Institutional Challenges and Solutions for Global Megaprojects[1]

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I. Introduction

Megaprojects are very large, complex projects requiring new, and often previously untested, management skills and techniques for their successful implementation. Multibillion-dollar projects have become the norm for many infrastructure and resource extraction facilities worldwide over the last decade. However, increased size and scope do not necessarily transform a large project into a "megaproject" in terms of coordination difficulty. (Lessard *et al* 2014) define project complexity in terms of a project's "difficulty, outcome variability and non-linearity, and (non) governability" and they propose a "House of Project Complexity"—a combined structural and process-based theoretical framework for understanding contributors to complexity. We agree with their characterization of the drivers of complexity. We distinguish "megaprojects" from other large projects in terms of the degree to which managers can reduce overall project coordination costs for handling overall project complexity through partitioning of the project into more or less autonomous subprojects. Further, "Global Megaprojects" also involve significant levels of cross-institutional complexity because they involve participants and outside groups from multiple countries with differing languages and institutions.

A. Spatial/Technical Configuration Complexity

The first key to the distinction between a large projects and a megaproject (from a coordination standpoint) is the number and importance of inter-subproject interdependencies that still remain between the most decomposable set of subprojects that can feasibly be conceived and executed. Large-scale, linear, "horizontal" projects like roads, railroads and pipelines with relatively few interconnected subsystems tend to be relatively easy to decompose into nearly independent geographical subprojects that

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face primarily local uncertainties, such as geological or climatic conditions. Such projects can be relatively autonomously coordinated as sets of subprojects, so they pose only a moderate need for central coordination. The $8 Billion Trans-Alaska Pipeline System project was built in this way during the 1970s as a set of five separate pipeline subprojects (plus a number of pumping stations and other ancillary facilities), each of which was small enough to allow for competitive bidding by teams of constructors, and could be managed primarily as a standalone subproject. Large-scale road, railroad, power and water transmission projects are also often procured and managed in this way.

In contrast, a large, spatially concentrated, "vertical" project that has many interconnected subsystems such as a nuclear power plant or large desalination facility is a megaproject because it cannot easily be subdivided, for management purposes, into any feasible configuration of "nearly decomposable [subprojects]" (Simon 1962). These projects exhibit both complexity and tight-coupling (Perrow 1984) among subprojects that have significant levels of the two most coordination-intensive kinds of interdependencies (Levitt 2015):

- *Compatible Interdependencies* that require intensive and continuous information sharing between the interdependent parties to ensure alignment of components' spatial and functional interfaces with each other; and
- *Contentious Interdependencies,* for which the interdependent parties have one or more conflicting subgoals—i.e., where some values of a parameter that affects the conflicting subgoal are better for Party A, but are worse for Party B, and vice versa. For example the designer of a computer's screen prefers high levels of brightness and resolution, which require additional power; the power supply designer prefers to limit total power demand to keep the power supply as light as possible and extend the computer's battery life. Contentious interdependencies require negotiation between the parties to reach agreement on parameter choices (Levitt et al 1999). In the event of deadlocks, they frequently trigger time-consuming escalation to higher levels of engineering and project management for resolution. So they remain difficult and costly to manage.

James Thompson's (1967) classic book, *Organizations in Action,* defines both of these types of interdependence somewhat tautologically to be "reciprocal interdependence" — the kind of interdependence that requires "mutual adjustment" to coordinate. However, he does not distinguish between these two kinds of "reciprocal" interdependence. For sub-tasks with "compatible interdependence," mutual adjustment by the interdependent parties requires only information sharing and updating between the interdependent parties to achieve coordination. In contrast, "contentious interdependence" is much more likely to lead to disagreement and conflict in the process of mutual adjustment, and escalation to resolve the deadlocks occurs more frequently.

B. Maturity of Involved Technologies

The maturity of the key technologies involved in a project also affects the project's divisibility into nearly decomposable subprojects. As complex technologies mature, the developers of subsystems comprising the technology evolve standard solutions for resolving interdependencies at subsystem interfaces through a combination of systematic analysis of remaining interdependencies and trial-and-error adjustment to coordination failures. The resulting standards for subsystem and interface specifications define an evolving "system architecture" for the technology.

A mature system architecture allows a product's multiple subsystems to be developed nearly autonomously. Moreover, it inevitably leads to supply chain fragmentation as specialized providers of subsystems can produce and enhance their subsystems faster and more efficiently than a central provider, following principles of transaction cost economics (Williamson 1979). For example, IBM™ decided to standardize and publish the system architecture for its personal computer in the early 1980s. This spawned a large industry of component suppliers—e.g., Seagate™ for disk drives, Logitech™ for mice and keyboards, etc. —and it turned the development of a new personal computer into a relatively simple project to manage, ultimately commoditizing the entire PC industry.

A complex project involving technologies that have matured to the level that formal or informal system architectures have become standardized and institutionalized thus lends itself to being subdivided more easily into nearly autonomous subprojects organized around its now modular subsystems. In contrast, a large project that incorporates multiple novel technologies whose subsystem performance and interface specifications has not yet been standardized and incorporated into the system architecture creates a large number of new compatible and contentious interdependencies to resolve. Novel components this add substantial incremental coordination complexity for the system integrator to manage and can transform a large project into a megaproject. Thus, from a coordination standpoint, a megaproject is a complex project whose scope, technologies and system architectures are not yet well enough standardized and institutionalized to permit decomposition into nearly autonomous sub-projects without incurring substantial additional central coordination costs; it must be centrally managed as an integrated whole.

