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The role of social heuristics in project-centred production networks: insights from the commercial construction industry

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Project production networks or PPNs are now the primary means for organizing in many industries including fashion design and manufacturing, moviemaking and construction projects. PPNs enable professionally and geographically distributed participants of a common project to bring their expertise and resources together to achieve an economically and technically superior product than a single firm could produce. PPNs also have benefits over purely market-based contracting relationships as participants often recombine to work on projects serially allowing knowledge and relationships to develop in ways that support production outcomes. The growth in the use of PPNs has led to a number of studies describing the structural characteristics and benefits of this organizing strategy as compared to firms and markets. Relatively little analysis has been done of the ways in which PPNs govern themselves, however. We report here on PPN governance in commercial construction focusing on the role that social heuristics as shared rules-of-thumb play in both aiding personal decision-making while also helping to govern network coordination across economic and social space. Through the use of the 'default-design heuristic', the 'value-added function and flexibility heuristics' and 'the reputational heuristic' commercial building practitioners both reduce coordination costs while simultaneously providing a justifiable foundation for their decisions in the high-stakes context of networked production and exchange relations.

Keywords: Decision-making, heuristics, networks, network governance, project management.

Introduction

Project-centred production networks (PPNs) are an increasingly important form of economic organization and are now used globally to conduct a wide range of production activities from developing computer chips to designer drugs. Although not new, PPNs gained recent notice because innovative 'new economy' industries like biotech, information technology and consulting services use the PPN form successfully. It is a form of economic organization that networks producers, buyers, sellers, subcontractors, clients and consultants into a temporary and flexible organization (see Powell *et al.* 2005). The PPN increasingly is seen as a lesser cost and adaptable means to promote industry growth and economic development (Powell, 1998; Powell *et al.*, 2005; Smith-Doerr and Powell, 2005).

PPNs, however, are used in a wide array of traditional industries too, including some that are making a transition towards less vertical integration and a greater dependence on outsourcing and commodity chain production (Appelbaum *et al.*, 1994; Gereffi and Korzeniewicz, 1994; Gereffi *et al.*, 2005) and project-centred delivery of products and services (Scott *et al.*, 2011). Rather than control all aspects of production 'in-house' they are incorporating more ongoing networks to gain both specialized expertise and reduce ongoing overhead (Dicken, 2003). Industries that have become reliant on PPN include auto parts (Schrank, 2004), footwear (Cheng, 2001) and apparel industries (Uzzi, 1996). Other industries have used elements of PPNs for years, including film production (Baker and Faulkner, 1991), publishing (Coser *et al.*, 1982; Baker and Faulkner, 1991; Jones, 1996), investment banking and

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financial services (Eccles and Crane, 1987; Zuckerman, 1999). Commercial building and heavy construction have historically been organized as a PPN (Stinchcombe, 1959; Eccles, 1981a,b; Henisz and Levitt, 2009; Beamish and Biggart, 2010; Taylor and Levitt, 2010; Scott *et al.*, 2011).

Researchers now agree that the PPN is neither a hierarchy or firm, nor merely a nexus of market contracts. We also do not believe that PPN should be understood as a hybrid of these two forms. Rather network forms of organization such as the PPN are qualitatively different with distinctive characteristics (Granovetter 1973, 1985; Eccles and Crane, 1987; Baker, 1990; Uzzi, 1997; Powell, 1998; Podolny, 2001; Watts, 2004; Smith-Doerr and Powell, 2005). PPN, like other types of social networks, reflects a 'relational form of governance in which authority is dispersed across distinct roles and positions' (Smith-Doerr and Powell, 2005).

Nonetheless, little research on networks attempts to understand issues of 'network governance'. Rather researchers tend to focus on issues of network architecture and the role and position of different agents in networks. We know less about how ongoing network coordination, reproduction and longevity occur, is enhanced, and even undermined by parties to the network (Podolny and Page, 1998; Smith-Doerr and Powell, 2005). Because this research emphasizes the structure of networks over the social rules that govern behaviours within networks, it also tends to operationalize strong and overly simplistic assumptions about network-agent behaviour such as how choice is exercised within them (Schweitzer *et al.*, 2009).

In this paper we focus on the basis for individual decision-making in PPN and the relationship decision-making has with network governance. Our insights emerged from our field studies of the commercial building industry (CBI), a quintessential PPN.[1] What we found and term 'social heuristics' are rules-of-thumb relied on by practitioners in CBI to make decisions. We define social heuristics as collectively held principles of evaluation that act as (quasi) models for choice and in so doing make agent search, assessment and selection processes both simpler as well as socially accountable. Social heuristics reduce coordination costs while simultaneously providing a justifiable foundation for actors' decisions in the context of networked production and exchange relations. In this capacity, social heuristics serve as both individual decision-making short cuts while also supplying a governance function insofar as individual decisions align with collective expectations and therefore reinforce ongoing network coordination and reproduction.

Understanding network governance is important to the success and failure of industries that rely on PPN, just as the governance of firms is improved by understanding the social bases of hierarchical organization (Meyer and Rowan, 1977; Selznick, 1980; Dimaggio and Powell, 1991; Scott, 1995; Weick, 1995). Network governance research should include study not only of network strengths but also the basis for 'network failures' (Podolny, 2001; Schrank and Witford, 2009; Whitford and Schrank, 2009; Schrank and Witford, 2010). Understanding network failure requires an explicit focus on those aspects of production networks that transcend individual interpersonal and organizational point-to-point ties[2] because networks ultimately do not fail, but forms of network governance do (Podolny and Page, 1998).

