

**Institutional Logics and Inter-Organizational Learning in Technological Arenas:
Evidence from Standard Setting Organizations in the Mobile Handset Industry**

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Abstract

Conceptualizing standard setting organizations (SSOs) as technological arenas within which firms from different countries interact and learn, we offer insights into the interplay between firms' institutional logics and their inter-organizational learning outcomes. We suggest that firms' inter-organizational learning is embedded in their macro-level country contexts, characterized by more corporatist versus less corporatist (pluralist) institutional logics. Whereas corporatism spurs coordinated approaches, pluralism engenders competitive interactions that affect the extent to which firms span organizational and technological boundaries and learn from each other. We test our theory using longitudinal analysis of 181 dyads involving 26 firms participating in 17 SSOs in the global mobile handset industry. We find that inter-organizational learning, measured by patent citations, involving corporatist firm dyads significantly increases when the dominant logic within the arena is also corporatist. By making cooperative schemas more accessible a dominant corporatist logic also enhances inter-organizational learning across technologically distant dyads. When a pluralist logic dominates the arena, corporatist dyads learn less because firms in the dyad activate a contradictory logic that decouples them from their natural processes for inter-organizational learning. These findings highlight the implications of institutional logics for inter-organizational learning outcomes and provide insights into how firms attend to institutional contradictions in arenas that provide opportunities for inter-organizational learning.

Introduction

In emergent technological domains, the locus of knowledge about new technological ideas, approaches and solutions often extends beyond firms' boundaries (Tushman 1977, Zahra et al. 2000, Rosenkopf and Nerkar 2001, Rosenkopf and Almeida 2003). To effectively learn from external sources and to sway the trajectory for future technological developments, firms engage in various organizational and technological boundary-spanning activities such as participation in standard setting organizations (SSOs) (Van de Ven et al. 1999, Ranganathan and Rosenkopf 2014). By engaging in technological arenas such as SSOs, firms' representatives not only contribute to setting technological standards but also serve as boundary spanners, channeling knowledge between the SSO and their firms' R&D units, and thereby facilitating inter-organizational learning. As Rosenkopf et al. (2001: 750) observed, "[SSO] participants represent critical boundary spanners...as they provide crucial technical information on which firms' future strategies and innovative directions depend." Underscoring this notion of SSOs providing a context that fosters inter-organizational learning, our interviews with standard setting experts revealed a process of "throwing in a good idea" and then "other good ideas are thrown into the mix" that necessarily rests on social interactions. While these interactions serve as precursors to the emergence of a technology standard (Rysman and Simcoe 2008), they may lead to broader inter-organizational learning not directly related to

standard setting outcomes or activities.

Building on the notion of SSOs as technological arenas that facilitate such inter-organizational interactions (e.g. Rosenkopf et al. 2001, Leiponen 2008), our interest lies in understanding the inherent differences in the participants' norms, values and goals or "institutional logics" (Friedland and Alford 1991) that could either permit effective interactions and inter-organizational learning or inhibit such exchanges. Understanding differences in institutional logics is critical because inter-organizational learning is subject to firms' backgrounds and histories that generate idiosyncratic routines guiding social and professional interactions (Cyert and March 1963, Levitt and March 1988, Nelson and Winter 1982). Because organizational routines predispose firms to engage with others in prescribed ways, the question of whether participating firms' institutional logics promote more cooperative or more competitive approaches becomes particularly germane to our understanding of inter-organizational learning.

To address this question we suggest that learning is heavily influenced by firms' institutional logics which constitute "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules" (Thornton and Ocasio 1999: 804, Thornton et al. 2012) that guide inter-organizational interactions and learning outcomes. In practical terms, institutional logics direct attention to specific problems and limit potential solutions, such that alternatives lying outside the bounds of the institutional logic may never enter into the solution set (Ocasio 1997, Thornton and Ocasio 1999). Attesting to this possibility, Argote and Miron-Spektor (2011) highlight the need for additional research examining the context, including the institutional context, in which organizational learning occurs.

Based on this conceptualization we investigate how the institutional logics of participating firms alter their propensity to learn across organizational and technological boundaries in SSOs. Our conceptualization of nationally embedded institutional logics draws from the literature on comparative social systems as providing the basis for explaining organizational behavior and actions in economic exchanges (Jepperson and Meyer 1991, Dobbin 1994). Of importance to our study is the theory of corporatism as a national-level social system wherein, on one end of the continuum, a high level of corporatism fosters a logic of overarching cooperation and coordination through which organizations

achieve their desired goals, and on the other end of the continuum, a low level of corporatism, or pluralism, engenders competitive and market-based solutions (Schmitter 1981, Cawson 1986, Jepperson 2002). Cross-national variations in corporatism are shown to hold important consequences for outcomes such as distinctive approaches to countries' technology policies (Spencer et al. 2005) and the redistribution of wealth (Hicks and Kenworthy 1998), inter-firm technological alliance formation and knowledge flows (Vasudeva et al. 2013), and training attitudes of individuals (Luo 2007). In this study, we suggest that the level of corporatism characterizing participating firms' home countries activates distinctive institutional logics that foster cooperative versus competitive approaches within an SSO thereby altering inter-organizational interactions and learning outcomes.

Our central contribution stems from the finding that inter-organizational learning, as measured by patent citations, is more fully understood upon considering the institutional logics of the firms in the exchange relationship, in conjunction with the logics of others in the technological arena. Inter-organizational learning is enhanced when firms identify with a more cooperative, corporatist logic in an exchange relationship, provided the technological arena offers a context that allows for activating the schema underlying the corporatist logic, thus, making cooperation more accessible (Ocasio 1997, Thornton et al. 2012). In particular, learning across firms identifying with more corporatist logics is reduced when these firms interact within a technological arena predominantly populated by firms that identify with a less corporatist or more pluralist logic, because the competitive and market-based approaches fostered by pluralism run counter to the corporatist logic of cooperation. By suppressing access to and activation of a corporatist logic at the dyadic level, a dominant pluralist logic in the technological arena decouples firms from the processes that foster inter-organizational learning. Further, we find that dyadic learning across technological distance is contingent on the dominant institutional logic within the technological arena. In this regard, we find that whereas corporatism's emphasis on cooperation and inclusiveness activates learning across technological boundaries, pluralism's emphasis on distinctiveness and immediate technological gain is consistent with the utilization of existing capabilities and, hence, supports learning from technologically proximate participants.

We find empirical support for our arguments in the context of 17 SSOs spanning the period 1971-1995 in the mobile handset industry that comprises a key segment of wireless telecommunication. Although countries have demonstrated different technological approaches, standardization in this industry at the international level has been a central component of firms' technology strategies across several countries in North America, Europe and Asia (Funk and Methe 2001, Leiponen 2006). Moreover, the economic significance of inter-organizational learning embodied in patent citations, is evidenced from the valuable inventions shaping standards in mobile telephony (Funk 2009). We begin by examining the institutional logics associated with the degree of corporatism at the societal level across countries, and establish the inter-linkages between this macro-level institutional logic and organizational and individual level actions and behaviors. Next, we substantiate our conceptualization of SSOs as technological arenas circumscribed by participants' corporatist versus pluralist logics, and build our theoretical arguments on how these institutional logics contribute to inter-organizational learning outcomes. We then present the research setting, explain our data and methodology and empirically test our hypotheses. We conclude with a presentation of our results and a discussion of our findings and limitations.

Theoretical Development

Corporatist and Pluralist Institutional Logics

Our theory of inter-organizational learning in technological arenas such as SSOs is grounded in the literature on cross-national comparison of cooperative versus competitive institutional logics. Among the most visible of such institutions is the varieties of corporatism across countries. We construe corporatism as "located in the realm of institutional behavior" (Schmitter 1981: 295)—an exploration of how society is organized to achieve its economic goals rather than as a political ideology (Cawson 1986, Hicks and Kenworthy 1998, Jepperson 2002). In this vein, the organization of society is characterized as either more corporatist—a society of orders with a set of rights and obligations, or less corporatist (pluralist)—a society of individuals bound in loose association (e.g. Jepperson and Meyer 1991, Jepperson 2002).

More corporatist societies adhere to a logic of cooperation manifested in the prevalence of encompassing associations that provide a mechanism for making policy bargains and coordination in

society (Katzenstein 1985, Cawson 1986). In more corporatist countries like Norway, Finland and Sweden, society rests on the fundamental logic of consensus building to maintain an organic rather than an atomistic community. Key elements of the inter-institutional system (Thornton et al. 2012) support organizations in developing structures emphasizing collective duties rather than individual rights and interests within the national context. Thus, social and economic groupings, guilds and associations feature prominently in these countries (Hicks and Kenworthy 1998, Schofer and Fourcade-Gourinchas 2001, Jepperson 2002). In other corporatist countries like Germany, Japan and Korea, industry groups operate in a close relationship with the state to promote national competitiveness, suggesting a strong guiding hand of the government coupled with tightly knit corporatist networks (Spencer et al. 2005).