In additional to project technical/spatial configuration and technology maturity, two additional complexity dimensions of large projects can make them exponentially more difficult to manage than equally large but less complex projects.

C. Scale of Project's Regional Economic and Political Impact.

A large project based in or traversing through an uninhabited region in a country with low levels of environmental and social concerns and safeguards can be built without energizing or generating social movements that attempt to reshape the project or block it entirely. When a project has large enough impacts on valued natural environments or human populations, it begins to activate or spawn social movements

attempting to reshape or block it. Managing the project then attains a level of political complexity that requires a completely different set of political and public relations skills to manage than a complex technical project for which there is an explicit or implicit social license to proceed—or no need for a social license in an autocratically governed country (McAdam et al 2010). In this way, a project like the Alaska pipeline project described above became a "megaproject" due to its regional economic and environmental impact and the resulting complexity of its relational external stakeholder management challenges, even though it was neatly divisible into nearly autonomous subprojects in terms of its spatial and technical configuration.

D. Cross-Institutional Complexity: "Global Megaprojects"

The fourth dimension of complexity that transforms a large project into a megaproject is its institutional complexity, arising from the participation of key project delivery partners coming from different national institutional frameworks who must find a way to resolve their differences so they can work effectively together to resolve multiple challenging technical, contractual and political issues. We define a large project that has this dimension of complexity as a "Global Megaproject."

This chapter focuses on defining the unique complexity of global megaprojects, assessing the impact of cross-institutional differences, and identifying ways for its sponsors, managers, and other stakeholders to address these challenges. We adopt the formulation developed by Orr et al. (2011: 17) as our working definition of a "global megaproject":

> *A global project is defined as a temporary endeavor where multiple actors seek to optimize outcomes by combining resources from multiple sites, organizations, cultures, and geographies through a combination of contractual hierarchical, and network-based modes of organization.*

E. Chapter Outline

From this densely-packed definition of global megaprojects, we abstract out those elements containing important institutional ingredients in this chapter. We embrace a broad conception of "institutions" to include symbolic frames, rules, and normative frameworks that provide guidance to and justification for varying modes of acting. These symbolic elements are often the source of misunderstandings, disagreements, and conflicts as actors interact across cultures, companies, professional specialties, and countries as they attempt to execute complex megaprojects. These elements are also the soil out of which solutions may be crafted as actors create a shared project identity and overriding objectives, relational contracts, shared governance arrangements, and a common conception of the work to be done and how it will be governed and coordinated.

The chapter is organized into three main sections. In the first, we unpack the notion of institutions to examine the varying elements and mechanisms involved in our conceptual framework. The second examines the distinctive institutional challenges

posed by global megaprojects. And the third considers how the numerous project delivery participants and a variety of other stakeholders can craft institutional elements into a variety of contractual, relational and psychological governance mechanisms to shape and influence project processes and outcomes.

II. The Multifaceted Nature of Institutions

Informed by the ideas generated from more than a century of scholarship (see Scott 2014, chap. 1), we embrace a broad, encompassing conception of institutions:

> *Institutions comprise regulative, normative, and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life* (Scott 2014: 56).

This definition stresses the centrality of symbolic elements in social life but insists that these be connected to the social behavior of actors and linked to resources: we focus on living institutions that are inhabited by actors and intertwined with the play of power. While the formulation privileges the capacity of institutions to guide and control behavior, it is equally important to recognize that institutions support and empower activities and actors. Also, acknowledging the reflexive dualism identified by Giddens (1979), we recognize the ongoing interplay of forces in which existing institutional structures provide a constraining context for actors and action while, at the same time, actors are busily working to harness their position and resources to reproduce, modify, and/or challenge these structures.

Our review of an extensive literature harking back at least to the middle of the 19th century persuades us that institutional theorists have devised and explored at least three different conceptions of the elements underlying institutions and the mechanisms that sustain them. Not surprisingly, these conceptions are broadly associated with disciplinary differences among the investigators. We briefly review each.

A. Diverse Institutional Elements

1. Legal-Administrative ("Regulative") frameworks

From the "historical institutionalists" working at the turn of the last century conducting comparative studies of administrative systems to the current rational choice scholars investigating how rule systems emerge to regulate markets, political scientists stress *regulative* elements as the primary basis of institutions (e.g., Burgess 1902; Moe 1984). Relatedly, economists emphasize these same elements as they examine ways in which the state regulates commerce or the types of governance systems that arise—or are designed—to manage exchanges within and between firms (e.g., North 1990; Williamson (1979). Not surprisingly, their favored subjects of study are formalized administrative structures and legal systems created to manage political and economic behavior. In part because such systems operate to control strangers and/or adversaries, they rely heavily on the mechanism of coercion: surveillance machinery is

created and sanctions are administrated to encourage compliance. It is assumed that those subject to these systems are rational beings, calculating the costs and benefits of compliance or defiance and, in general, will behave instrumentally.