Understanding the governance of economic production networks requires examination of, for example: How is coordination accomplished and social order maintained in PPN where participants are not 'free' to exchange as in a market or to form a firm? How are important decisions regarding designs, technology and personnel pragmatically made in PPN where justifiable principles for search, evaluation and selection are required of dispersed practitioners? How do satisfying immediate project demands influence the longer-term likelihood of participation in a PPN? How are PPNs maintained over time and across projects? And how do long-term PPN dynamics influence short-term judgments and selections? These sorts of questions are outside a purely structural analysis because coordination, in both the short and long term, and personal and collective accountability lay outside the bounds of roles and positions.

These are more than academic questions. How PPNs are managed, policies put in place to encourage PPN industries and production successes and failures understood will only be successful if we begin from correct premises of how this organizational form operates.

In what follows, then, we suggest network governance insights from our study of the CBI and specifically focus on the role and function served by social heuristics. We examined how coordination is accomplished in the CBI and how the distinctive social and economic logic characteristic of its project networks influences decision-making at the microlevel. We studied decisions regarding innovative energy-efficient designs, technologies, and specialized project personnel and what elements of PPN organization enhanced or impeded adoption of innovations. We initially pursued the research to better understand why the mainstream CBI had not widely adopted advanced energy-efficient designs and technologies when the information, evidence and incentives supporting them had been in place for 30 or more years. Efficient technologies are often competitively priced and predict superior performance over the short and longer term. Policy-makers have been perplexed as to why the CBI has been slow to adopt energy-efficient

technologies (Blumstein, *et al.*, 2000; Hoffman and Henn, 2008; Lutzenhiser *et al.*, 2001; Mills, 1995). In the end, we learned a broader set of lessons regarding how aspects of networked production, decision-making and innovation adoption proceed in commercial construction that hold implications for understanding the relations of production in PPN and therefore network governance more generally. Again, we found social heuristics to play a central role.

We were also motivated by the limited success of demand-side management (DSM) policies to shift technology adoption practices in design and construction of buildings. DSM has been the leading theoretical perspective and practical tactic that policy-makers and energy utilities have used to understand and encourage the diffusion of energy-efficient practices and technologies in buildings and the influence that DSM has exerted cannot be overstated.

DSM emerged in the 1960s and 1070s and its novelty was to introduce the idea that utilities could influence how much and when customers use electrical power. The hope for DSM was that utilities could balance the supply-side and demand-side of electricity production and consumption. This is particularly critical in balancing a utility's 'peak load': the least-efficient, most expensive to operate, and often the most polluting energy plants are brought online to manage peaks of demand. If utilities shift customer demand and avoid expensive peaks loads, economic and environmental benefits ensue. DSM broadened into 'market transformation' or 'MT' in the 1990s the idea that strategic actions such as monetary incentives would shift demand until intervention was no longer needed. At the residential level, customers were given items such as subsidized efficient light bulbs in hopes of making a new market, and commercial building owners were incentivized to choose efficient boilers and chillers, for example, or to switch to off-peak energy appliances.

The DSM perspective has viewed the failure of the construction industry to adopt high-efficiency designs and technologies as a 'market failure', the inefficient allocation of goods and services caused by lack of information, lack of competition, principal-agent problems, externalities and other barriers to market efficiency. Our research suggests that DSM assumes that the CBI is a classic market and that this presumption limits its effectiveness to shift adoption towards energy-efficient technologies. Reliance on social heuristics presents a case-in-point. Social heuristics highlight the collective aspect of network governance at the level of decision-making heretofore neglected by structural approaches and accounts.

The paper is organized into four sections. First, we present the case of CBI, noting the PPN on which it is based and how we approached the study of it. Second, we briefly discuss existing theories of economic decision-making that helped us make sense of what we were observing while studying the industry and from which we derived and developed our ideas regarding social heuristics. Third, we empirically demonstrate how actors use social heuristics to guide and defend their decision-making practices. Finally, we discuss how attention to social heuristics can contribute to the understanding economic coordination and innovation diffusion.

Understanding/situating decision-making in PPN

The CBI: neither market nor hierarchy but PPN

The CBI is not a 'spot market'. The individuals and firms that invest, produce and consume commercial buildings are mostly known to one another as they compete and cooperate with a high level of mutual understanding (cf. White, 1981). The CBI in the USA and globally is also not typically organized via authoritative relations and vertically integrated firms. Rather a number of firms typically participate in different aspects of the investment, design, construction, and lease or sale process. Construction industry practitioners typically are not members of the same firm, and single firms usually do not dominate any given region or sector of the construction industry. Specialists are characteristically in quasi-market relation to one another buying, selling, sub-contracting, competing and regulating the goods, services and products produced and used by the industry to design, create, sell and lease their co-produced commercial buildings.

CBI is a prototypical networked production market (Podolny and Page, 1998; Smith-Doerr and Powell, 2005; Whitford and Schrank, 2008) organized around projects with overlapping communities of practice (Stinchcombe, 1959; Riemer, 1976; Eccles, 1981a,b; Feagin and Parker, 1990; Krugman and Furlong, 1993; Davis, 1999; Gann, 2000). Practitioners from different firms, or as independent professionals, coordinate their activities with other crafts, occupations and professionals with limited oversight. CBI as a PPN continues to reflect its origins in mediaeval craftwork where master builders would coordinate crafts in the same way that today's general contractor and developer manage relations and production processes (Davis, 1999; Beamish and Biggart, 2010).