In less corporatist or more pluralist countries like the U.S., U.K., Australia and Canada, a greater degree of individualism governs inter-organizational interactions. Underpinned by a logic that stresses the rights of individuals, pluralism gives rise to conventions about the primacy of property rights, market-based competition, and contractual relationships that give structure to societal interests and serve as the means for achieving them. Thus, pluralism is characterized by an atomistic society that relates to, but differs from, an avowedly market logic that describes the principles of economic exchange (e.g. Thornton 2002). For example, in pluralist settings, private appropriation of rents from innovation is supported by a complex system of intellectual property rights. Such structures are necessary to provide an efficient basis for exchange between organizations where markets serve to coordinate business activity and where firms are driven by the pursuit of individual self-interest rather than reconciling disparate societal interests. Thus, as Schmitter (1981) noted, while dealing with the same issues as more corporatist societies, pluralist models take on different institutional forms. While, pluralist models favor competitive interaction and market-based solutions, corporatist models favor coordinated interdependence.

Based on these observations, we ascertain that corporatism represents a macro-level institutional logic that generates unique organizing principles and practices that influence individuals and organizations across countries (Jepperson and Meyer 1991, Jepperson 2002). It encompasses not only material structures such as interest groups and business associations (Hicks and Kenworthy 1998) but also

embodies norms, values and symbolic aspects of the nature of social organization characterized by a greater degree of cooperation versus competition. Thus, as Jepperson (2002: 61) notes, corporatism and pluralism polity forms “capture strikingly well the distinctive ‘institutional logics’ (Friedland and Alford 1991) and political cultures of the Anglo, Nordic, Germanic, and French orbits.”

As an institutional logic, corporatism operates at multiple levels of analysis shaping organizational and individual behaviors through the processes of identification, attention structuring, and legitimation (Thornton and Ocasio 1999, Luo 2007). Identification with an institutional logic occurs as practices, beliefs and values are learned and reinforced through experience and affiliation with a community (Stryker and Burke 2000). An individual’s focus of attention and, hence, actions are activated by the attributes of the situation and environment (Ocasio 1997). As Goodrick and Reay (2011: 376) note, societal level “logics shape practices by structuring individual and organizational attention vis-à-vis rules and conventions for deciding what issues are important and thus worth resolving (Thornton 2002).” Finally, legitimation occurs within communities, when individuals rely on other members as referents by which to judge the appropriateness of actions, and how to respond in a given situation that further reinforces the salience of an individual’s identity in a given context (Stryker and Burke 2000). As Luo (2007) finds, a more corporatist logic supports a limited functional role of the self as a member of a collective, in contrast to a more entrepreneurial role supported by pluralism.

To ground our theoretical arguments and make explicit the inter-relationships between macro-level institutional logics and organization-level outcomes (e.g. Thornton et al. 2012, Pache and Santos 2013) we conceptualize SSOs as technological arenas that provide opportunities for inter-organizational interactions and learning among participating firms. As such, SSOs constitute collectivities of firms embedded within more or less corporatist logics, and from whose participation in the arena the SSO dominant logic emerges to become the focus of attention. Based on prior theory we identify the ‘ideal’ types (Thornton et al. 2012) of SSOs, highlighting the characteristics of the environment within an SSO which structures firms’ attention and legitimates pluralist versus corporatist logics (Table 1). We also provide examples from our interviews to illustrate the characteristics associated with each “ideal” type.

As Table 1 shows, corporatist versus pluralist logics define participants' identity, the core values and goals that constitute the focus of their attention, and the sources of legitimacy that circumscribe their behaviors and actions (Thornton et al. 2012). Our theory proposes that the logic firms activate within an SSO emerges from the participants' institutional backgrounds. An SSO comprising participants from mainly pluralist logics will project the characteristics of pluralism; a preponderance of participants from corporatist backgrounds will give rise to a corporatist logic. This emergent logic activates the beliefs, values and practices for inter-organizational learning in the dyadic relationship.

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The Effect of Institutional Logics on Inter-Organizational Learning

In the hypotheses that follow, we build on Friedland and Alford's (1991) foundational idea that societal institutions and the underlying institutional logics guide the organizing principles, interests, and preferences of individuals and organizations. In particular, we argue that the level of corporatism across countries relate to distinctive institutional logics that generate different organizational behaviors in SSOs and impact inter-organizational learning.

We conceptualize SSOs as technological arenas that expose firms to industry knowledge and allow for conversations and debates with the joint objective of shaping the industry's future technological direction. In this process of setting technological standards, participants are immersed in a rich context that provides opportunities to span organizational and technological boundaries and to form inter-organizational relationships. Consequently, firms can access new knowledge and transfer this knowledge back to their R&D units resulting in innovations that embody inter-organizational learning. This type of inter-organizational learning is stimulated by the pursuit of a technological standard, but can move well beyond the standard itself (Rosenkopf et al. 2001). As our informants expressed, "it would be foolish to have a totally isolated standards department...smart companies do connect standards to development." Hence, R&D engineers, who represent participating firms, are responsible for carrying the firm's knowledge to the SSO and vice versa, as illustrated by a participating engineer: "I am able to tell others—we need to get this done by this date otherwise we'll lose the opportunity to move the [technical

specification] document forward...people came back from the standards meeting and said, we need to solve this problem and develop something to come back with a solution.” This type of boundary-spanning activity by scientists and engineers is vital for innovating under technological uncertainty (Leibeskind et al. 1996). Yet, as Bouty (2000) observed, the availability of knowledge does not guarantee that it is exchanged and built upon; rather, the richest type of inter-organizational learning emerges from a continuous process of exchange between partners. In the absence of continuous feedback between the SSOs and firms’ R&D units, inter-organizational learning is likely to suffer.

We suggest that for continuous feedback and inter-organizational learning to occur, it is important to understand firms’ propensities to cooperate—or not—within the framework of the SSO. Importantly, our argument draws from the organizational learning perspective (e.g. Levitt and March 1988), but recognizes that the availability of material practices and normative aspects of cooperative or competitive behaviors in a learning-oriented exchange relationship do not arise in a vacuum. Instead, as Thornton et al.’s (2012: 93) key insight reveals, “given a social actor’s embeddedness within institutional logics and prior commitments and experiences, specific identities, goals and schemas will be readily accessible to attend to the salient environmental stimuli.” As we explain below, firms’ embeddedness in corporatist versus pluralist backgrounds determines the distinctive goals and the natural processes underlying their behaviors and interactions for achieving these goals.

Firms from corporatist backgrounds seek enlightened self-interest--a schema featuring long-term considerations that combine private benefits with social benefits and individual gains with collective gains for the industry. With these goals in sight, corporatism engenders a greater degree of concerted engagement and willingness to negotiate and communicate with others within an SSO. As one expert recounted, the technical proposals presented by a European telecommunications firm from a corporatist country tended to be “heavily reviewed and not laid lightly” so that potential solutions had already been raised with allies and tensions had been gauged ahead of time. By participating in formal procedures and through informal interactions aimed at building consensus, participants from corporatist backgrounds constitute fertile conduits for knowledge flows that culminate in inter-organizational learning.

In contrast to corporatist firms' emphasis on coordination and relational approaches, firms from pluralist settings prefer transactional and market-based solutions. Attesting to the presence of a strong competitive dynamic underpinning the behavior of pluralist firms, one participant noted, "where [intellectual property] is critical, ...it is difficult to handle the discussion and tension is very high." Moreover, by virtue of operating within a technology neutral framework (U.S. Congress, 1992), pluralist firms tend to spread their efforts across a plethora of organizations and interests (Tate 2001), thereby diluting participants' attention and contributions within a particular technological arena. Our interviews highlighted that, "North American companies are not participating [in SSOs] to the extent that they should...[there is] not enough focus on how to get the next wave of innovation into the field." An important implication of such diluted efforts is that some firms are represented by individuals that are akin to "standard setting tourists," less connected to the firms they represent and less engaged with the standard setting process. Consequently, participants from pluralist backgrounds constitute weaker channels of knowledge flows between the standard setting arena and their firms' R&D units.

Applying these insights concerning the differences in the standard setting goals and the means to achieve them, we propose that whereas corporatism promotes organizational boundary-spanning that facilitates knowledge flows and inter-organizational learning, a pluralist logic introduces a competitive dynamic that detracts from such learning.

HYPOTHESIS 1 (H1): Inter-organizational learning between firms in an SSO is greater when the firms in the dyad are from more corporatist rather than less corporatist countries.