Global megaprojects are confronted with multiple forms of regulative frameworks, including the laws of home and host countries, legal agreements with financing firms, regulations of regional and local entities, and corporate hierarchies. On the "solution" side, project management units create rules and sanctions to buttress contractual agreements and to form the scaffolding for agreements between project and client entities.

2. Normative frameworks

From the beginnings of their discipline, sociologists have embraced both a broader and more diffuse conception of institutions. Because they focus on arenas such as the stratification system and ethnic relations, religion, the family, the community, and voluntary associations, they stress the importance to social order of social obligations and binding expectations. They view social institutions as normative frameworks providing a moral order undergirding social life (e.g., Durkheim 1912/1961; Selznick 1992).

Normative systems are made up of both values, providing conceptions of preferred or desired ends, and norms which specify how the valued states are to be pursued. The differing facets of society—e.g., political, economic, family, religion—vary in terms of values they serve and the appropriate means for attaining them, giving rise to diverse *institutional logics* guiding behavior in these separate spheres (Davis 1949; Friedland and Alford 1991). Rather than assuming that individuals adopt an instrumental orientation, individuals are seen to be guided by a sense of appropriateness. Rather than asking: "what are my interests?" individuals ask "what is my role in this system and how am I expected to behave in circumstances such as this"? (March and Olsen 1989). The mechanisms at work securing compliance are shared standards and internalized expectations that can incur severe social sanctions when violated.

Megaprojects operate in a sea of normative pressures ranging from the professional standards which undergird global construction practices to the moral standards evoked by NGOs overseeing the welfare of the environments and the rights of local communities. Normative frameworks also loom large in the kinds of mechanisms that underlie relational contracting and the use of "soft" voluntary standards, such as the "Equator Principles" used by banks to indicate they are requiring that environmental and social safeguards be respected on projects that they finance.

3. Cultural-cognitive frameworks

For many decades, anthropologists have labored to examine and explain the extraordinary variation that exists over time and space among different tribes and peoples. The dominant explanation developed is that these groups embrace a shared

conception of their social world, indeed a common notion of social reality itself (Kroeber and Kluckhohn 1952; Geertz 1973). Although emerging much later, a closely related conception has been devised by cognitive psychologists who stress the importance of cognitive frames, mental models, and related scripts as an explanation for individual behavior (e.g. Lewin 1951; Shank and Abelson 1977). Linking these two views, Hofstede (1984) has suggested that individuals from different cultures are equipped with diverse "software" of their minds.

A cultural-cognitive conception of institutions stresses the extent to which social order relies on a shared understanding of the situation resting on deeply embedded, taken-for-granted assumptions that operate often beneath conscious awareness. The paring of cultural and cognitive stresses the bridge between subjective perceptions and interpretations on the one hand and wider shared semiotic systems of meaning on the other.

A hallmark of global megaprojects is the wide range of cultural differences they confront, ranging from varying economic and religious ideologies to differing ethnicities and languages. Cultural systems also support solutions as ideas can be crafted to frame or reframe task conceptions and shared identities can support cooperative behavior among participants (Swidler 1986).

In sum, over the centuries, scholars have identified and often selectively emphasized one or another type of institutional element based on their interest in varying chunks or types of social order. This work viewed as a whole underscores the multifaceted nature of institutional systems. In our view, it also suggests the wisdom of constructing an encompassing framework that can include all of the elements providing the ingredients of rich and robust institutional systems.

B. Institutional Elements in combination

While, as suggested, one type of element is dominant in some social orders, providing a distinctive "pillar" to support the structure, it is more common to observe the elements working in combination: the interaction of multiple "pillars". Any robust institutional arrangement is made up of varying combinations of regulative, normative, and cultural-cognitive elements. A part of the work of analyzing any institution is to parse the interplay of the several elements. In some cases, they will be mutually supportive, as when informal work group norms emerge that are consistent with formal rules or broader ideologies; in other cases, rules may be enacted, but over time are redefined or transformed by ongoing work routines and belief systems; in still other cases the elements are misaligned, leading to instability, conflict and change.

The mechanisms at work in sustaining and changing institutions also vary in their malleability. Formal rules and legal frameworks are more readily enacted or changed: they are "fast-moving" institutions compared to "slow moving" normative and cultural systems, which more often evolve as the result of unintended, interdependent actions of collections of individuals over long periods of time (Roland 2004; Scott 2013:114).

The challenges posed by analyzing institutions are rendered more transparent and understandable if we view them as working within a delimited social arena. One promising approach to defining these boundaries is provided by the concept of *organization field.*

III. Organization Fields and Projects

Global megaprojects are usefully viewed as a distinctive type of organization field. Such an approach incorporates not only the full range of relevant relational elements (stakeholders), but also the salient symbolic elements that inform and motivate the actions of participants.

A. Organizational fields

Following DiMaggio and Powell (1983: 148):

> *By organization field, we mean those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products.*

Like the economists' notion of industry, an organization field usually highlights a category of similar organizations, e.g., infrastructure construction projects, but also extends attention to other organizations providing crucial support or oversight. It allows us to treat as the focus of analysis a complex of diverse organizations operating in the same "small world"—organizations sharing the same or related institutional habits. "The notion of field connotes the existence of a community or organizations that partakes of a common meaning system and whose participants interact more frequently and fatefully with one another than with actors outside the field" (Scott 1994: 207-208).