Today, the projects that lay at the centre of the CBI's production process are capital-intensive and socio-technically complex requiring a diversity of technological inputs such as electrical, heating, ventilation, lighting,

transport, plumbing, as well as technical inputs such as design, planning and aesthetic considerations. In addition there are multiple capital and regulatory inputs from parties outside the actual construction process including investors and regulatory officials. Time and coordination pressures are ubiquitous and always involve tradeoffs between, for example, short- and long-term profitability, product performance and durability, and ergonomic and aesthetic considerations among others. Some of these conditions are unique to CBI, but some are shared with other PPN industries such as moviemaking. Considering the complexity of these processes, it is amazing that coordination is done with limited rules (though external regulation plays a role), with contracts often serving as 'just-in-case' backups should networked relations fall apart.

Coordinating through conventions

Commercial building construction involves an extraordinary number of considerations and decisions that must be agreed upon and synchronized among many actors. Given the number of dispersed participants involved and the fact that most projects are unique, one-off ventures it is quite amazing that major projects get built successfully and that groups continue to work on projects together over time. There are a number of reasons that coordination under these circumstances is possible. PPNs—like markets and firms—have made use of IT that links actors and technical plans on near real-time bases. Indeed it is the ubiquity and flexibility of IT that has fuelled the growth of PPN and specialized project management software has enabled subcontractors to access critical data such as schematics in a way that mediaeval builders could only do when physically present.

A second reason that construction coordination is possible in PPN is the highly trained and professionalized workforce that is typically involved in major projects today. Apprenticeships and professional education and certifications inculcate standards of practice—internalized rules and conventionalized approaches and language for understanding solving problems (Scott, 2003, 2008). When practitioners are aligned professionally and embedded in communities of practice, solution-sets can become at least partly tacit reflecting understandings of how choices should be made, and even what they should be (Van Maanen and Barley, 1984; Wenger and Snyder, 2000).

However, there is an even deeper source of coordination in constructing PPNs that allow participants across occupations, time and space to synchronize actions in a socially and economically efficient manner. What we describe as 'social heuristics' are shared principles for evaluation that provide 'rules-of-thumb' for making critical decisions in CBI. Put another way, social heuristics act as a set of default presumptions that are both technically and socially justifiable within CBI's community of practice and across the roles and positions that define the networks that coalesce around the projects that lie at its centre.

Our development of social heuristics shares and is indebted to the insights of those who have developed institutional approaches and especially those who have sought to link the actions of individuals with the institutional contexts within which they are embedded and therefore act (Meyer and Rowan, 1977; Freidland and Alford, 1991; Zucker, 1991; Scott, 2008; Thornton and Ocasio, 2008). However, while these and related institutionalists have sought to explain individual action and therefore agency, decision-making and action have continued to be primarily inferred from macroscopic trends and attentions where the emphasis has also remained the structural aspects of institutions and not how individuals navigate through structures.

Our development of social heuristics differs from these approaches because it reflects our focus on the specific mechanisms by which practitioners in CBI address and resolve the typical problems they confront in their industry. Social heuristics are pragmatic cultural-cognitive and normative models that resolve practical problems at the nexus of institutional logics such as investment and project success, on the one hand, and individuals' current and future viability as participants in an active and ongoing PPN. Social heuristics is a non-reductionist concept for understanding actor choice in PPN and captures institutional structures at play along with actor-level decision-making and action. As a theoretical concept, social heuristics does not replace institutional theory but rather adds an action-oriented corollary.

Social heuristics play a similar role in CBIs' PPN that administrative rules play in firms and prices play in markets. They all help to *govern* decisions and coordinate collective action. Our findings suggest that social heuristics may be characteristic of a PPN organization generally and provide a partial answer as to why the industry had been so slow to adopt performance-enhancing energy-efficient designs, technologies and techniques into commercial buildings.

While studying how decision-makers pragmatically choose among available options and justify those choices we found that PPN decision-making could not be reduced to issues of price or technical performance, although these do play a part insofar as a minimum price and performance standard are satisfied (i.e. satisficed). That is, one cause of the failure to adopt innovative technologies in CBI is partly a function of 'network costs': the very strengths characteristic of PPN also played against the embrace of new and higher

performing designs and technologies (Stinchcombe, 1959; Eccles, 1981a,b; Henisz and Levitt, 2009; Taylor and Levitt, 2010). CBI practitioners rely on socially vetted heuristics to guide their decisions and this leads to the avoidance of new technologies and construction strategies as 'newness' disrupts conventionalized relations and expectations and with them network stability. Without significantly increasing the benefits to upstream producers in the CBI—those who invest, design and construct commercial structures—innovation comes at a high a cost to routines and conventions that harmonize network coordination during projects and, overtime, across them.

Stability and risk aversion are highly prized in major construction projects as they are almost always financially, socially and technically complex, and temporally and financially constrained. Social heuristics—already established principles and default solutions—support quick coordination across networked agents. Actors come to issues with already limited sets of considerations and even an array of probable solutions. Collective reliance on social heuristics enables a level of predictability to technology and personnel decisions that can be anticipated by others not only in the investment, design and construction process but also the marketing, leasing and sales. When decisions follow from shared premises they make contingent design and construction processes less problematic and more manageable. Social heuristics assure decisions are technically adequate insofar as they satisfy standards set both formally and informally in the industry. Finally, social heuristics assure that decisions are socially accountable and therefore socially defensible within the production network. Choices made according to collective standards are justifiable even if that decision ends in failure. As such, social heuristics also make choices less personally risky for CBI practitioners given that they are socially vetted.