Activating Institutional Logics for Inter-Organizational Learning

Next, we explicate the contextual conditions within the technological arena that determine whether firms activate a corporatist logic or pluralist logic at the dyadic level where learning occurs. We draw on the institutional logics perspective that recognizes that—contrary to the notion of homogenous organizational fields (DiMaggio and Powell 1983)—multiple and contradictory logics that inhere in firms' backgrounds (e.g. Lounsbury 2007) often co-exist within an organizational arena (Thornton et al. 2012). Although potential conflicts and complexities could arise in such arenas, by adopting the dominant logic

participants often expedite the resolution of such tensions and are able to conduct their work in a non-disruptive environment (Thornton and Ocasio 1999, Goodrick and Reay 2011). As one of our interviewees expressed, “It is a balancing act. At the end of the day there must be cooperation. At some point companies must agree that this solution is certified.”

A dominant institutional logic, representing a larger proportion of the participants, becomes manifest in an SSO’s material structures and symbolic practices. Moreover, it focuses an SSO’s attention on specific values and ideals, such that a distinctive corporatist or pluralist logic permeates the arena. Indeed as an informant attested to the distinctiveness of SSO logics, “there is very much the attitude of this is the way we do it.”

As an illustration, one senior member of a standards body described a dominant corporatist logic as manifested in “regulation that puts the interests of society over the interests of companies.” In such an SSO, European participants agreed upon a single technology for text or short message service (SMS) while three incompatible standards persisted in the U.S. The SSO dominated by corporatist participants approached their goal by enacting a set of schemas or cognitive frameworks embodying the perspective that “we have a duty to have a pan-European phone system...we need to provide this as a utility” to benefit consumers and firms in the long-run. An important implication of a dominant corporatist logic that fosters this collective approach is that it activates greater coordination and interaction critical for inter-organizational learning. By contrast, in SSOs dominated by a pluralist logic, reliance on competition and market-based approaches perpetuates a “wait and see” approach—firms want to see orders rolling in before they build a system. One interviewee commented that over a 30-year period, he had observed a “huge difference in how companies perceive standardization. I see that American companies have a distaste for standards [as they] never liked putting huge resources in standards,” further, “they often take a short term view of things and it is hard to justify standards on quarterly basis.” These illustrations of the distinctive contexts within which an SSO’s activities unfold are relevant for understanding differences in inter-organizational learning. They highlight that the logic surrounding the standards setting processes in a ‘corporatist arena’ dominated by corporatist firms facilitates the practices that support inter-

organizational learning, whereas the structures in a more 'pluralist arena' detract from such inter-organizational learning.

When participants in a dyad encounter a dominant logic potentially contradicting their own principles, the institutional logic to which the participants in a dyad subscribe becomes less salient because participants in a dyad will invoke their institutional logic only to the extent that the surrounding context legitimizes it (Ocasio 1997). When attention is directed to a dominant logic, practices associated with the less prominent logic may not even get activated. In such situations, as alternative practices compete for attention, participants prioritize and allocate resources towards those issues to which the dominant logic attaches more salience, so as to gain legitimacy and improve their expectation of succeeding in their immediate tasks (Ocasio 1997). Importantly, while participation in an SSO is voluntary, the ability of a firm to achieve its strategic standard-setting objectives is entwined with its ability to navigate across alternative norms, values and beliefs (Kraatz and Block 2008) and select an appropriate repertoire of action (Ocasio 1997, McPherson and Sauder 2013). By adopting the repertoire associated with the dominant logic, firms can ease the tensions and avoid disruptions arising from institutional contradictions; hence, firms attend to the dominant logic even at the expense of decoupling from their natural processes for inter-organizational learning.

More specifically, a dominant pluralist logic diverts attention away or decouples firms from the activities and cooperative schemas that foster inter-organizational learning and hence, suppresses the activation of a dyadic corporatist logic. Likewise, a dominant corporatist logic blunts the competitive dynamic of a pluralist logic. Conversely, a congruence of institutional logics can reinforce commitment to that logic, thereby, enhancing inter-organizational learning in corporatist dyads, and detracting from such learning in pluralist dyads. Consistent with these ideas, discussions with a senior standards setting chairman revealed that SSO participants do adopt the dominant logic of the SSO, but not without some pain, as when delegates come "from completely different backgrounds, it takes longer to build up...an understanding...and can make friction." In sum, participating firms learn from each other, the more they are able to identify with cooperative routines and schemas embedded in corporatist logics, but the extent

to which such schemas are accessible and activated depends on the dominant logic in the context, as summarized in Table 1 previously, within which inter-organizational learning occurs.

HYPOTHESIS 2 (H2): Inter-organizational learning between more corporatist firm dyads increases when the dominant logic in the SSO is also more corporatist rather than less corporatist.

Activating Institutional Logics for Inter-Organizational Learning Across Technological Distance

In the preceding hypotheses we suggest that inter-organizational learning at the dyadic level is contingent on the predominance of corporatist logics in SSOs because corporatist logics activate the cooperative schemas and routines that are necessary for spanning organizational boundaries. We now address an important source of cognitive constraint that arises from spanning technological boundaries at the dyadic level, which could potentially affect inter-organizational learning. In the arguments that follow, we propose that corporatist logics dominating an SSO activate routines that allow firms in a dyad to not only transcend organizational boundaries, but also span technological boundaries more easily, thereby facilitating learning from technologically distant firms.

The salience of technological distance arises because technological arenas such as SSOs often attract firms whose technological capabilities are similar and overlapping, as well as those whose technological capabilities are more distant but potentially complementary. Indeed, firms in emergent technological settings confront the dual pressures of learning from their fiercest rivals and adopting an inclusive approach that builds upon distant knowledge (e.g. Katila and Chen 2008). However, prior studies have shown that learning from firms that are technologically distant is especially challenging from a cognitive standpoint (Rosenkopf and Nerkar 2001, Benner and Tushman 2002, Vasudeva and Anand 2011). As March (1991: 85) explains, inter-organizational learning that is technologically proximate involves the “refinement and extension of existing competences, technologies, and paradigms. Its returns are positive, proximate, and predictable.” By contrast, learning across technological boundaries calls for “experimentation with new alternatives. Its returns are uncertain, distant, and often negative.” Similarly, applying Szulanski’s (1996) notion of ‘sticky’ knowledge, technologically distant knowledge tends to be more complex, systemic and difficult to transfer between organizations.

For these reasons, learning across technological boundaries relies heavily on coordination and social proximity (e.g. Stuart and Podolony 1996). Ironically, technological distance often precludes social relationships and interactions that are so crucial for overcoming technological distance. As Rosenkopf and Almeida (2003: 752) observe, firms' representatives that participate in SSOs, "interact most frequently with other firms and individuals with similar technological expertise. Social networks [in SSOs] emerge between professionals with common technological interests."

It follows from these observations that cooperative principles built on the notion of inclusiveness and a long-term orientation—characteristic of corporatist logics—are more conducive for overcoming the social and cognitive barriers that technological distance perpetuates. An arena that activates corporatist logics, therefore, should make cooperative schemas more accessible and foster greater relational investments that facilitate learning from more technologically distant firms. By contrast, pluralism's orientation towards more immediate pay-offs associated with efficiency-seeking behavior propels firms towards specialization with a focus on developing existing competencies. Such an orientation degrades firms' incentives to engage and interact with technologically unrelated firms and instead, predisposes firms towards learning from those that are technologically similar. It follows from these arguments that:

HYPOTHESIS 3 (H3): Inter-organizational learning between technologically distant firm dyads increases when the dominant logic in a standard setting arena is more corporatist rather than less corporatist.

To summarize, our theoretical model (Figure 1 in the online appendix) relates national institutional logics to the three core mechanisms of the institutional logics perspective—identification, attention structuring, and legitimation (Thornton et al. 2012)—that underpin our arguments linking macro-level logics with more micro-level behaviors and actions. These shape the boundary spanning role identities and actions of firms' representatives in inter-organizational learning at the dyadic level. Our model highlights the role of participating firms in bringing their national institutional logics into the technological arena and shaping the dominant logic of the SSO. In turn, the dominant SSO logic is shown to act as a contingency, shaping the focus of attention and behaviors that affect the relationship between the organizational and technological boundary spanning activities and inter-organizational learning outcomes.

Data and Methodology

Research Setting

We test these hypotheses in the context of SSOs in the mobile handset industry. The industry involves firms from North America, Asia and Europe resulting in diverse institutional backgrounds coalescing in SSOs, thereby allowing for variance in their learning routines as well as institutional contradictions that may arise. SSOs in this industry have unique material structures (Table 1 in the online appendix) in terms of the format of technical committees, deliberations of technical proposals, and voting rules with which firms' participants engage as they seek to build consensus around a technological standard (Funk and Methe 2001, Leiponen 2006). In addition, inter-organizational learning from both technologically distant and technologically proximate firms occurs in these settings as organizations from diverse technological backgrounds coalesce to agree on a common standard.

