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Stephan Manning
stephan.manning@umb.edu, stephan.manning@umb.edu

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Stephan Manning
University of Massachusetts Boston
100 Morrissey Boulevard
Boston MA 02125 USA
Email: Stephan.manning@umb.edu

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ABSTRACT

This study shifts attention from project-based firms (PBFs) to project network organizations (PNOs) as increasingly important interorganizational contexts of project collaboration. As a result of organizational specialization, PNOs have emerged as generic organizational forms combining the coordination capacity of PBFs with the resource richness of networks. PNOs connect legally independent, yet often operationally interdependent individuals and organizations in strategically coordinated sets of core project teams and flexible partner pools that sustain beyond singular projects. Based on an empirical review of PNOs in film, event organizing, construction, complex product and system development, research, open innovation and international development, core features, antecedents and differentiating properties of PNOs are identified. Structural differences are related to project variety and connectivity, degree of specialization and geographic concentration of resources. Findings extend our understanding of interorganizational project coordination across fields, and the interplay of PBFs, networks and project entrepreneurship.

KEY WORDS: Projects, networks, collaboration, organizational form, specialization, project-based firms

INTRODUCTION

In many domains, such as film, events, software, research, construction, consulting, complex product and system (CoPS) development, and open innovation, projects are an important form of organizing and collaborating (Hobday, 2000; Grabher, 2002; Ibert, 2004; Klimkeit, 2013; Du et al., 2014). Projects can be defined as temporary systems that are constituted by multiple individual or organizational actors to accomplish rather complex and partially unique tasks (Lundin and Soederholm, 1995; Obstfeld, 2012). Projects, in particular those involving multiple organizations, have become an increasingly important form of organizing (Bakker et al., 2011, 2016; Cattani et al., 2011). Their rising importance relates to shorter product lifecycles and an increasing need for flexible mobilization and coordination of dispersed resources and expertise (Soederlund, 2008). As temporary systems, projects are partially self-contained, partially dependent upon norms, resources and expectations from other social contexts, such as project-based firms, networks and fields (see e.g. Engwall, 2003; Manning, 2008; Bakker, 2010).

In past research, two contexts of project organizing have been discussed extensively – project-based firms (PBFs) and networks. PBFs are firms whose capabilities and structures are primarily built around coordinating projects (Hobday, 2000; Soederlund, 2008). Specifically, they are "legally constituted collective actors that control property rights and exercise formal authority over task organization and performance through employment contracts." (Whitley, 2006, p. 79). Examples include software firms, construction firms, innovation agencies, and consultancies. Yet, partly as a result of growing specialization and vertical disintegration in many project businesses, PBFs increasingly engage in inter-organizational projects involving multiple legally independent, yet often operationally interdependent partners (Bakker et al., 2011; Jones and Lichtenstein, 2008). In doing so, PBFs depend on resources from outside the firm, such as funding, freelancers, temporary workers, suppliers and partners (Johnson, 2011). Because of this, project scholars have increasingly studied the role external networks play in generating project ideas and forming teams (Jones, 1996; DeFillippi and Arthur, 1998), and in facilitating learning and access to various resources across firm boundaries (Powell et al., 1996, 2005).

With the growing importance of inter-organizational projects, PBFs and network structures have jointly contributed to a new organizational form that combines the coordination capacity of PBFs (Blindenbach-Driessen and van der Ende, 2010) with network access to dispersed resources (Johnson, 2011) – so-called 'project network organizations' (PNOs) (Manning, 2010; Foster et al., 2015). Unlike PBFs, PNOs are composed of legally independent, yet operationally interdependent individuals and organizations who maintain longer-term collaborative relationships beyond the time limitations of particular projects. PBFs can play an important part within PNOs, e.g. as project and network coordinators (Manning, 2010). Such PBFs are typically rather lean firms run by so-called 'project entrepreneurs', e.g. film producers or consultants, who initiate project ideas and build inter-organizational teams around them on a regular basis (Ferriani et al., 2009; Manning, 2010; Grabher, 2002, 2004). PNOs are different from 'boundary-less networks' in having a collective coordination capacity that enables partners to repeatedly initiate projects