As institutional systems, all organization fields contain actors—both individual and collective—who are supporting by varying amounts and types of capital—e.g., land, financial, social and cultural—carry differing institutional logics, and are overseen by varying types of governance structures (Scott et al. 2000). Global megaprojects are a distinctive type of organization fields characterized by interactions among an extraordinarily diverse and shifting set of actors or stakeholders.

B. Multiple Levels

The examination of global megaprojects may be conducted at varying levels of analysis. For example, at the international level, Khagram (2004) chronicles the rise and fall of the construction of big dams, from its origins in the early 20th century in the U.S., through its spread and eventual decline in the developing world. He parses the changes over times in stakeholders, institutional logics and regulatory regimes in his rich institutional history. At a lower level, numerous studies examine project organizations conducting similar types of work within a given nation or region. For example, Jooste and colleagues (Jooste, Levitt and and Scott 2011; Jooste and Scott

2011) studied a sample of public-private partnership (PPP) construction programs, comparing field configurations in three areas, South Africa, the Province of British Columbia in Canada, and the Republic of Korea. They found varying program configurations involving differing sponsoring departments, company combinations and intermediaries, e.g., financial and legal advisors, auditors, advocacy groups and consultants. More significantly, the approach allowed consideration of the broader political and societal environment affecting the conception and design of PPP programs. And, we have many useful studies focusing on a single project organization as its work is affected by the surrounding support and control entities (e.g., Mahalingam, Levitt and Scott 2011; South, Levitt and Dewulf, 2015).

C. Distinctive features of global megaprojects' institutional fields

As organization fields, global megaprojects exhibit a number of features which set them apart from other, less complex arenas.

1. More diverse set of participants

Megaprojects by their nature involve a diverse set of participants. The participants vary in terms of their professional roles: legislators, government agency executives, a range of private firms proving expertise from several planning disciplines, multiple engineering design disciplines, construction companies of multiple specialties and their construction workers, who may be represented by up to 15 separate craft-based unions in the US.

During the 20th century, governments or multilateral development agencies like the World Bank or Asian Development Bank, typically took a leading role in financing megaprojects through the issuance and sale of government bonds. However, in the 21st century, governments worldwide are facing severe financial strictures so that many large infrastructure projects are being privately financed as long-term concessions of 25 to 50 years or even longer. This has brought a new set of financial participants into the megaprojects' fields, including infrastructure investment funds, and a variety of institutional investors who typically provide long-term debt for concession projects, such as pension funds, sovereign funds, family offices and university endowments. Commercial banks provided megaproject debt in earlier times, but the stricter banking regulations that imposed higher capital reserves on banks worldwide based on their risk exposure have made it less attractive for them to lend money to long-term investments such as infrastructure concessions.

As projects proceed through the shaping phase into design and construction, a variety of NGOs and civic organizations will almost always be activated or even created to advocate for, or more often to oppose, some aspects of the project's scope scale and/or location or even its raison d'être. Moreover, individuals with strong opinions regarding a given project can now disseminate their support for or opposition to aspects of a megaproject using both traditional and increasingly "viral" social media channels. In this sense, the entry of a mega-project into an existing organization field can transform

the nature of the field, generating a very complex and heavily contested institutional field for the sponsors and managers of megaprojects to traverse.

Over the 30 to 50 year lifespan of a megaproject, local politics will often shift multiple times between local and national political parties that are more or less pro-development vs. conservation, or pro-business vs. pro-large government. Global geopolitics can change seismically as in the Arab Spring of the early 2000's; economic power can shift across continents as in the phenomenal economic rise of China during the 1990s and the fall of Europe's economic power following the 2007 financial crisis; and global demand for the commodities often associated with the inputs or outputs of megaprojects can rise or fall by orders of magnitude, as in the drastic fall in the price of crude oil, iron, copper and gold in mid-2015 as China's economy declined abruptly from its decades-long, double-digit annual growth rate. Coping with all of these risks poses huge governance challenges for global megaprojects and can precipitously reshape their institutional fields.

2. Varying degrees of local embeddedness

While some economic models assume that rational actors are unaffected by the social structures in which they are located, sociologists emphasize that all actors are embedded in and affected by concrete personal and social systems in which they operate (Granovetter 1985). However, particularly for global mega-projects, it is important to emphasize that the degree to which participants are embedded in the local context surrounding the project varies greatly. Defining "local embeddedness" as the "overall number of relationships and the level of interaction, coordination, or negotiation between an entrant" and other local entities involved in the project, (Orr and Levitt 2011: 185) document the substantial differences that exist among types of project participants. Based on interviews with more than 50 managers who had worked on global infrastructure projects, they found that general contractors exhibited the highest level of local embeddedness while systems contractors, such as those who supply elevators in a building bioreactors for a water treatment system, exhibit lower levels. Developers and engineering, financial or legal consultants show intermediate levels, but also greater variability depending on the nature of their services to the project.

Strategies for managing high levels of embeddedness vary from engaging in attempts to increase local knowledge (e.g., hiring locals) to decreasing the need for local knowledge (e.g., outsourcing to local contractors), to reducing the impact of a local knowledge deficit (e.g., buying political risk insurance) (Orr and Levitt 2011).