SSOs have featured prominently in the development of analog and digital mobile technologies as the need for interoperability across technologies required more coordination structures. According to our informants, “[SSOs] in telecommunications play a critical role in the commercialization of technology.” Due to the complexity of the technology, manufacturers have been the main source of innovation; hence, the most important flows of knowledge are between pairs of manufacturers (Funk 2009). Indeed, our key informant interviews stressed the importance of the manufacturers in the work of SSOs because “these firms are doing the R&D and learning—the meetings’ records show that the operators are much more in the background,” and “there is a big difference between operators and [manufacturers]: ...[manufacturers] have the main competition/cooperation dynamic to meet [operators] requirements.”

Data Sources and Sample

We collected data for firms in the mobile handset manufacturing industry from 1971, the year that the first SSO in the industry was initiated, until 1995, and collected patent data until 2000, allowing a five-year window to observe inter-organizational learning. Data regarding handset manufacturers and SSOs were collected from academic and industry publications detailing these standard-setting events (see Table 1 in the online Appendix). Because our main interest lies in examining inter-organizational learning

between pairs of firms in an SSO, we created a dyad-year panel. To estimate the likelihood that firms self-select to co-participate in an SSO in a given year, we use a dyadic dataset of 1,541 dyad-year observations over the period 1971-1995, including all pairs of firms that could potentially co-participate. Our final dataset for estimating inter-organizational learning between pairs of firms within SSOs comprised 601 dyad-year observations, involving 26 firms in 181 unique dyads across 12 countries in North America, Europe and Asia. Our sample included well-known firms (e.g., Motorola, Nokia, Ericsson, and Samsung) as well as lesser-known firms in the industry. No single firm claimed a majority of patents or patent citations. The 181 unique dyads participated in 17 standards in our sample period.

The time to develop a standard—from initiation to operationalization—ranged from two to nine years. Participants in an SSO ranged from two to 19 mobile handset manufacturers, and the number of countries represented in an SSO ranged from one to 11. We include the earliest SSOs formed in 1971 up to 1995 to observe firms in the initial stages of technological development when their innovation approaches were more embedded in their national institutional context. As in the case of other industries, such as semiconductors (e.g. Macher et al. 2007), our data reveals that on average 80 percent of all inventors associated with patents in this industry reside in the assignee firm's home country, suggesting a strong influence of national institutions in the early stages of firms' technological innovation.

Patent data are used to measure firms' technological characteristics and inter-organizational learning (e.g. Ahuja 2000, Rosenkopf and Almeida 2003). These data were obtained from the U.S. Patents and Trademarks Office (USPTO), retrieved from the Delphion database. A review of the USPTO Manual and discussion with patent examiners revealed that mobile handset patents do not fall into identifiable patent classes. To avoid including patents outside our focal industry, we undertook a keyword search in the title, abstract and claims fields of the patents for each of the firms to generate the appropriate dataset. Similar to Régibeau and Rockett's (2010) approach to identify patents for genetic engineering of genetically modified crops, our keyword search focused on cellular or mobile telephones and specifically excluded networks, or pager technologies as well as satellite and cordless telephone technologies that fall outside the scope of our study. Our search resulted in 1033 patents between 1971 and 1995 for all firms in

the industry. Of those, 820 patents belong to the firms in our sample who co-participated in SSOs.

Dependent Variable

The dependent variable in our analysis is inter-organizational learning for which we use the proxy of patent citations between pairs of mobile handset manufacturing firms participating in SSOs. Rysman and Simcoe (2008) interpreted patent citations as a measure of economic value with implications for the overall performance of an SSO. However, our measure of patent citations does not distinguish between learning that is facilitated by the SSO context and that which directly corresponds to the standard outcome or performance of the SSO. We calculated this variable as the extent to which firms in a dyad cite each other in their USPTO patent applications in the five years following the observation year (e.g. Jaffe et al. 1993, Rosenkopf and Almeida 2003). We calculated these citations as a proportion of the total citations made by the firms in the same five-year window. The following formula shows this calculation: $\frac{1}{2} (C_{F_1F_2}/C_{F_1F} + C_{F_2F_1}/C_{F_2F})$ where $C_{F_1F_2}$ is Firm 1's citations to Firm 2 in the five years following the observation year, C_{F_1F} is Firm 1's total citations to any firm in the following five years. $C_{F_2F_1}$ and C_{F_2F} are Firm 2's citations to Firm 1 and its total citations to any firm, respectively. We used total citations (C_{F_1F} and C_{F_2F}) as a base to adjust for relative differences in general propensity to cite across firms in the sample. Using a five-year future window across all firm observations addresses the issue of high variability in the level of citations from one year to the next, and accounts for the collaborative impact of an SSO that may easily extend beyond a single year. Despite limitations of patent-based measures (Alcácer and Gittelman 2006), they remain one of the primary ways to capture technological knowledge flows and learning because of the systematic, rigorous, and uniform nature of the patenting process.

Independent Variables

The dominant logic within an SSO is operationalized based on the extent to which firms in SSOs and the SSO sponsors originate from more corporatist versus less corporatist (or pluralist) countries. This measure captures the availability of corporatist versus pluralist logics within the arena, and hence, the extent to which corporatist versus pluralist logics get activated in dyadic exchanges that drive inter-

organizational learning. Country level scores for participating firms are obtained from the Hicks-Kenworthy scale of corporatism (Hicks and Kenworthy 1998, Kenworthy 2000) with values ranging from 0 to 1, where 1 is most corporatist. This is a quantitative composite index varying over time capturing the level of inter-organizational networks such as business confederations, and level of cooperation between labor and management, the government and interest groups, and between financial investors and firms.

To create the SSO corporatism score, we calculated the weighted average of the corporatism values for all firms in the SSO each year, as follows: $\frac{1}{G} \sum_{i=1}^G H_{it} \cdot W_{it}$, where H_{it} is the Hicks-Kenworthy value in year t for the home country of firm i , W_{it} is the socio-technical weighting for firm i in year t , and G is the number of firms in the SSO. We include the socio-technical weighting to capture the heterogeneous influence of firms. Since firms with greater technological prowess (more cumulative patents) and firms with greater prominence in the inter-organizational network (more inter-organizational alliances in the industry network) may exert greater influence on which institutional logics become dominant in an SSO, these firms' corporatism scores were given a greater weight. We also assigned corporatism scores (1 = corporatist, 0.5 = mixed, 0 = pluralist) to the SSO sponsoring countries (Table 1 of the online appendix). The weighted corporatism score derived from firms' corporatism and the SSO sponsors' corporatism were averaged to create the final SSO corporatism measure. In 15 instances (2.5 percent of observations) where a dyad simultaneously participated in two SSOs in a given year, we averaged the corporatism values corresponding to each SSO to create one value for the dyad-year observation. The SSO corporatism scores range from less corporatist (0.01) to more corporatist (0.92). The dyadic institutional logic is operationalized as the weighted average of the Hicks-Kenworthy corporatism values for the two firms in a dyad. Dyads range from less corporatist or more pluralist (0.01) to more corporatist (0.95).

The technological distance between two firms in a dyad was calculated using Jaffe's (1986) measure of technological distance (Sampson 2007). The measure captures the dissimilarity of two firms' technological profiles. The measure was calculated using the correlation between the patent profiles of

each dyad's firms for each observation year using the following formula: $1 - P_1 P_2' / \sqrt{(P_1 P_1')(P_2 P_2')}$. P_1 is the patent profile of Firm 1 and P_2 is the patent profile of Firm 2. Each profile is a vector of the number of patents in each three-digit patent class: $P_1 = \{P_1^1, P_1^2, \dots, P_1^K\}$ and $P_2 = \{P_2^1, P_2^2, \dots, P_2^K\}$. We identified 52 patent classes to which these patents are assigned. Values for technological distance range from 0 to 1; a higher value represents a greater technological distance between firms in a dyad.

Control Variables

To account for alternative explanations of inter-organizational learning, we control for a number of SSO- and dyad-level variables. Since it is plausible that an SSO's established procedures and formal structures drive learning in SSOs, we identified SSO properties that characterize the nature of an SSO's formal structures. We constructed a composite measure—SSO formal establishment—that includes whether the SSO was state sponsored (1 = Yes, 0 = No), the basis of decision making in the SSO (1 = Sponsor, 0.5 = Consensus vote, 0 = Majority Vote), and the organizing framework (1 = Vertically integrated, 0.5 = Hybrid committee, 0 = Market committee). We used principal components analysis to ensure that the three measures loaded together and then created the composite score by averaging the three values. Further, we controlled for the eventual outcome of the SSO—whether the associated standard was adopted or rejected. We also control for SSO age (i.e., the number of years since the SSO was initiated), which accounts for the time that SSO participants have worked together. Following Luo's (2007) finding that statism has a marginal effect on preferences for training approaches, we controlled for the impact that statist backgrounds of SSO participants may have on inter-organizational learning. We created a statism index based on the OECD's yearly country-level measure of regulation in the energy, transport and communications sectors (Conway and Nicoletti 2006). We scaled the measure from 1 = high statism to 0 = low statism. We used the same weighted average technique that we used for calculating the corporatism of SSO firms. The degree of interconnectedness among SSO members through alliances could also impact learning. To account for such effects we include the alliance network density of an SSO measured as the existing number of alliance ties among SSO members divided by the total potential ties. Further,

we include an SSO's cultural diversity to separate institutional effects from other confounding country-level characteristics. We used Hofstede's (2001) cultural measures to calculate the SSO cultural diversity (Lavie and Miller 2008) based on the standard deviation of participants' home countries on each of the five cultural dimensions, and then take the average. Finally, regional proximity of participants in an SSO could affect inter-organizational learning outcomes. Accordingly, to capture such geographic effects, we include a measure of regional diversity within SSOs, calculated as a Herfindahl index based on three regional categories: Europe, North America and Asia.