Social heuristics, judgmental heuristics, and conventionalized markets

Social heuristics do share some of the characteristics of judgmental heuristics described by cognitive scientists, and more recently behavioural economists have used heuristics to understand how choice is realistically exercised in economic contexts in contrast to neoclassical economic presumptions of pure rationality. In the 1970s, judgmental heuristics were recognized as an important uncertainty reduction strategy for individuals solving complex problems (Tversky and Kahenman, 1973, 1974; Kahneman and Tversky, 1979; Kahneman *et al.*, 1982; Heap, 1992; Alhakami and Slovic, 1994).

Judgmental heuristics function as individual 'rules-of-thumb', mental shortcuts based on cognitive limitations, experience and selective recollection. Cognitive psychologists find that when confronted with complex tasks, such as assessing probabilities, estimating numeric outcomes and gauging risk through, for example, costs-to-benefit ratios, people rely on judgmental heuristics including representativeness, the degree to which a situational probability resembles an already known quantity; availability, the frequency of a class of experiences given the ease by which they are brought to mind; loss aversion, the tendency of decision-makers to weigh more heavily the potential damage of losses given an exactly equivalent potential gain; and anchoring, when problem solving begins with an initial value or estimate that reflects values suggested from previous experience or that emerge via partial computation. Judgmental heuristics such as these are used to simplify and thus enable complex and timely decisions.

While they are 'highly economical and unusually effective', judgmental heuristics can lead to 'systematic and predictable errors in estimation' (Kahneman and Tversky, 1973, 2000; Tversky and Kahneman, 1974; Kahneman *et al.*, 1982) This deficiency has been the primary focus of cognitive psychologists exploring the use of judgmental heuristics (Funder, 1987; Taylor-Gooby and Zinn, 2006; Gigerenzer and Brighton, 2009) as well as for economists in the developing field of behavioural economics (Barber *et al.*, 2003).

Recently researchers have argued that rather than simply 'biasing' cognition because they violate abstract rules of logic, judgmental heuristics can improve accuracy when individuals are confronted with computationally 'intractable problems'. Problems are considered intractable when they are formally solvable, but not fast enough for the solution to be useful to the decision-maker in context (Gigerenzer and Selten, 2001; Hutchinson and Gigerenzer, 2006; Gigerenzer, 2008; Gigerenzer and Brighton, 2009). They speculate that heuristics play a role as 'social tools' through which individuals search, assess and select when seeking to 'solve different types of real ecological problems' (Marsh 2002, p. 50; Gigerenzer, 2008).

Also in contrast to presumptions of comprehensive rationality, Herbert Simon coined the term 'satisficing' to capture how pure rationality is constrained by real limits of incomplete information, cognitive capacities, aspirations and environmental constraints (Simon, 1956, 1957). Simon called this condition 'bounded rationality'; a concept that has had wide application outside of its originally intended domain. Simon's subsequent work with James March (March and Simon, 1958) and March's own work (March, 1978) sought to further situate rationality in administrative systems. This work opened research to the influence that context—planned, unintentional, cultural and

otherwise—plays in decision-making processes (Meyer and Rowan, 1977; Vaughan, 1990; Feldman and Pentland, 2003).

Judgmental and social heuristics both limit the information that decision-makers take into consideration when searching, assessing and selecting from a range of options (Kahneman and Tversky, 2000). By contrast, however, the social heuristics we observed in the CBI are not only psychological in nature because they are shared and thus provide a key source of interactor stability among networked actors where formal authority is diffuse. Social heuristics are constructed and sustained by a community of practice and reflect the underlying logic of action of the community as it has developed historically (Van Maanen and Barley, 1984; Wenger and Snyder, 2000). Social heuristics cannot be reduced to individual experience or cognitive functioning, but reflect conventionalized conduct.

Some economists have, in fact, recognized the role of conventions in markets in work related to our analysis. Transaction cost economists note that transactions involving great uncertainty and repetition in markets favour firms over individuals because they could coordinate via contracts (Coase, 1937; Williamson, 1975). Williamson, however, dismissed networks as 'hybrids' being neither markets nor hierarchies (Williamson, 1985). In response, Powell (1990) argued that rather than simple hybrids, networks were governed by principles irreducible to either markets or hierarchies and must be understood on their own terms.

Over the past two decades, economic sociologists have pursued an understanding of network governance showing them to foster learning, innovation and cost-reductions over markets and firms, especially in industries characterized by shared projects and high levels of uncertainty as reflected in complicated tasks, dispersed competencies and rapidly changing relations and environments, but that simultaneously require high-fidelity coordination (Jones *et al.*, 1997; Grabher and Powell, 2005; Smith-Doerr and Powell, 2005). The implication of this research on network forms of governance is that decision-makers and therefore decisions are more reliant on and reflective of interdependent social relations, mutually shared interests, and reputation than markets and less reliant on and reflective of formal authority than vertically integrated firms (Smith-Doerr and Powell, 2005, p. 384).

French pragmatist economists identify coordination between buyers and sellers as the critical economic act and uncertainty around coordination as the primary conundrum for all economic contexts and exchange (Thévenot, 1994, 1995, 1998). According to them, participants collectively address uncertainty by invoking *a priori* and *retrospective* justifications for their actions so that they appear rational, reasonable and accountable to those with whom they co-participate. Over time, justifications can become conventionalized, consensus beliefs about why certain acts and practices are deemed normal and to be expected (Biggart and Beamish, 2003). Market-based regimes of justification allow actors to transact without formally calculating and defending every decision while psychologically affirming the 'goodness' of those act(s) (Thévenot, 1994; Wilkinson, 1997; Thévenot, 1998; Boltanski and Chiapello, 1999; Gomez and Jones, 2000; Beckert, 2002; Favereau, 2002).