3. Long duration, multi-phase project lifecycle

Megaprojects move through a predictable set of phases in their lifecycle: shaping; design and construction; startup and commissioning; operations and maintenance; and renovation, demolition or recycling.

As (Miller and Olleros 2000) point out, the Project Shaping phase is the crucible in which a megaproject is gestated and molded. During the project shaping phase, the

lead stakeholder group promotes the project and shapes it through successive iterations to accommodate and/or overwhelm the economic, environmental and social desires and constraints of other key stakeholders, including regulatory agencies, other legislators and a variety of NGOs or community groups that get activated to support or oppose different versions of the project's scale, scope and location. In most developed countries, the project is required to proceed through a lengthy environmental review process, which may also include a review of its social impacts. This phase can last from several years up to several decades. Projects like the Channel Tunnel from the UK to France and the California High Speed Rail Project were gestated over more than 30 years.

The proponents of a project during this phase typically include a group of local, state and/or national politicians, a set of corporations that have an economic stake in the project's delivery or end use, one or more labor unions or trade associations as members could benefit from the project, individuals or businesses that own real assets whose value would be enhanced by the project (such as the real estate tycoons who owned the orange orchards that would be irrigated by the proposed new aqueduct depicted in the movie, Chinatown) and multiple other individuals, media and economically disinterested individuals who support the project for ideological reasons.

Projects sometimes advance through several iterations of the shaping phase, are abandoned by the original sponsors in the face of overwhelming opposition or a changed economic and political environment, and are then later rekindled by the same or new sponsors when conditions change. For example satisfying the multiple state and federal regulatory agencies that had jurisdiction for environmental review of the Trans-Alaska Oil Pipeline System that was intended to ship crude oil from Prudhoe Bay on the North Slope of Alaska to a marine terminal at the ice-free port of Valdez in the southern part of the state made the project seem infeasible to both oil companies and regional politicians who supported this project during the 1960s. However, following the 1973 Arab oil embargo of the US oil prices rose dramatically and the national political mood shifted abruptly toward finding ways to address this "national petroleum emergency." Responding to the public outcry over gasoline scarcity and cost, the President and Congress of the US took the unusual step of setting up an integrated environmental review process for this project by a single agency to simplify and obviate the tangle of legal and regulatory challenges that the project had previously faced. This made the project feasible to implement on a reasonable timescale, so a group of oil companies formed the Alyeska joint venture to deliver the project, five construction joint ventures were each contracted to deliver one segment of the pipeline and this megaproject of enormous technical and logistical complexity moved ahead so rapidly that oil began flowing through the pipeline by 1977.

The shaping phase is arguably the most critical phase of a project and the most turbulent phase in terms of the development of its institutional field. The reason for this is that the conceptual planning and design decisions that are made during this phase of

the project will typically lock in many aspects of what will be the final project configuration. Once the decision has been made by its proponents to commit more substantial investments to proceed with detailed design and construction, the steadily escalating investments by all parties in the agreed-upon scale, scope and location together with the incremental cost and time that would be involved in renegotiating and changing commitments and agreements that have been reached between the multiple stakeholders during this phase, make it increasingly unlikely that a project's fundamental shape will be significantly changed at the conclusion of the shaping phase.

Following the project shaping phase the level of investment in the project increases rapidly as detailed design, procurement of materials and components and construction proceed, typically following an S-curve trajectory. At this phase, the project becomes very real to, and impactful upon, local communities. Megaprojects are large enough that they frequently drive local or even regional economic booms that create regional or even global scarcities of skilled labor and key commodities, components or construction equipment and, in turn, drive up real estate and consumer prices for everything. In addition, they frequently generate significant amounts of vehicular traffic, noise, air pollution, pollution of waterways or groundwater, the importation of large numbers of construction workers and all of the "project camp followers" who can introduce alcohol abuse, drugs, prostitution and other social ills that severely disrupt what were previously sleepy communities.

The operations and maintenance phase is the lengthiest phase of a megaproject's lifecycle, and can extend for as long as 50 to 100 years. This phase is often the least challenging phase to manage. Nevertheless, governments worldwide have systematically under-maintained large infrastructure projects in favor of using government funds to launch more politically-appealing new projects. When the old bridges literally collapse or the water system leaks so badly that it is beyond repair, local legislators then seek national assistance to build replacement projects in a crisis environment. Recent US examples include the clamor for federal assistance following the New Orleans flooding due to levee collapses in the wake of hurricane Katrina and the collapse of a bridge on an Interstate highway in Minnesota.

For infrastructure megaprojects like water supply systems, bridges or roads that charge tolls or fees to users, the level, rate of increase—or even very existence—of mandatory user fees can generate severe political challenges for the governmental or private project's owners and operators. New user fees and restrictions on groundwater pumping form the aquifer generated such an outcry from local urban water users and farmers, respectively, during the early operational phase of the Cochabamba water project in Bolivia that it precipitated a mini-revolution regionally and ultimately a revolution that led to a new national government in the country.