At the dyadic level, we include controls that account for alternative explanations arising from firms' technological capabilities and relational attributes. We control for the firms' combined industry experience calculated as the number of years since the firms entered the mobile handset industry. To account for firms' technological base, we include a count of cumulative patents assigned to the firms in a dyad (Rosenkopf and Almeida 2003). We also include prior citations to each other, to account for the extent to which firms in a dyad have learned from each other in the past. To account for relational embeddedness, we calculated the number of SSOs in which firms in a dyad jointly participated in prior years, as well as the number of prior alliances (Gulati and Gargiulo 1999). We also identify connections between firms arising through their investments. An investment control is coded as 1 in dyads where one firm has an equity investment in the other. To capture competition effects that might spur inter-organizational learning, we include the total number of firms in the home countries of firms in a dyad. Finally, we include the average GDP per capita in firms' home countries to account for economic or market influences acting upon dyads. We also include dyadic fixed effects to account for other unobservable time-invariant characteristics, and year fixed effects to account for changes in the industry.

Model

The unit of analysis in our model is a dyad comprising a pair of firms. These dyads are often repeated across years because dyads are observed for each year in which the SSO is operational. Sometimes the same dyad appears in multiple SSOs resulting in an unbalanced panel structure for our dataset. Our main interest lies in comparing inter-organizational learning within pairs of firms or dyads in an SSO as a

function of the dyadic corporatism, technological distance and the dominant logic in an SSO. Since firms are non-randomly assigned to SSOs, potential endogeneity concerns arise from firms' decisions to co-participate in SSOs (Heckman 1979). Relatedly, unobserved attributes of the firms in a dyad may both predispose them to co-participate in SSOs and impact the extent to which they cite one another as evidence of inter-organizational learning. If this is the case, then the estimate for the effect of dyadic and SSO characteristics on inter-organizational learning could be biased (Shaver 1998). To account for such biases, we use a two-stage regression model (Wooldridge 2002).

In the first stage we estimate the likelihood that firms in a dyad co-participate in an SSO in a given year. We estimate this binary outcome using a fixed effects logit regression for 1,541 dyads, or all possible dyads that can be formed between pairs of incumbent firms in the mobile handset industry in each year. We use a fixed-effects logit to account for time-invariant drivers of participation among dyads, which is not available with a probit model. Although a probit model is traditionally used in the first stage of a sample selection model, the two-stage sample selection approach by Heckman (1979) has been generalized for other distributions, including logit (Lee 1983). From the predicted probabilities generated in the first stage regression we computed the inverse Mills ratio: the correction term which, if significant in the second stage model estimating inter-organizational learning, suggests that unobserved factors driving dyadic firms to co-participate in an SSO also correlate with dyadic inter-organizational learning.

The first stage model, as shown later in Table 3, includes dyadic explanatory variables that might influence co-participation in an SSO that are also included in the second stage model. To identify the system of equations, the first stage model includes three variables that impact dyads selecting to co-participate in SSOs but do not directly affect inter-organizational learning: the number of active SSOs in a year, and measures for the market penetration of fixed-line and mobile telephony calculated per 100 individuals in the dyadic firms' home countries (ITU 2004). The second stage regression estimates inter-organizational learning between dyadic firms as a function of dyadic corporatism, technological distance and the dominant logic prevalent in an SSO. In this stage, we only retain dyads that co-participate in an SSO and estimate inter-organizational learning in the five-year window following each observation year

in which the firms co-participate. Based on the significance of Hausman test, we use a fixed effects specification to account for time-invariant sources of unobserved heterogeneity across dyads. We use clustered standard errors to account for autocorrelation within dyads repeated across multiple years.

Results

The descriptive statistics for the variables estimating dyadic inter-organizational learning are presented in Table 2. On average, patent citations between a pair of firms in an SSO account for two percent of these firms' total citations. A t-test for the difference in means reveals the citation rate (which is about one-half percent) among pairs of firms that do not participate in SSOs is significantly lower than pairs that do ($p < 0.001$). This result follows from Rosenkopf et al.'s (2001) findings and confirms our baseline expectation that pairs of firms co-participating in SSOs will tend to learn more from one another than pairs of firms that do not co-participate in such technological arenas. The mean value of corporatism in the SSOs is 0.53. Table 2 shows a correlation of only 0.29 between the SSO corporatism score and the dyadic corporatism, thus, suggesting that the dyadic and SSO level institutional logics are often different.

---INSERT TABLE 2 ABOUT HERE---

Table 3 provides estimates from the first stage regression estimating the likelihood that firms in a dyad co-participate in an SSO in a given year. These results show that a larger number of active SSOs in a given year significantly increases the likelihood of co-participation in an SSO, but the fixed-line and mobile market penetration rates in their home countries significantly decrease the likelihood of co-participation. The significance of these results establishes the relevance of our instrumental variables for model identification. In addition, while industry experience increases the likelihood of co-participation, dyadic corporatism and prior co-participation in SSOs decrease the likelihood of co-participation.

Table 4 presents the results from the second stage model estimating inter-organizational learning between pairs of firms in an SSO using a linear probability model and dyadic fixed effects. Model 1 includes the control variables only. Model 2 adds the main effects of SSO corporatism, dyadic corporatism and technological distance. Models 3-4 include the interactions between SSO corporatism and the dyadic characteristics sequentially. Model 5 is fully specified and includes all the main and

interaction effects to test the hypothesized relationships. The effects of some controls in our models are theoretically interesting. Inter-organizational learning is lower when SSOs comprise firms from statist institutions or when regional diversity in the SSO is higher. The model also suggests that firms learn from one another more when they have less industry experience or when they have prior relationships through alliances or past SSOs. The inverse Mills ratio, which captures unobserved characteristics that can influence SSO participation and inter-organizational learning, is negative and marginally significant. This suggests that it is capturing a modest positive selection effect (Hamilton and Nickerson 2003; Shaver, 1998). In other words, firms that are more likely to learn from co-participating in SSOs also choose to participate in them. While these effects remain directionally consistent in all our models, for certain variables, we find a weakening in their significance once the model is fully specified. We also find that the model R-squared and log-likelihood statistics improve with the inclusion of the explanatory variables.

Results from Model 2 show a marginally significant positive main effect of dyadic corporatism, which provides modest support for H1 ($p < .10$). This main effect is illustrated in Figure 1a by the line labeled “All SSOs.” Results from the fully-specified Model 5 lend strong support for H2 ($p < .01$). As illustrated in Figure 1a, corporatist dyads learn to a greater extent when the dominant SSO logic is corporatist rather than pluralist. On average, patent citations are three times greater in corporatist dyads (i.e. corporatism is one standard deviation above the mean) when they are situated in SSOs dominated by corporatist rather than pluralist logics. Although, as Figure 1a reveals, pluralist dyads tend to learn more in SSOs dominated by a corporatist logic, this increase is not statistically significant. This finding corroborates our expectation that pluralist dyads are more decoupled from learning within the SSO context to begin with, such that, the dominant logic has little effect on their patent citation rates.

Model 5 provides strong support for H3 ($p < .01$) as well. Figure 1b shows the impact of SSO corporatism on the relationship between technological distance and dyadic learning. Technological distance itself is neither beneficial nor detrimental for dyadic learning; rather, our results show that the effect of technological distance depends on the dominant institutional logic of the SSO in which the dyad is situated. Inter-organizational learning in technologically distant dyads (i.e. one standard deviation

above the mean value of technological distance) in corporatist SSOs exceed the inter-organizational learning for these dyads in pluralist SSOs by nearly fivefold. While the average patent citation rate in technologically distant dyads in corporatist SSOs is 5 percent, this citation rate dropped to nearly zero for pluralist SSOs. In technologically proximate dyads, the effect of the dominant SSO logic is much smaller.