The role of social heuristics in the CBI

Our study findings build on the implications of these and related works. We found that in CBI social heuristics act as socio-technical tools. Like all tools their use enhanced some practices while obstructing others. In this regard, our study findings do not so much challenge the insights of cognitive psychologists, who assume methodological individualism, as modify them by situating choice in a highly networked, institutional context (cf. Kahneman *et al.*, 1982; Gigerenzer and Brighton, 2009).

To better understand the slow adoption of energy-efficient technologies in the CBI, we asked a range of centrally located networked practitioners with the power to make critical funding, design and construction decisions 'what options were available', and 'how they chose among them' and specifically 'why they made those choices'. We anticipated that they could describe the considerations that structured their choices and thus what inhibited and by contrast would incentivize their adoption of innovative designs and technologies given the constraints and obligations they encountered in the CBI. In short, we wanted to know their basis for evaluations and justifications for their decisions.[3]

Coding interview transcripts and other materials thematically, we found that principals in CBI consistently rely on decision-making shortcuts, but that these did not so much reflect individual cognitive models for computation than they did widely acknowledged and shared rules-of-thumb. That is, the explanations they gave of what lay behind their decisions reflected socially shared and vetted means of computing 'best choices' in the context of the CBI's project-centred production network. In listening to our informants, it also became clear that they preferred to work with others with whom they shared these rules-of-thumb and that they too were expected by others to rely on them well because coordination among the network of practitioners on any given project became less problematic: principals in the CBI network also sought to be and to work with people who are socially consistent.[4]

The view of social heuristics that emerged from our studies is also in line with recent scholarship regarding network interdependencies and social conventions (Jones *et al.*, 1997; Grabher and Powell, 2005; Smith-Doerr and Powell, 2005). Practitioners put a premium on working with others with collectively held presumptions about how their industry operates and what constitutes a socially rational, understandable and defensible decision in that context (Thévenot, 1994, 1998; Biggart and Beamish, 2003; Boltanski and Thévenot, 2006). Social heuristics supply a defensible basis for decisions since they reflect what practitioners believe to be 'tried and true' aspects of the CBI. Those we spoke with repeatedly invoked social heuristics through both explicit and implicit reference to principles of evaluation claimed that they and others in the industry relied on to make what were collectively deemed prudent decisions.

Based on the comments and observations made by our informants, there are a number of social heuristics used in CBI, but we focus on three that were widely invoked and acknowledged in our interviews and field study. First, there was an industry-wide consensus on what might best be termed the 'default building heuristic' from which many decisions regarding design, technology and construction originated; second, the reflexive role that 'adding value' played in construction choices as operationalized through rule-of-thumb metrics 'function' and 'flexibility'. As social heuristics, function and flexibility worked to narrow choices to designs, technologies and construction options that had worked in the past or that enhanced aspects of buildings that were known by practitioners to leave the greatest room for modifications in the future. Third, our informants consistently inferred through reference to reputation the important reproductive role that trust placed in their network of affiliates and CBI affiliations played in both the success of projects and their own personal futures. The reputation heuristic works as both an aid to social decisions regarding who is chosen, i.e. project personnel, but also and less often noted in the literature in technical decisions regarding what designs, technologies and construction options are best and even what risks are worth taking.

Beyond simply making individual decisions easier, we also found that these social heuristics fulfilled three important network governance functions. Social heuristics supplied individual practitioners with acknowledged points of network consensus, reflexivity and reproduction on which their individual decisions could find collective foundation.

Social heuristics govern by providing consensus regarding, for example, 'What one is seeking to accomplish in the industry' and 'why they are seeking to accomplish it'. Today this consensus is an economic logic—buildings are constructed for a market, a logic that emerged in the early twentieth century in the USA (Beamish and Biggart, 2010). Social heuristics also reflect and provide widely accepted performance criteria that help practitioners reflexively answer, 'Whether they are making acceptable decisions and performing their role appropriately given industry standards and expectations'. Social heuristics therefore also provide CBI practitioners with one basis from which to reflect on their own choices and those of others in their PPN for coherence with formal and informal industry standards. Finally, social heuristics also provided practitioners in CBI an ability to make socially conscious decisions based on reputation that satisfied both their immediate circumstances and also their longer-term success in the CBI's PPN; that is, on the ability to reproduce the PPN into an unknown future.

Reputation as a criterion of choice greatly increased the likelihood of repeated transactions with the same persons and firms and therefore the same conventions of practice and understanding. By sticking with established standards of thought and practice individuals sought to cultivate their own reputable career trajectory over the short and longer term and in doing so reproduced the network and network-governing conventions contained therein.

CBI's default building heuristic

Today the dominant industry logic defines commercial buildings primarily as a vehicle for investors seeking long-term predictable income from leases, often as a hedge against other more volatile assets in a portfolio. By the mid-1990s, pension funds, banking conduits or trusts, mutual funds and real estate investment trusts (REITS) had become the largest source of investment capital in commercial building development and therefore the CBI. Collectively, they financialized the real estate sector and transformed the reigning market order.[5] Partly as an outgrowth, today's consensus heuristic frames buildings as conservative investments, and guides practitioners to make decisions that will produce non-descript buildings certain to return stable income for 10, 20 or 30 or more years by leasing space to a series of tenants. All other considerations, including aesthetics, energy efficiency and tenant desires, are subordinated to this current consensus heuristic.[6] The power of the default-design heuristic to shape a decision is reflected on what shared standards' practitioners in CBI rely on regarding what is and is not considered at base a 'good' commercial building and simplifies what would otherwise be a bewildering array of potential choices and tradeoffs. By sharing a loose ideal-typical vision of 'best practice' and 'best product' practitioners are better able to compare, assess and make final judgments when designing and

constructing material buildings. In this, commercial buildings as predictable 'real' estate investments are rarely challenged, reflecting strong practical bias against innovations and deviations from normative expectations and problem-solving practices.