In the final stage, when projects reach the end of their useful life for either technical or economic reasons, their assets must be renovated or demolished and their materials and components recycled to the extent feasible. This, too, can be a

contentious process when powerful stakeholders disagree on the need or desirability of various options for expansion or renovation vs. demolition, as in the case of some older urban freeways in cities like San Francisco and Brooklyn New York. Because of lax oversight, companies often fail to take responsibility for cleanup or restoration activities. The phases identified for the life-course of megaprojects is reflected in a matching fragmentation of the supply chain that delivers them. As (Lawrence and Lorsch 1967) explain, such fragmentation leads to a differentiation in skills, and more importantly, to a differentiation in goals. The separate firms or agencies that plan megaprojects, design them, build them and operate them develop local subgoals that increasingly diverge from those of the long terms sponsors, investors and users.

Flyvbjerg and his colleagues (Flyvbjerg *et al* 2002; 2003) have persuasively argued and documented that megaproject planners—in explicit or implicit collusion with sponsoring agencies and firms—systematically underestimate the cost and time required to develop megaprojects and over-estimate the demand for them. In a similar vein (Levitt *et al* 1980) *and* (Henisz *et al* 2012) argue that design firms in a traditional design-bid-build megaproject delivery process have strong incentives to over-design facilities, both to reduce the design effort required and to protect themselves against liability from failures. And the economic incentive for fixed price, competitively bid contractors in this delivery process is to bid just low enough to be selected, build at the lowest cost that can satisfy the specifications, and then seek additional compensation by negotiating change orders based on any perceived or defensible change, inconsistency or incompleteness of the project design. This “broken agency” across project phases, detailed in (Henisz *et al* 2012) gravely complicates the management of megaprojects and can heavily impact their outcomes.

Global megaprojects thus have a very long life cycle, often exceeding the lives of companies, and almost always exceeding the tenure of particular legislators or political parties. They include a diverse set of participants with a variety of skills, different and frequently conflicting goals, different institutions and dynamic levels of involvement. This creates a set of risks and associated management challenges for megaprojects that are very difficult to anticipate, even with the most diligent and thorough risk analysis.

4. Shifting of anchor tenant

As just described, major infrastructure projects pass through multiple lifecycle phases in which a variety of public, private, non-profit and civic participants are activated and enter the project’s institutional field, while others are deactivated and exit the field. At the same time, the central and most influential player in the institutional field that primarily shapes the institutional logic and direction of the project — analogous to a stakeholder network’s “anchor tenant” (Padgett and Powell 2014)— also changes by project phase.

For example, in a stakeholder network analysis of the California State Route 91 (SR91X) public-private infrastructure concession project, (South et al 2015) found that the levels of participation by key stakeholders in the project's institutional field rose and fell across project phases, as shown in Figure 1.

> *"As specific stakeholders interacted within the PPP and with each other, and in consequence with the critical events, the level of involvement changed dramatically. In the SR91X case, Caltrans took a dominant position at the beginning of the project, but upon concluding [the] award they became less involved with the PPP.*

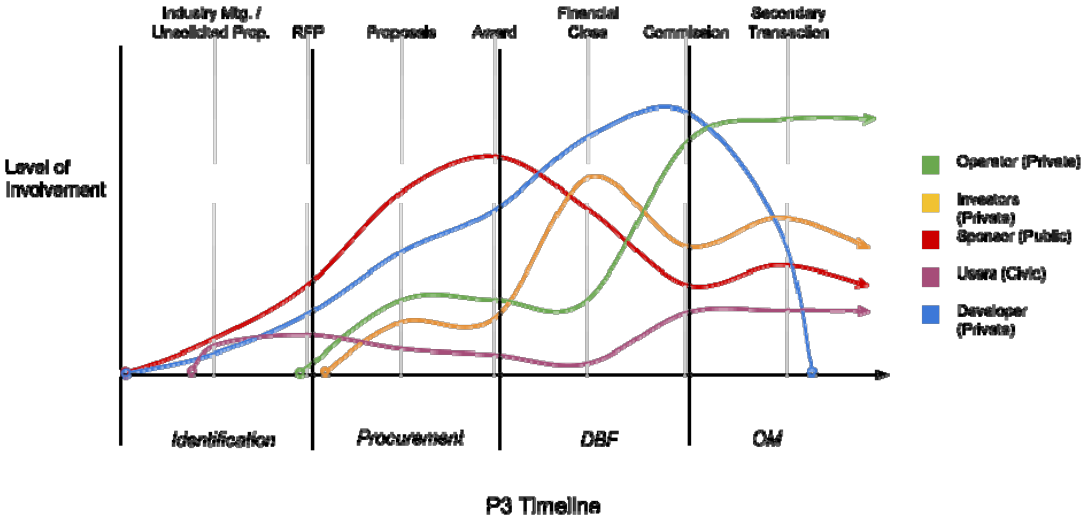

Figure 1. Involvement level of key actors in SR91X at critical events over the course of development. *Source: (South et al 2015)*

"[The California Private Transportation Company (CPTC) - a developer SPV consortium of three corporate organizations, including two U.S. construction firms and one European toll road operator] (and their parallel competition) were involved prior to the official RFP, and continued to participate as SR91X developed. As a result of a concession award to CPTC, the SPVs competition quickly diminished, but CPTC continued to develop a dominant place in the PPP. As financial close was achieved, CPTC had become the most involved stakeholder in SR91X. Then as the project was commissioned and early operations commenced, the majority ownership in the SPV consorti[um] recognized that the business model was not consistent with their operations. Daniel Hanson, a private executive closely involved with SR91X, noted, "It was lots of work, lots of friggin politics, so it didn't make sense to continue with equity in PPPs." Having de-risked SR91X of construction and early development risks,