---INSERT TABLES 3 AND 4 AND FIGURES 1(a) -1(b) ABOUT HERE---

Supplementary Analysis

We tested the robustness of our findings with several alternative specifications (see Models 6-10 in Table 2 of the online appendix). Since our dependent variable is a proportion bounded between 0 and 1, it presents some challenges for linear regression (Greene 1997). We tested an alternative specification using a log odds transformation of the dependent variable (Phelps 2010). We also tested a mixed-effects model that allows for multiple sources of non-independence across observations, factoring in SSO-level and dyadic random effects and accounting for correlations within SSOs and within dyads. In this manner, we address an important limitation of our fully specified fixed effects model that accounts for correlations within dyads but not within SSOs. Although the mixed-effects model factors in both sources of non-independence, it requires an additional assumption that the unobserved attributes of dyads are not correlated with any observed variables, which may not be true in our sample. For this reason, our results are presented based on the findings from the fixed effects model shown in Model 5. To test the sensitivity of our measure for the dominant SSO-level logic, we used an alternative operationalization of our explanatory variable employing Jepperson's (2002) time-invariant dichotomous measure of country corporatism that takes on a value of 1 for a corporatist country and 0 for a pluralist country. This classification scheme is used to calculate the proportion of corporatist firms in an SSO. In this model, we use Jepperson's coding scheme to create the dyadic value of 1 for corporatist dyads, 0.5 for mixed dyads (one firm is corporatist and the other is pluralist), and 0 for pluralist dyads. We also tested for the interaction between technological distance and dyadic corporatism and find that the result is consistent with the reported interaction between technological distance and SSO corporatism. To test the sensitivity of our results to the length of window used to measure inter-organizational learning, we estimated a

model using a three-year window for the dependent variable. In each of these alternative specifications, the results across the alternative specifications remain consistent with the reported results from Model 5.

Discussion

Our study set out to understand the variations in inter-organizational learning outcomes by taking into account differences in the institutional logics of firms participating in technological arenas such as SSOs. The point of departure for our study stems from Levitt and March's (1988: 320) key insight that "organizations are seen as learning by encoding inferences from history into routines that guide behavior." We build on this idea and submit that the "history" that underpins organizational routines is not an atomized history, rather organizational routines and the resulting interactions that guide learning are embedded in firms' institutional logics. Towards this goal, we show that firms enact very distinctive logics that arise from firms' country specific institutional contexts, characterized either by pluralist norms of competition or corporatist norms that emphasize cooperation. We find that although firms from both corporatist and pluralist societies often coalesce together in technological arenas such as SSOs, their institutional logics exert differential effects on the nature of their inter-organizational learning outcomes.

The marginal support for Hypothesis 1 concerning the positive effect of dyadic corporatism on inter-organizational learning suggests that the effect of firms' institutional logics is more fully understood upon taking into account the institutional context of the participants in the technological arena and the dominant logic that confronts firms in the exchange relationship. Indeed, as our findings based on Hypothesis 2 reveal, dyadic corporatism takes effect contributing to significantly greater inter-organizational learning when the SSO context activates corporatist rather than pluralist logics. In contrast, a contradiction between the dyadic corporatist logic and the dominant logic in the technological arena, suppresses inter-organizational learning outcomes. Our arguments center on the notion that even though the SSO does not constitute an institutionalized organizational form, it provides a context that alters the extent to which the cooperative schema and associated mechanisms for inter-organizational learning become accessible to participants in an exchange relationship.

It is noteworthy that pluralist firms learn little from one another within an SSO context even when

the SSO is dominated by a corporatist logic. We attribute this lower propensity to learn among pluralist firms to their more competitive orientations and detachment from committee-based standard setting. It is plausible however, that pluralist firms rely on alternative mechanisms not only for standard setting but also for inter-organizational learning, that we do not observe in the context of this study. Further, as we posit under Hypothesis 3, while learning across technological distance is activated by a dominant corporatist logic, a pluralist logic impedes such learning. Technological distance on its own, however, does not have a significant effect on inter-organizational learning, thus confirming the idea that the effect of dyadic firm characteristics on learning are more fully understood when the broader context that structures firms' attention towards specific institutional logics is taken into consideration.

Implications for Theory

Drawing on Thornton et al. (2012) our study offers a link between macro-level logics and more micro-level organizational behavior and actions, and contributes to research that probes the nuances of the relationship between institutional logics and organizational learning (e.g. Owen-Smith and Powell 2008, Gavetti et al. 2012). Our work highlights how institutional logics activate cooperative versus competitive schemas and practices through the mechanisms of identification, attention structuring and legitimation of the firms' representatives acting as boundary spanners. In this way our work emphasizes the idea that the routines for inter-organizational learning are grounded in institutional logics that lead to stable patterns of behavior learned through experience over time.

By employing an institutional logics perspective derived from firms' corporatist versus pluralist country contexts, our theoretical framework addresses Thornton et al.'s (2012: 174) concern that "there are relatively few institutional logics studies in the international context, highlighting an opportunity to link the historical and comparative institutionalists." Our findings indicate that the pursuit of knowledge in international arenas motivates firms to confront and cope with contradictory institutional logics. This insight from our study points to the strategic rationale for engaging in institutionally heterogeneous arenas, which contrasts with the approach that institutional contradictions arise exogenously (Lounsbury 2007, Pache and Santos 2013). Our conceptualization of an arena comprising firms subscribing to

different institutional logics also addresses a limitation of earlier work (e.g. Zeng and Chen 2003) that assumed a consistent set of institutional norms shared by all organizations within a multiparty arena.

Our work addresses Greenwood et al.'s (2011: 332-333) observation that “logics are typically portrayed as incompatible nominal categories” and that “research into institutional complexity has to be more explicit about both the degree and the sources of incompatibility.” Addressing the first of these points, we theorize about institutional logics in terms of the degree of corporatism associated with firms’ country contexts. For the second observation, prior work on standards (e.g. Simcoe 2012) characterizes conflicting logics between competing professional categories—private sector firms, or “suits,” versus not-for-profit and academic institutions, or “beards”—within a single Internet standards setting committee. We propose a different source of institutional contradictions within an SSO based on societal logics for inter-organizational learning rooted in “polities” rather than “sectors.”

Finally, while a number of studies have investigated the salience of multiple contradictory institutional logics confronting organizations (Greenwood et al. 2011), our study accounts for the ascendancy of one logic at the expense of another. In such settings, firms manage institutional contradictions by attending to the institutional logic that is not necessarily rooted in their own background and is yet appropriate for interactions with specific audiences. Our conceptualization resonates with the notion of an “institutional toolkit” (McPherson and Sauder 2013, Ocasio 1997) or repertoires of logics that comprise stable and recognizable practices, whereby, while firms adhere to their own institutional logics, they use agency in activating a different logic that is appropriate for coping with the immediate goals and demands of their local environment. Framed as repertoires, firms can deduce the appropriate line of action to navigate the resolution of actions in standards setting committees. Adopting a contrary logic, albeit temporarily, represents a process of decoupling that creates a wider gap between the external arena and the firm’s internal organizational practices for inter-organizational learning.

Limitations and Future Research

One of the main limitations of our theoretical approach is that while we invoke mechanisms at the micro-foundations of the institutional logics perspective, our study design does not enable us to explicitly

account for individual behaviors or cognition. We are also not able to operationalize all the underlying mechanisms such as attention and cognitive constraints at the individual or organizational levels. We address this weakness in part through detailed interviews with individuals who have been involved in the telecommunications standards setting process across several countries since the inception of SSOs in the 1980s. These interviews shed light on the micro processes underlying the hypothesized relationships, and provide greater depth and nuance to our arguments.

Our theoretical arguments and findings are restricted to specific settings characterized by early stage technological innovation when firms are more likely embedded in their national institutional context (Macher et al. 2007). Further, our theory that firms' dyadic logic get suppressed in favor of a contradictory dominant logic is more plausible in settings where organizations from different institutional backgrounds coalesce temporarily for achieving a specific goal. Such arenas, however, limit the opportunities to study the conditions under which competing logics generate entrepreneurial opportunities and other coping strategies (Greenwood and Suddaby 2006, Kraatz and Block 2008).

Future studies could also delineate the symbolic from the material dimensions of institutional logics. While we take a step in this direction, by showing that even after accounting for the decision-making and procedural aspects of SSOs, the informal norms and codes of conduct remain salient, it is plausible that the material aspects of logics operate differently from the symbolic dimensions. In light of such a possibility, studies of institutional logics may need to decompose the material and symbolic elements into their constituent parts and build appropriate theory for each element separately.

Finally, by recognizing their common cognitive underpinnings, our study seeks to create a bridge between the institutional logics and organizational learning perspectives. In particular, the processes of identification, attention structuring and legitimation arise from cognitive constraints and are presumably learned processes through which organizations and individuals activate distinct patterns of values, beliefs, norms, and interpretations. Future studies that advance our understanding of the cognitive processes that are so central to the study of organizational learning, thus, can also inform the institutional logics perspective and its underlying mechanisms.