In the regions we studied, for instance, the default-design heuristics for a commercial office building was founded on the ideal parameters of two to three storeys, 50 000–65 000 gross square feet, rectangular form and an elongated floor plate with windowed premium offices around the outer edges. The interior spaces were open for office cubicles and modular walls that were easily moved and reorganized. Parking was adjacent to the structure and was considered a premium aspect of such buildings.

These and still other, more specific expectations were —dependent on where in the production process a practitioner contributed to the design and construction process—reflected in the presumptions and choices exercised by principal decision-makers. The default-design heuristic as a rule-of-thumb was not fixed so much as it was a relatively durable set of presumptions about what a commercial office building was and what one strove to achieve when participating in its construction. Social heuristics were relatively change resistant through our eight-year study period.

CBI's value-added heuristics

The default building heuristic incorporates the prevailing market logic that defines investment, design and construction of commercial buildings as primarily conservative financial instruments. At the level of decision-making and as a general rule, CBI practitioners are always under pressure from investors to produce commercial buildings that are stable investments in the short and long term. 'Adding value', as a social heuristic, lends CBI principals direction as to how to make the many choices that will produce buildings that best reflect the investment logic characteristic of CBI. The choices they make generally do not reflect beyond a minimum the actual users of the buildings, but consonant with the default-design heuristic, give primacy to the expectations of upstream participants such as investors, designers and producers of commercial buildings.

Using 'value added' as a cost control strategy, however, does not resolve the intractability of problems decisions-makers routinely confront in CBI: adding value must be translated into a material end in the myriad decisions that transpire in construction projects. Practitioners seek to, in their own words, 'add value' to projects where prudence compels them to address prevailing expectations locally, where construction trends can but do not necessarily simply mirror the nation or adjacent regions, and at the level of the national industry where standard bearing institutions like BOMA, among others, can influence what is considered the baseline for projections.

While adding value or creating the greatest return is a motive found in all capitalist markets, we found that nested within CBI the value-added motive decomposes into two industry-specific rules-of-thumb: function and flexibility. Function requires that any given project input demonstrate a necessary purpose, in which 'purpose' reflects how short-term profits would be enhanced while adequately fulfilling longer-term building performance expectations. Understanding the calculation of short- and long-term profits, however, requires explanation because the industry deviates from simple market presumptions. It is routine in the CBI for those involved in financing, investing and constructing to target their expected returns on investment by calculating in advance both the probable costs and probable profits they will make given their financial commitments. In this regard, profit targets become benchmarks from which downstream decisions flow. A market for buildings or building services does not decide profitability; profits are pre-ordained by decisions made in the design and construction phase and in the generation of formal plans.

One consequence of such 'targeted profits' is that project-focused cost-reductions become central in decision-making rather than profit or performance maximization (Mohamed, 2006). We found CBI practitioners routinely operationalize the function heuristic with an eye for controlling 'unnecessary expenditures' so that they achieve profits they have already anticipated. Function focuses attention on the immediate and 'attributable purpose' of a project input; an ability to describe and justify what a particular item adds to a project given that all additions subtract from already targeted profits.

The second heuristic, flexibility, emphasizes the linkage of these and related short-term interests with longer-term concerns that buildings be amenable to multiple uses and tenants over the lifetime of a building. Flexibility reflects CBI consensus that commercial buildings are financial instruments that must remain viable investments over time. The focus on long-term viability also impacts short-term interests in building projects, such as developers and contractors who count on being 'bought out' by longer-term investors. By choosing designs and technologies that appeal to the widest number of both current and potential future users, a building is interpreted as flexible, reducing uncertainty over future returns on investment. In short, producing non-specialized or 'flexible' buildings reassures the typical investor their money is protected. Together, function and flexibility, as rules of thumb for adding value in CBI, are widely shared heuristics used

to ground judgments that had to be made during the planning and design phase but also in construction decisions.

Reputation in CBI as heuristic

Economic and sociological studies of networks, organizations and markets have long examined the critical role that social accountability plays across such contexts (Ahuja, 2000; Burt, 2000; Podolny, 1994; Raub and Weesie, 1990; Uzzi 1997). We also observed for individual actors in CBI reputational effects similar to those Podolny (1993) observed when examining the role of reputation for firms: uncertainty in the market promotes heavy reliance on already known, reliable and similar others within a network (Elsbach and Kramer, 2003). Reputation is also a social heuristic when it becomes a decision-making proxy for judging social and technical information. That is, insofar as reputation is used to judge potential project participants, to gauge the merit of a proposal, and the believability of technical information supplied by a CBI practitioner—such as an appraisal regarding the quality of building plans, location and/or projected costs of a project—it too serves as a social heuristic.

Actors are aware that their performance as well as the ideas and recommendations they bring to a project will follow them, playing a part in their future in the industry's network. For example, whether and how projects are funded often depends on a lender's knowledge of a person's reputation as much as it does on the project concept or formal market assessments outlining a project's market feasibility. The reputational heuristic can reflect technical, moral and personal standards.