and mobilize project resources in specific project domains (Windeler and Sydow, 2001; Starkey et al., 2000). Typically, PNOs consist of both stable core teams across organizational boundaries (Blair, 2001) and complementary pools of freelancers and independent partners (Manning, 2010). PNOs have been adopted and studied in various fields, e.g. TV production (Starkey et al., 2000), advertising (Grabher, 2002), academic research (Manning, 2010), and international development (Manning and Von Hagen, 2010). Yet, despite their empirical importance, we lack a more integrated understanding of their unifying and differentiating properties across fields. This study attempts to review past research and make some propositions as to how and in what way PNOs may establish as organizational forms in project businesses. This has important implications for our understanding of PBFs and project organizing across industries.

Based on a thorough review of studies across project businesses, including film/TV production, event organizing, construction, CoPS development, collaborative research, and international development, it is proposed that PNOs are most likely to emerge in fields where inter-organizational projects are a dominant form of organizing. Yet, the way project partners get embedded and coordinated within PNOs differs across project businesses. For example, PNOs differ in the relative size of core project teams vs. flexible partner pools, which relates to the degree of project variety, as well as the degree of integration of core team members in larger organizations which relates to how much projects depend and expand on specific knowledge, technologies and capabilities. Also, PNOs may be either coordinated by PBFs or individual project entrepreneurs, depending on the degree of organizational specialization in a field. Finally, PNOs may differ in geographic concentration, which affects network roles of core team members since growing distribution increases the need for local-global intermediaries.

This study informs future research in two major ways. First, it extends prior research on PBFs by applying questions of project-based coordination (Whitley, 2006; Soederlund, 2008) to strategically coordinated network relationships beyond PBFs. For example, findings suggest that PBFs within core project teams can

play a central role in stimulating and combining both intra- and inter-organizational, local and global learning in PNOs, using formal and informal mechanisms, which extends prior research on project-based learning and capability development (Nightingale et al., 2011; Brady and Davies, 2004; Bouncken, 2011; Schuessler et al., 2012). Second, this study brings prior research on networks in project businesses, which has treated networks primarily as emergent opportunity structures (Schwab and Miner, 2008; Ferriani et al., 2009; Johnson, 2011; Burke and Morley, 2016), closer to questions of strategic coordination and resource allocation (Cattani et al., 2011), including a more nuanced, operational understanding of how (and why) project entrepreneurs form and manage strong ties and cliques in project businesses and how strong ties are connected to more volatile network structures (see also Ferriani et al., 2009). Finally, this study helps better integrate project scholarship across fields.

The paper starts with a review of projects as embedded forms, focusing on inter-organizational projects and the role of PBFs, networks, fields, and PNOs. Then PNOs are refined and differentiated based on empirical studies in different project businesses. Finally, propositions are made on the field-specific structural properties of PNOs as organizational forms for future research. The paper finishes with broader implications for research on projects, networks, and management in more general.

THE EMBEDDEDNESS OF PROJECT ORGANIZING: A MULTI-LEVEL PERSPECTIVE

Projects are often seen as highly flexible forms of organizing activities towards often rather complex goals. In fact, scholars have argued that projects seem more suitable than permanent organizations to take on complex tasks in creative and flexible ways, combining heterogeneous sources of knowledge and competencies (Asheim and Mariussen, 2003; Obstfeld, 2012). However, so-called 'project businesses', i.e. businesses in which temporary projects are the primary means of developing/delivering products and services, are typically characterized by relatively high uncertainty, volatility and dispersion of specialized

resources and capabilities across organizations and professionals (Whitley, 2006; Manning and Sydow, 2011). This poses important managerial challenges for project entrepreneurs, who are regularly involved in developing project ideas, mobilizing project support and assembling project teams.