Conclusion

In sum, our study builds on the fundamental idea that organizations bound together in a technological arena are embedded in institutional logics derived from their societal backgrounds. These logics give rise to distinctive identities, goals and schemas that shape inter-organizational learning outcomes. Regardless of their institutional backgrounds firms enter such arenas, generating institutional contradictions, with the expectation of transferring and gaining knowledge across organizational, technological and institutional boundaries. Importantly, firms exercise agency in managing institutional contradictions in such arenas and activate the dominant logic that is legitimated in their local environment.

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Figure 1 (a). The Interaction between Dyadic Corporatism and SSO Corporatism

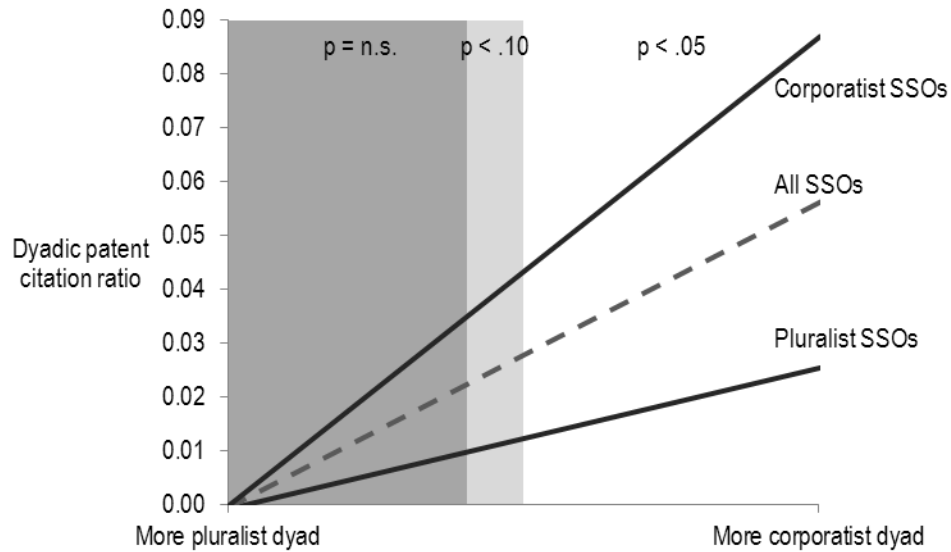
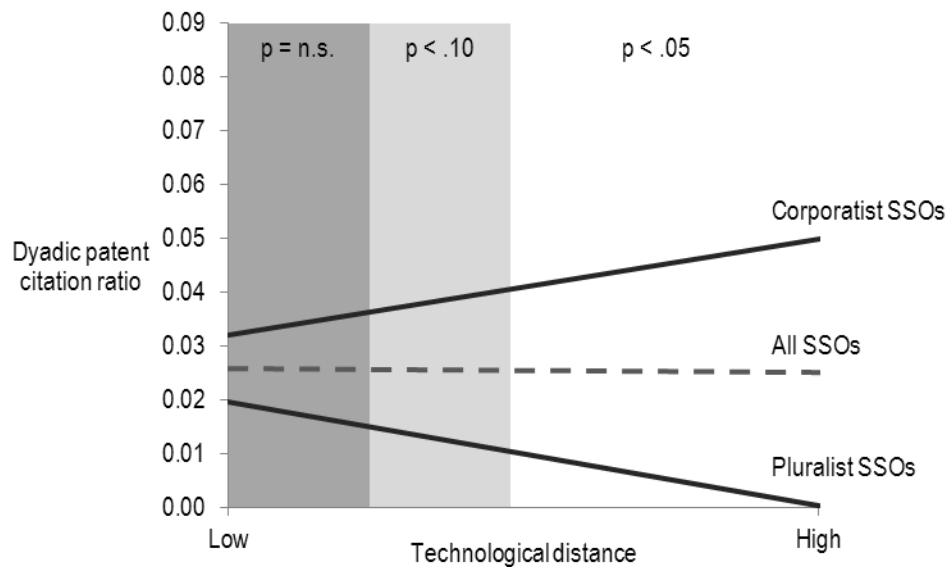


Figure 1 (b). The Interaction between Dyadic Technological Distance and SSO Corporatism



Corporatist and pluralist SSOs are calculated at +1 and -1 standard deviation from the mean of the SSO corporatism index, respectively. Dyadic pluralism-corporatism and technological distance on the x-axes range from -1 to +1 standard deviation. The one-tailed p-values ($p = \text{n.s.}$ in the dark gray area, $p < .10$ in the light gray area, and $p < .05$ in the white area) are calculated for the difference between corporatist and pluralist SSO predicted values at different levels of dyadic corporatism and technological distance. The predictions are based on year = 1990.

Table 1. Ideal Types of Institutional Logics and Firms' Behaviors in Standards Setting Organizations

| Attributes ¹ | Pluralist Logic | Corporatist Logic |
|--|--|--|
| Foundational perspective | Society of individuals bound in organization through loose association Individual rights and interests Competition oriented | Society of orders communally bound in organization through structured obligations and rights Cohesion and inclusiveness; collective duty Cooperation oriented |
| Sources of legitimacy | Distinctive technological position Technological dominance <i>"R&D engineers' jobs can be at stake when a company has put forward a solution... they come in with an idea and do not like to shift at all"</i> | Serving collective and societal interests Corporate stewardship <i>"We have a duty to have a pan-European phone system...No one was saying we are going to make a pile of money, they said we need to provide this utility."</i> |
| Actor identities | Expertise and knowledge contained in atomistic individuals who negotiate to confer private benefits, learning, and status in fluid labor markets <i>"U.S. people can be more 'cow-boyish' in some senses...can be more individualistic ... it's a pioneer attitude"</i> | Expertise and knowledge contained within collectives of individuals with a shared destiny in the firm, R&D community and research institutes <i>"invest in a skilled standards expert ...with standards engineering knowledge, the diplomacy ... coalition building skills"</i> |
| Normative goals and Strategic imperatives | Standards arise as a result of choice in markets Immediate technological and economic returns Status in markets Private benefits Appropriation of and control over proprietary knowledge: property rights; zero sum game <i>"May the best man win...they wait and see if the orders start rolling in and can plan at that point to build the system"</i> <i>"Its often very difficult to justify standards on the basis of quarterly profits"</i> | Explicit rationale for collective benefit Long-term technological and economic returns Status in community and society Public, collective and private benefits Policy bargains Appropriation of and control over knowledge: redistributive; positive sum game <i>"Standards that put the interests of society over the interests of companies"</i> |
| Nature of organizational actions and behaviors | Standalone Pursuit of self-interest Transactional Entrepreneurial <i>An American delegate "stalled the meeting till we had to accept his proposal. He had it his own way...and was willing to jeopardize the entire meeting"</i> <i>"Not enough focus on how to get the next wave of innovation into the field. I think it is a very short-sighted viewpoint, but I have seen that particularly with North American companies, not participating to the extent they should"</i> | Cohesive and inclusive Systemic credible commitments Formalized coordinated approaches Collective interest intermediation Constrained behaviors <i>"The other extreme is the Japanese ... they are extremely polite, they will stand back"</i> <i>Proposals are "heavily reviewed and not laid lightly"</i> |

¹ Attributes derived from Thornton et al. (2012), Jepperson (2002); Examples of logics in SSOs from informant interviews in italics.

