circumstances in this day and age: namely, a booming portfolio of transportation projects that demand utility involvement, all under the shadows of a thriving economy and generous tax base.

Specifically, this research provides key revelations about complex and intertwined functions within the City of Seattle. The nexus of utilities and transportation is rarely discussed by elected officials and the media, despite the vast magnitude of public investment in this matter. Some may argue that this lack of attention is justified, as sweeping issues like homelessness, affordability, and the Trump administration overwhelm local politics. This thesis conveys an examination of cross-departmental capital project delivery that may otherwise be ignored.

6.2 Final Thoughts

Future studies should quantitatively confirm the existence and extent of the schedule performance gap. In addition, any additional research should dive deeper into lean implementation, especially the correlation between investment into lean implementation and level of efficiency outcomes. These should inform a lean implementation plan, which may include an analysis of scope, schedule, budget, and risk.

Seattle Public Utilities' mission is to provide efficient and forward-looking utility services to keep Seattle the best place to live. Meanwhile, Mayor Jenny Durkan's visions prioritizes issues related to affordability and livability – especially as our city's cost-of-living continues to rise, which fuels displacement, gentrification, and homelessness. Making sure that the City of Seattle's capital investments are well-managed, high-performing, and cost-effective is unquestionably consistent with these values. Ensuring that the public works agencies can work together seamlessly – to serve the collective public interest – is well aligned with new public service.

In this remarkable age of rapid public works construction, Seattle should seize this opportunity to transform the fractured bureaucracy into a harmonious enterprise. Improving outcomes is critical to maintaining public trust and remaining accountable. Spending dollars and

time efficiently is essential to stretching the potential of our limited public funds – especially as the rising demand for infrastructure improvements are concurrent with an affordability crisis (City of Seattle 2014, 2017).

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Appendix A: Determination of Exempt Status, University of Washington Human Subjects Division

DETERMINATION OF EXEMPT STATUS

February 14, 2018

Dear Marlon Herrera:

On 2/14/2018, the University of Washington Human Subjects Division (HSD) reviewed the following application:

Type of Review:	Initial Study
Title of Study:	Seattle Public Utilities' response to Seattle Department of Transportation capital projects
Investigator:	Marlon Herrera
IRB ID:	STUDY00003720
Funding:	None

Exempt Status

HSD determined that your proposed activity is human subjects research that qualifies for exempt status (Category 2).

- This determination is valid for the duration of your research.
- This means that your research is exempt from the federal human subjects regulations, including the requirement for IRB approval and continuing review.
- **Depending on the nature of your study, you may need to obtain other approvals or permissions to conduct your research. For example, you might need to apply for access to data (e.g., to obtain UW student data). Or, you might need to obtain permission from facilities managers to approach possible subjects or conduct research procedures in the facilities (e.g., Seattle School District; the Harborview Emergency Department).**

If you consider changes to the activities in the future and know that the changes will require IRB review (or you are not certain), you may request a review or new determination by submitting a Modification to this application. For information about what changes require a Modification, refer to the **GUIDANCE: Exempt Research**.

Thank you for your commitment to ethical and responsible research. We wish you great success!

Sincerely,

Jennifer McCauley
IRB Administrator, Committee D
206-543-0884
jmccaule@uw.edu

Appendix B: Research Information and Informed Consent for Open-Ended Interview Participants

A STUDY ON SPU AND SDOT INTERAGENCY PROJECTS.

RESEARCH INFORMATION AND PARTICIPANT CONSENT.

Spring 2018

Researcher: Marlon Herrera
Concurrent Master of Public Administration &
Master of Urban Planning Candidate
marlondy@uw.edu

Committee: Jan Whittington, Chair of the Committee
Associate Professor of Urban Design and Planning
janwhit@uw.edu

Joaquín Herranz, Jr.
Associate Professor of Public Policy and Governance
jherranz@uw.edu

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Researchers' statement

We are asking you to be in a research study. The purpose of this consent form is to give you the information you will need to help you decide whether to be in the study or not. Please read the form carefully. You may ask questions about the purpose of the research, what we would ask you to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered all your questions, you can decide if you want to be in the study or not. This process is called "informed consent." We will give you a copy of this form for your records.