As a technical criterion, reputation is also used to appraise the professional skill and proficiency necessary for one to add value to a given project. As a gauge of moral concerns, reputation is used to assess reliability and trustworthiness and in doing so reinforces production network homophily because it truncates search and therefore assures greater predictability and accountability in performance. Personal qualities, while harder to define, reflect social credit gained over time in a network for fulfilling expectations, for providing a solid track record of predictable performances over time and multiple projects, and for with sticking with industry convention. This leads to one's reputation as reliable, trustworthy and not in need of micromanagement.

While the reputational heuristic seems to incorporate separate dimensions, in practice they are largely conflated. Practitioners who are favourably evaluated accrue their reputations and assiduously protect them so as to promote their future prospects in the CBI network. Those who build favourable moral, technical and personal reputations in their production networks are repeatedly brought back to initiate and confer on pending and future deals.

In brief, then, in our larger study of CBI we noted that our informants cited repeatedly working for the same customers, partnering with the same firms and individuals, going to the same sources for investment money, and contracting with the same practitioners. Reliance on reputation in search, assessment and selection processes works to order and reproduce predictable networked relations where predictability, accountability and trustworthiness of one's performance are prioritized even if they cost a premium.

Conclusions: social heuristics, network governance and innovation

While practitioners routinely identified economic factors such as cost, profits and technological performance as a basis for their decision-making, factors consistent with a market-based rationality and vocabulary of motive (Mills, 1940), we found that market terms like these were regularly filtered through network-inspired social heuristics whose substance deviated appreciably from the terms and presumptions associated with them in economic theory. Actors relied on economic language, but used it in ways that reflected the production logic of the industry at the historic moment we studied it, framing their calculations in terms 'best' costs, profits and performance founded on shared and widely acknowledged standards not through abstract economic principles (Beamish and Biggart, 2009). Put simply, practitioners in CBI used the language of economics but did not necessarily conform to the behaviour assumed by economic theory. Instead, the language of economics was regularly interpreted through actionable standards—what we term social heuristics—that helped practitioners in CBI address the social and technical uncertainty inherent to PPN in a pragmatic manner. These findings have consequences for our understanding of the PPN as an organizational form, and they also offer insights into the possibilities for innovation in the CBI.

Our findings from our study of CBI suggests that social heuristics dampened the probability of innovation diffusion because they reflect conventionalized assumptions and practices that served to mitigate coordination problems. Because new designs, technologies and practices introduced into any given building project will necessarily cascade into other aspects of the same project, embracing such 'newness' means knowingly introducing coordination difficulties into a production process where network coordination is as complex and fraught with uncertainty as is the material product itself: commercial buildings. Thus, in addition to

fulfilling the psychometric conceptualization of cognitive heuristics as 'calculation short cuts', social heuristics serve as *a priori* decision guides for a dispersed network of economic actors. In this high-stakes and networked context where decision-makers frequently confront difficult problems, where problems are formally solvable but where resolution is compromised by time and cost constraints, social heuristics offer socially defensible justifications for actions planned and already taken. While social heuristics support interactional stability they reduce interactional and cognitive flexibility and therefore fast-paced technical change. Networked organizations in CBI resist novelty in exchange for consistency, predictability and social accountability (see Hannan and Freeman, 1984 for other contexts).

Production network dynamics can resolve some market and firm limits including uncertainty, complexity and coordination problems, but in the case of commercial building this is at the expense of other desirable ends such as a willingness to embrace new, even more effective technologies and designs (cf. Henisz and Levitt, 2009; Taylor and Levitt, 2010). Because network forms of governance are more interdependent and reliant on inter-subjectivity than are markets they reduce transaction costs through conventionalized conduct. What is more, network forms of governance are less reliant on formally prescribed relations than are vertically integrated firms and thus evince greater flexibility and lower long-term costs since participants are chosen for what they can lend to any given project and are dispersed once a project is finished.

Our study suggests the role routines, practices and conventions play in networked economic contexts generally. Construction practitioners utilized limited information heavily filtered by socially acknowledged vetted rules-of-thumb to make time-sensitive and highly technical decisions that were deemed economically warranted and defensible. Social heuristics, then, reflect *a priori* and *ex post facto* consensus regarding the prevailing market logic and therefore meaning of buildings that animates, focuses and limits practitioner search in building projects; reflexive standards based on market idioms that align assessment and selection of options because they provide specific guidance in choosing among available 'right', 'best' and 'most effective' solutions; and as a means of assessing technical, moral and personal qualities that play in what and who is chosen for projects based on reliability and believability. This provides social accountability in PPN where direct observation is limited and liabilities pose potentially catastrophic consequences to both projects and the personal careers of those that participate in them.

What we report also overlaps with research on temporary organizations and project-organized markets. This research emphasizes the importance that relational understandings and intersubjectivity have when formal lines of authority are weak but high levels of coordination are required. Coordination in these contexts reflects a number of strategies including career structures (Faulkner and Anderson, 1987; Barley and Kunda, 2004), role structures (Weick, 1993; Weick and Roberts, 1993; Bechky, 2006), and reputation and typecasting (Jones, 1996; Zuckerman *et al.*, 2003). We add to these the role social heuristics play in maintaining order for practitioners in the present and into the future.