CPTC sought opportunity to sell their equity in the concession. After an unsuccessful sale attempt to a newly formed nonprofit organization (established for the purpose of privately owning and managing SR91X), CPTC eventually made an agreement with Orange County Transportation Agency (OCTA) to buy out their equity in the agreement.[OCTA] effectually become the new concessionaire. Although, OCTA was interested in maintaining the existing business model and contracted with the previous SPV's operations equity partner who retained (and later expanded) their existing operations staff while OCTA dedicated less than two full-time equivalents to manage the asset." (South et al 2015)

IV. Responding to Megaprojects' Institutional Challenges: Mixing and Matching Governance Mechanisms

Global megaprojects are exceptionally challenging to manage, as explained above. Their large and complex spatial and technical scope, their macroeconomic importance to regions and countries, their potential incorporation of novel embedded technologies, and their extended duration and institutionally diverse participants all create huge coordination challenges. The attendant economic and political risks arising from these sources of managerial complexity have proven impossible to manage using strictly contractual means. As Williamson (1979) argues, the propagation of "contingent claims" clauses, which get incorporated into megaprojects' contracts in an attempt by lawyers to address every newly discovered or newly imagined risk, make the resulting multi-volume contracts unwieldy and costly to create, negotiate and administer. So megaprojects inevitably incur huge claims and costly arbitration and litigation that can extend for decades. The current project to enlarge the Panama Canal is an excellent example of this tendency.

Fortunately, we have found that successful megaproject managers can and do augment their projects' necessarily incomplete contracts based on regulatory mechanisms, which have proven to be unable to fully address the management challenges of delivering global megaprojects, with "relational governance" mechanisms based on the other two institutional pillars— normative and cultural-cognitive elements. The final section of this chapter describes explains some of the relational governance mechanisms that managers can employ to augment the contractual/legal governance of global megaprojects. A more detailed coverage of these mechanisms can be found in (Henisz *et al* 2012).

A. Enhanced legal-contractual governance mechanisms

Clauses can be embedded in megaprojects' contracts that "creat[e] a significant, long-term economic stake for the most influential counterparties—the "selectorate" (Mesquita et al., 1999)—[to] align their interests" (Henisz *et al* 2012). These include local hiring quotas, local procurement set-asides or investment in the project by local governments and local pension funds or sovereign funds. By better aligning the interest

of participants or incorporating those of potential project opponents, such clauses can reduce the tendency toward conflict or opposition. Similarly, if a multilateral bank, such as The World Bank or Asian Development Bank, is brought in as a grantor or lender to the project, both the local government or private client and contractor must weigh the “shadow of the future”—the risk to their reputations that could potentially limit future business opportunities—when considering whether and how to deal with political, economic, geological, social or other perceived changes in the project context that could be the basis for opportunistic claims or contractual renegotiations.

A second way to augment traditional contracts to align the interests of key members of the internal project delivery team is to set them up as a framework of alliance contracts. In the approach, the overall project management entity employs clauses in its contracts with supply chain partners that recreate many key elements of a unified hierarchy (Stinchcombe 1986). This “virtually integrates” the geographically and functionally fragmented construction industry supply chain to reconstitute the project as a single “macrofirm” (Dioguardi 1983) or "quasi-firm” (Eccles 1981) in which the contractual terms attempt to create a framework in which all participants have more or less shared economic objectives (Gunnarson & Levitt 1982). This approach was employed in some North Sea oil projects, and was subsequently used to build Heathrow Terminal Five (Gil 2005).

Sutter Health, a large US healthcare provider, is now using this form of contract to develop most of its new or refurbished multi-billion-dollar hospitals on the US West Coast, and the approach is gaining traction among other UK, US and Australian clients for delivering large, complex megaprojects. All the key parties to these so-called Integrated Project Delivery (IPD) contracts— the multiple design firms, the prime or general contractor and the major specialty construction firms—sign a single integrated form of agreement (IFOA) in which they agree that each party's direct costs will be reimbursed, liability claims against each other will be waived, and the parties’ home office overhead costs and profits will be earned based on the degree to which a set of high-level project criteria and goals of the client are met, including budget, but also schedule, quality, and other more subjective metrics.

However, even these legal mechanisms to augment project contracts can break down in the face of significant changes in any of the key project contextual dimensions, especially when the potential fiscal or economic impact of changes reaches the level that it poses significant political or business career risks to individuals—or profitably and even survival risks to their organizations—on either side of the contract. So how is it that global megaprojects are often successfully completed in spite of these challenges? We argue that successful clients and managers of project delivery teams employ additional, relational governance mechanisms built on normative and cultural-cognitive institutions to encourage cooperative behavior and discourage opportunism by all parties in global megaprojects.