Purpose of the study

The primary research question of this study is:

> During initiation, options analysis, and design, what opportunities exist to improve the schedule performance of Seattle Public Utilities' scope in Seattle Department of Transportation capital projects.

The deliverable will include a gap analysis and case study. This work will be presented as a master's thesis, which will be submitted to the University of Washington in partial fulfillment for the concurrent degrees of Master of Public Administration and Master of Urban Planning.

Study procedures

I am kindly requesting a 30-minute semi-structured interview on your experience planning and delivering improvements to Seattle Public Utilities' infrastructure in Seattle Department of Transportation capital projects. Below are example questions:

- Tell me about your role in project planning and delivery, as it relates to SPU interagency projects with SDOT?
- With regard to SPU/SDOT interagency projects, is there any procedural aspects that you think is beneficial to schedule performance?
- Overall, what are the biggest challenges to planning and delivering SPU scope in SDOT projects?
- Are there any specific challenges to schedule performance in SPU/SDOT interagency projects?
- What do you think of the relationship between SPU and SDOT in the context of capital project delivery?
- Tell me about specific procedures in SPU/SDOT project delivery that you find onerous?
- If you were the Mayor, what would you do to improve these processes?
- Do you have any notable stories about SPU/SDOT interagency projects that you would like to share?

Risks, stress or discomfort

There is a risk that unfavorable statements or conclusions may harm your formal and informal standing as an employee of the City of Seattle. I am actively mitigating this risk, per the confidentiality statement below.

Benefits of the study

There are no direct benefits to participating in this study. Participation may help create and disseminate knowledge as it relates to interdepartmental organizational performance in the context of public management.

Financial interest

Marlon Herrera has a financial or other relationship with the City of Seattle. The University of Washington (UW) developed a Conflict Management Plan to reduce the possible effects of this relationship on your safety or welfare.

Confidentiality of research information

All information provided will remain confidential. However, if I learn that you intend to harm yourself or others, I must report that to the authorities.

Information that can reveal your identity will be codified and stored separately from study data. The link between identifiers and codes will be destroyed after completion of this project. Every reasonable attempt will be made to keep your anecdotes, facts, and other data unidentifiable. For example, I will be using aliases throughout the entire data collection process. In addition, I will not be revealing specific job titles or duties in my publication.

All data will be stored on a private computer, and **not** on the City of Seattle's network. Information collected from your participation is expressly delineated from my responsibilities as an employee and are **not** subject to public disclosure.

Refusal or withdrawal

You may refuse to participate, and you are free to withdraw from this study at any time.

Research-related injury

If you think you have been harmed from being in this research, contact Marlon Herrera at marlondy@uw.edu.

The UW does not normally provide compensation for harm except through its discretionary program for medical injury. However, the law may allow you to seek other compensation if the harm is the fault of the researchers. You do not waive any right to seek payment by signing this consent form.

Subject's statement and signature

This study has been explained to me. I volunteer to take part in this research. I have had a chance to ask questions. If I have questions later about the research, or if I have been harmed by participating in this study, I can contact one of the researchers listed on the first page of this consent form. If I have questions about my rights as a research subject, I can call the Human Subjects Division at (206) 543-0098 or call collect at (206) 221-5940. I will receive a copy of this consent form

	X	
PRINTED NAME OF SUBJECT	**SIGNATURE OF SUBJECT**	**DATE**

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1. Determination of exempt status, University of Washington Human Subjects Division.

Appendix C: Questions from the Open-Ended Interviews

A STUDY ON SPU AND SDOT INTERAGENCY PROJECTS.

INTERVIEW QUESTIONS

1. Overall, what are the biggest challenges to planning and delivering SPU scope in SDOT projects? How do these challenges affect our ability to stay on schedule?
2. With regard to SPU/SDOT interagency projects, are there any procedural aspects that you think is working well?
3. If you were the Mayor, what would you do to improve these processes? In an ideal world, how would these processes work?
4. Are there any specific challenges to schedule performance in SPU/SDOT interagency projects?
5. What do you think of the relationship between SPU and SDOT in the context of capital project delivery?
6. Tell me about specific procedures in SPU/SDOT project delivery that you find onerous?

UNIVERSITY of WASHINGTON
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College of Built Environments