Finally, we observed that social heuristics, as currently expressed in commercial construction, dampen the willingness of decision-makers in this PPN to embrace novelty, innovation and change generally. This empirical finding explains in part why innovative 'green' technologies have been slow to be adopted and diffuse in CBI. In CBI's highly networked, capital-intensive, time-pressured production setting where intractable problems are the norm new persons, ideas and technologies challenge and thus are at a serious disadvantage and thus are typically unwelcome. Our findings are in contrast with economic orthodoxy, which assumes that price and its proxies 'profit' and 'performance' are the only valid and appropriate bases for decision-making. It also suggests that the current policy model for incentivizing change in the CBI, which assumes a market for technology goods, is seriously flawed. Construction practitioners do account for economic considerations, but these considerations are embedded in and reflective of the project-centred production relations and the socially shared decision-making heuristics characteristic of CBI. Social heuristics as one aspect of network governance distinctively shaped decision-making, choices and therefore industry outcomes in CBI in ways that we believe are informative for other PPN from auto parts (Schrank 2004) and apparel industries (Uzzi 1996) to investment banking, financial services (Eccles and Crane, 1987; Zuckerman, 1999) and mega construction projects (Henisz and Levitt, 2009; Taylor and Levitt, 2010; Scott *et al.*, 2011).

Social order and control are defining elements of any form of organized activity. Controls are necessary but if not properly understood can undermine the purposes of organization. Firms that allow rules to become valued for themselves risk 'rule ritualism' and undermine the purposes of the organization. Markets that operate slavishly on price signals risk overlooking non-price considerations that may be important to sustaining a market. Commercial construction revealed the role social heuristics and other conventionalized behaviours play in coordinating large projects across many participants, and also how network based conventions may limit good if novel outcomes in project-centred production networks.

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Notes

1. The real estate industry roughly segments commercial construction into three sectors by building type. The sectors are: (1) institutional (i.e. government/non-profit), (2) private (i.e. owner-occupied homes) and (3) commercial. Commercial real estate is typically further broken down into (i) office/retail, (ii) industrial/warehouse and (iii) multifamily residential. Within these categories are further distinctions, such as the class of buildings—A, B and C—that reflect more local and regional distinctions (Collier *et al.*, 2002; EIA 2004). Our focus in this paper applies to commercial office and retail, industrial facility and warehouse construction.
2. Podolny and Page (1998) define networked forms of organization as 'any collection of actors that pursue repeated, enduring exchange relations with one another, and at the same time, lack a legitimate organizational authority to arbitrate and resolve disputes that may arise during exchange' (p. 59).
3. We conducted 1–3 h interviews with 68 persons and targeted individuals who held prominent positions in industry decision-making processes at different places in the production process. These included financiers such as bank loan officers and developers; design professionals such as architects and structural engineers; real estate professionals including property managers, operations and occupancy personnel; construction professionals such as contractors and construction managers and finally energy experts such as electrical engineers and regulatory officials. Asking informants about their past and present dealings provided a view of individual decision-making criteria. It also provided a view of the collective interdependence that characteristic of this market; because individuals must interact with others over time to succeed in an industry founded in recombinant social relations, we assumed decisions and decision-making criteria must be at least nominally similar. We thus searched for the overlap, shared outlooks and sense-making criteria employed by decision-makers and in decision-making. See the following on language as a medium for understanding cognition and decision-making (Mead, 1977; Knorr-Cetina, 1981; Carley and Palmquist, 1992; Knorr-Cetina, 1999; Stryker, 2002).
4. Over a four-year period, 1999–2003, we conducted a field study of the economic organization of the commercial building market in Sacramento, the San Francisco Bay Area, Portland and Seattle. The fieldwork began during a boom time (1999) in an industry characterized by boom-bust cycles (Stinchcombe, 1959, 1965, Eccles, 1981a,b). To understand the social, cultural and cognitive dimensions of participants in commercial construction, we pursued an intensive case study, a research method centered on field study that included in-depth interviews, construction site visits, archival document collection and media analysis (Yin, 2003a,b).
5. The rise of institutional investors in commercial real estate is a trend observable across investment sectors (Useem, 1996; Krippner, 2005; Beamish and Biggart, 2009). Since World War II, institutional investors—pension funds, banking conduits or trusts, mutual funds and in the case of real estate REITS—have markedly increased their trading presence. By 1986, institutional investors accounted for 90% of the total volume traded on the New York Stock Exchange, while individual investors—who in 1976 had accounted for 30% of the volume (Lowry, 1984)—represented less than less than 10% (Mccoy, 1988). As it related directly to investment in all forms of real estate, public securities jumped from $27 billion in 1990 to $360 billion in 1999 (Muldavin, 1999) and in the first quarter of 2000, institutional lenders represented fully 89.9% of loans given for all commercial construction (Collier *et al.*, 2002). This trend continued until 2005 (Downs, 2009). For 2002, the breakdown of public security investment in real estate is as follows: Commercial Mortgage Backed Securities or conduits (where an institution, say a bank, makes hundreds of separate real estate loans, bundles them and sells them on Wall Street as a bond) 3 248 282 000 (29%); Life Insurance Co. 2 833 969 000 (25.3%); Fannie Mae, Freddie Mac, FHA 2 455 805 000 (21.9%); Commercial Banks 1 193 108 000 (10.6%); Pension Funds 187 614 000 (1.7%); Credit Companies 156 942 000 (1.4%); Other 1 132 315 000 (10.1%). Total 11 208 035 000 (100%) (see Collier *et al.*, 2002, p. 151).
6. While inroads have been made on issues such as the energy efficiency of buildings, even with spikes in energy costs and the 2007 real estate crisis the industry continues to use many of the social heuristics we identified in the early 2000s. Conventions of these kinds are very difficult to extinguish because they are not simply 'economic' in the classic sense of the word, but social and relational too.

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