B. Normative and cognitive-cultural governance mechanisms

Normative and cognitive-cultural megaproject project governance mechanisms build on sociological and psychological processes that have by now been well studied and are broadly accepted. Social exchange in which parties exchange favors for obligations (Blau 1964; Homans 1958) and identity theory in which people augment or subsume their existing identities with identities based on perceived belongingness to new groups or communities (Armstong 2002; Scott and Lane, 2000) are two examples of this.

1. Shared identity based on an exciting project vision

Managers of megaprojects have the opportunity to describe and continuously espouse the goals of their projects in ways that engage project participants' imaginations and passions. Unlike their peers in manufacturing, workers on construction projects build large and enduring "monuments" to their labor that offer a visible and "concrete" meaning for the work they do, and that they can proudly show off to their friends and families. Research by Borcherding (19xx) on the motivation of construction workers illustrated this dramatically. Electrical workers on two very similar large coal-fired power plant megaprojects in the Four Corners area of the Southwestern United States were asked what they were doing by a researcher. A worker on the first project explained how he was connecting cables from a particular safety system to a gauge on a control panel. An electrical worker doing a virtually identical task on the second project said to the researcher, "I am lighting up the Southwestern United States!"

Fligstein (2001: 106; 112) points out that some skillful individuals can transform organization fields by "providing actors with collective identities as motives for action"—to "create new systems of meaning" that allow disparate groups to come together in the pursuit of goals that appeal to large numbers—to "find reasons to cooperate". Many megaprojects, especially social infrastructure projects like hospitals or sports stadiums, and civil infrastructure projects like water supply, roads or power projects, produce not only concrete monuments to the labors of their participants, but also generate highly visible social economic or cultural benefits. Skillful managers can engage the imaginations and passions of workers and managers contributing to these benefits by making the project goals highly visible and by continuously reminding workers of the importance and societal value of the project in which they are engaged.

2. Partnering and colocation of key participants

Several public and private organizations that are required by their charters or policies to employ traditional fixed-price, competitive bid contracting approaches attempt to use early engagement of participants in social settings that build trust to enhance their future cooperativeness. A "ropes course," with physical obstacles—e.g. high, smooth walls—that requires cooperation among participants for any individual to traverse them, is one example of this kind of trust-building exercise that some megaproject clients engage in. Early, all-hands, planning meetings in which the participants begin to define the conceptual design of the project collectively using teams

made up of representatives from the client and multiple delivery firms are another example of a mechanism that can build trust and develop shared project identity. Managers will often make legally nonbinding pledges to one another in these settings to escalate issues for resolution by senior managers, for whom the shadow of the future may be more salient than the outcome of the current project. These and other "partnering" mechanisms that attempt to build shared project identity and trust between parties can help to advance project execution but may break down in the face of changes that impact significantly on the project's perceived scope or schedule and the resulting cost implications for the various parties.

3. Procedural justice

Research on procedural justice, versus distributive justice, has demonstrated that following "fair processes" in making controversial and highly contested decisions of all kinds will result in participants having a higher sense of ownership of the ultimate decision and a greater willingness to accept even outcomes that are suboptimal for them (Kim and Mauborgne 1991). The three elements that generate perceptions of procedural justice are: early *engagement of participants* in presenting and debating their points of view; clear and rational *explanation of the criteria and processes* used to make the final decision; and *setting out clear expectations* for what will occur next. All contribute to a sense of procedural justice and increase the level of cooperation by involved parties. When prior assumptions about the context of a project change, the extent to which managers employ processes that are perceived to be fair can significantly affect the degree of cooperation by and among other megaproject participants.

4. Building a strong project culture

There is a large body of literature demonstrating that organization culture is set by the vision of organizational leaders as substantiated in their actions (Selznick 1957). Managers who assert they care about the safety of workers on megaprojects above everything else, but focus only on cost and schedule when they visit projects that have recently experienced accidents, expose themselves as hypocritical and inauthentic. Successful megaproject managers immerse themselves in the local environments and the cultures of the various project participants and self-consciously act in ways that demonstrate sensitivity to the significant institutional differences among project participants. This allows them to avoid making a major cross-cultural *faux pas,* and to build bridges between their project's multiple sets of cultures and institutions. The Swedish manager of a successful major infrastructure project in Afghanistan (prior to the Russian occupation) wrote a book on the history and culture of Afghanistan at the end of the project. Other megaproject managers who have had success have studied the histories and religious texts of key groups on their projects and used this institutional contextual knowledge to govern their everyday practices.

V. Conclusions

Megaprojects pose political, institutional, macroeconomic and fiscal challenges that create “wicked” problems for managers. Traditional legal-contractual governance mechanisms almost always break down in the face of the risks that these challenges create over their extended durations. We have identified some of the unique challenges of global mega projects for which the cross-institutional differences create particular challenges. At the same time, we have shown how the three pillars of institutions can be used to shape governance mechanisms that render the legal-contractual mechanisms more supportive of long-term cooperation by the project's diverse participants, and to augment the legal-contractual mechanisms with relational contracting mechanisms sculpted from the normative and cognitive cultural pillars of institutions.

Readers interested in a more detailed description of the three pillars of institutions described in this chapter should refer to (Scott 2014). And managers interested in harnessing these pillars of institutions to augment traditional governance approaches for global megaprojects can find additional detail and references about the bases and application of these mechanisms in (Henisz et al, 2012).

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