Table 2. Descriptive Statistics and Correlation Matrix

| | Mean | StDev | Min | Max | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | |
|------------------------------------|-------|-------|------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|------|------|------|------|------|--|
| (1) Dyadic patent citation ratio | 0.02 | 0.04 | 0.00 | 0.45 | | | | | | | | | | | | | | | | | | | |
| (2) SSO corporatism | 0.53 | 0.15 | 0.01 | 0.92 | -0.06 | | | | | | | | | | | | | | | | | | |
| (3) Dyadic corporatism | 0.52 | 0.26 | 0.01 | 0.95 | -0.20 | 0.29 | | | | | | | | | | | | | | | | | |
| (4) Technological distance | 0.57 | 0.34 | 0.00 | 1.00 | -0.32 | -0.16 | -0.04 | | | | | | | | | | | | | | | | |
| (5) SSO formal establishment | 0.28 | 0.24 | 0.00 | 1.00 | 0.15 | 0.24 | -0.03 | -0.19 | | | | | | | | | | | | | | | |
| (6) SSO statism index | 0.67 | 0.08 | 0.39 | 0.96 | -0.16 | 0.21 | 0.11 | 0.20 | 0.06 | | | | | | | | | | | | | | |
| (7) SSO rejected | 0.01 | 0.12 | 0.00 | 1.00 | -0.02 | -0.23 | -0.12 | -0.12 | 0.29 | 0.20 | | | | | | | | | | | | | |
| (8) SSO age | 2.82 | 1.28 | 0.00 | 7.00 | 0.05 | -0.20 | -0.14 | -0.02 | -0.14 | -0.34 | -0.13 | | | | | | | | | | | | |
| (9) SSO alliance density | 0.12 | 0.20 | 0.00 | 1.00 | -0.03 | 0.07 | 0.06 | -0.13 | 0.72 | 0.15 | 0.28 | 0.11 | | | | | | | | | | | |
| (10) SSO cultural diversity | 19.84 | 2.60 | 0.00 | 25.90 | -0.05 | 0.65 | 0.21 | -0.08 | 0.00 | -0.01 | -0.37 | 0.11 | -0.03 | | | | | | | | | | |
| (11) SSO regional diversity | 0.50 | 0.12 | 0.00 | 0.63 | -0.03 | 0.03 | -0.06 | -0.01 | -0.33 | -0.59 | -0.33 | 0.47 | -0.43 | 0.48 | | | | | | | | | |
| (12) Industry experience | 16.80 | 5.25 | 3.00 | 27.50 | 0.09 | 0.23 | 0.26 | -0.31 | -0.03 | -0.27 | 0.05 | -0.13 | -0.04 | 0.05 | -0.01 | | | | | | | | |
| (13) Prior alliances | 0.34 | 0.86 | 0.00 | 4.00 | -0.02 | 0.06 | 0.03 | -0.07 | 0.41 | 0.07 | 0.09 | 0.10 | 0.60 | 0.03 | -0.22 | 0.01 | | | | | | | |
| (14) Prior citations (within dyad) | 0.62 | 1.94 | 0.00 | 26.00 | 0.27 | 0.17 | -0.11 | -0.36 | 0.24 | -0.32 | 0.09 | -0.05 | 0.10 | -0.07 | -0.02 | 0.32 | 0.03 | | | | | | |
| (15) Prior patenting | 29.21 | 36.14 | 2.00 | 241.00 | 0.22 | 0.27 | -0.03 | -0.42 | 0.22 | -0.45 | -0.04 | -0.03 | 0.11 | 0.18 | 0.11 | 0.45 | 0.02 | 0.57 | | | | | |
| (16) Prior SSO joint participation | 0.51 | 0.89 | 0.00 | 4.00 | 0.20 | 0.30 | 0.22 | -0.23 | 0.14 | -0.06 | -0.05 | -0.27 | 0.02 | 0.00 | -0.16 | 0.47 | 0.14 | 0.36 | 0.43 | | | | |
| (17) Investment | 0.01 | 0.11 | 0.00 | 1.00 | -0.02 | 0.09 | 0.06 | -0.05 | 0.10 | -0.07 | 0.12 | -0.02 | 0.07 | 0.05 | 0.00 | 0.12 | 0.14 | 0.13 | 0.05 | 0.04 | | | |
| (18) Firms in dyad countries | 13.3 | 8.07 | 2.00 | 34.00 | 0.16 | 0.10 | 0.10 | -0.37 | 0.06 | -0.27 | -0.06 | 0.11 | 0.02 | 0.23 | 0.22 | 0.15 | -0.06 | 0.16 | 0.16 | 0.01 | 0.01 | | |
| (19) GDP per capita | 21.6 | 5.86 | 5.55 | 42.29 | -0.06 | 0.08 | 0.27 | -0.19 | -0.21 | -0.63 | -0.16 | 0.15 | -0.10 | 0.19 | 0.34 | 0.42 | -0.03 | 0.24 | 0.41 | 0.14 | 0.14 | 0.41 | |

Table 3. First Stage Selection: Fixed Effects Logit

| DV: SSO Participation | | |
|-------------------------------|----------|--------|
| Dyadic corporatism | -6.10* | (2.78) |
| Technological distance | -0.46 | (0.70) |
| Industry experience | 2.96** | (0.35) |
| Prior alliances | 0.33 | (0.26) |
| Prior citations (within dyad) | 0.06 | (0.05) |
| Prior patenting | 0.01 | (0.01) |
| Prior SSO joint participation | -11.88** | (0.90) |
| Investment | -0.60 | (1.08) |
| Firms in dyad countries | -0.20 | (0.20) |
| GDP per capita | 0.13+ | (0.07) |
| Total active SSOs | 0.27** | (0.08) |
| Fixed-line penetration | -0.95** | (0.19) |
| Mobile penetration | -0.52** | (0.12) |
| Observations | 1,541 | |
| Log likelihood | -133.4 | |

Standard errors in parentheses
 ** p<0.01, * p<0.05

Table 4. Second Stage: Fixed Effects Regression

| | DV: Dyadic patent citation ratio, 5 year window | | | | | | | | | |
|--------------------------------------|--|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| | Model 1 | | Model 2 | | Model 3 | | Model 4 | | Model 5 | |
| SSO corporatism | | | 0.047 | (0.062) | -0.179* | (0.082) | -0.038 | (0.060) | -0.206** | (0.072) |
| Dyadic corporatism | | | 0.061+ | (0.047) | -0.151* | (0.078) | 0.089* | (0.050) | -0.098 | (0.082) |
| Technological distance | | | 0.008 | (0.017) | 0.005 | (0.013) | -0.134** | (0.038) | -0.099** | (0.034) |
| SSO corporatism * Dyadic corporatism | | | | | 0.462** | (0.090) | | | 0.391** | (0.086) |
| SSO corporatism * Tech. distance | | | | | | | 0.253** | (0.071) | 0.185** | (0.068) |
| SSO controls | | | | | | | | | | |
| SSO formal establishment | 0.042+ | (0.023) | 0.027 | (0.020) | 0.057** | (0.020) | 0.018 | (0.029) | 0.046* | (0.022) |
| Statism index | -0.448** | (0.147) | -0.558** | (0.199) | -0.279+ | (0.147) | -0.464** | (0.170) | -0.254+ | (0.130) |
| Rejected | -0.043* | (0.019) | -0.027 | (0.026) | -0.052+ | (0.027) | -0.024 | (0.034) | -0.046 | (0.030) |
| Age | 0.019** | (0.003) | 0.021** | (0.004) | 0.025** | (0.002) | 0.016** | (0.005) | 0.021** | (0.003) |
| Alliance density | 0.020 | (0.018) | 0.029 | (0.025) | 0.033 | (0.023) | 0.021 | (0.021) | 0.027 | (0.022) |
| Cultural diversity | 0.007** | (0.003) | 0.008** | (0.003) | 0.001 | (0.002) | 0.006* | (0.003) | 0.001 | (0.002) |
| Regional diversity | -0.208* | (0.084) | -0.262* | (0.103) | -0.069 | (0.076) | -0.235** | (0.087) | -0.079 | (0.072) |
| Dyadic controls | | | | | | | | | | |
| Industry experience | -0.020** | (0.005) | -0.021** | (0.005) | -0.019** | (0.003) | -0.017** | (0.005) | -0.016** | (0.003) |
| Prior alliances | 0.008+ | (0.004) | 0.009* | (0.004) | 0.009** | (0.003) | 0.008* | (0.004) | 0.008* | (0.003) |
| Prior citations (within dyad) | -0.005** | (0.002) | -0.005* | (0.002) | -0.005* | (0.002) | -0.005* | (0.002) | -0.005* | (0.002) |
| Prior patenting | 0.001** | (0.000) | 0.001** | (0.000) | 0.000** | (0.000) | 0.001** | (0.000) | 0.000** | (0.000) |
| Prior SSO joint participation | 0.065** | (0.015) | 0.070** | (0.012) | 0.081** | (0.009) | 0.062** | (0.011) | 0.073** | (0.011) |
| Investment | -0.008 | (0.013) | -0.010 | (0.014) | -0.024 | (0.015) | -0.004 | (0.014) | -0.018 | (0.013) |
| Firms in dyad countries | 0.005 | (0.004) | 0.006 | (0.004) | 0.006 | (0.004) | 0.006 | (0.005) | 0.006 | (0.004) |
| GDP per capita | -0.002 | (0.002) | -0.002+ | (0.001) | -0.001 | (0.001) | -0.001 | (0.001) | 0.000 | (0.001) |
| Lambda | -0.007+ | (0.003) | -0.005 | (0.004) | 0.002 | (0.003) | -0.009+ | (0.005) | -0.002 | (0.004) |
| Year dummies | Included | | Included | | Included | | Included | | Included | |
| Constant | 0.380** | (0.107) | 0.391** | (0.136) | 0.228* | (0.088) | 0.349** | (0.110) | 0.223** | (0.078) |
| R-squared | 0.385 | | 0.397 | | 0.462 | | 0.440 | | 0.483 | |
| Adjusted R-squared | 0.347 | | 0.356 | | 0.425 | | 0.401 | | 0.447 | |
| Log likelihood | 1422 | | 1428 | | 1462 | | 1450 | | 1474 | |

Robust standard errors in parentheses; 601 observations in 181 dyads

** p<0.01, * p<0.05, + p<0.10; one-tailed tests for hypothesized parameters; two-tailed tests for controls