In face of these challenges, several project scholars have emphasized that projects are 'embedded systems' (Engwall, 2003; Bakker, 2010) whereby the initiation of each project is shaped by various norms, expectations and resources provided by the social contexts projects are embedded in (Manning, 2008). Projects are typically embedded in multiple layers of social structure – from organizations, to networks and fields (Cattani et al., 2011; Burke and Morley, 2016). This sets boundaries to what projects can accomplish, but also reduces uncertainty and allows projects to accomplish complex tasks (Manning, 2008). Specifically, various social contexts have not only helped professionalize project organizing as a set of practices and norms across multiple businesses, but also led to a differentiation of such practices in line with conditions in particular fields. This study thus takes a multi-level perspective on project organizing that combines insights from prior research on the importance of various critical contexts. Figure 1 displays in a simplified manner how projects are embedded in various contexts: project-based firms, networks and communities, organizational fields, and project network organizations, which interlink these various contexts. Each context will be discussed next.

>>>>>>>>>>>>>>>>>>>>> FIGURE 1, TABLE 1 <<<<<<<<<<<<<<<<

One frequently studied context of project organizing are *project-based firms* (PBFs). PBFs are legal entities that are typically founded and/or run by project entrepreneurs (DeFillippi and Arthur, 1998) and that provide critical organizational resources and capabilities needed to regularly initiate and manage projects in professional project businesses (Whitley, 2006; Johnson, 2011; Soederlund, 2008). PBFs can range from rather large organizations, e.g. software and technology firms, with a project-focused structure (Galbraith, 1971), to rather lean organizations, e.g. film production firms, which typically only employ managerial

staff, whereas creative and technical service providers are embedded in external labor pools and networks (Starkey et al., 2000). No matter what size, PBFs typically maintain employment contracts with critical staff beyond the time limitations of particular projects and thus embody an important coordination capacity in project businesses, facilitating learning and professional project management across projects (Whitley, 2006; Nightingale et al., 2011). However, many, especially 'inter-organizational', projects are composed of specialized independent partners, including client representatives, suppliers, freelance experts and temporary workers, who cannot be directly 'controlled' and 'allocated' through long-term employment contracts within single PBFs (Johnson, 2011). Therefore, PBFs in many businesses need to develop the ability to build and manage alliances and connections with external partners to successfully initiate and carry out projects (Bouncken, 2011; Schuessler et al., 2012). It is therefore important to understand contexts of project organizing aside from PBFs.

One important context which has attracted attention in particular in creative industries are informal, often regionally situated, *networks and communities* which provide access to important resources outside the boundaries of PBFs (Johnson, 2011). They are typically composed of rather long-term, more or less 'latent' relationships between organizations or individuals, who occasionally work together on projects but who remain legally independent beyond their contractual obligations in those projects (Jones et al., 1997; Grabher, 2004; Hadjikhani, 1996). Such, often rather informal, networks help participants manage risks, bundle resources and competencies, and lower transaction costs in highly volatile industries (Powell, 1990; Raab and Kenis, 2009). They have typically been analyzed in terms of their structural features, such as 'structural holes' (Zaheer and Soda, 2009; Burt, 2004; Soda et al., 2004), project-based cliques and ties (Schwab and Miner, 2008; Sorenson and Waguespack, 2006), and the effect of these structures on project initiation, team formation and performance (Perretti and Negro, 2006). Importantly, such networks are typically studied as 'boundary-less' opportunity structures whose evolution is outside the control of any network participant (Faulkner and Anderson, 1987; Burke and Morley, 2016).

Another important context of project organizing are so-called *organizational fields.* In general, DiMaggio and Powell (1983) describe fields as "…those organizations that, in the aggregate, constitute a recognized area of institutional life: key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products […]" (p.148). Fields capture the "totality of relevant actors […] involved in a common enterprise" (p.148), looking at both competitive and collaborative relationships and practices evolving between individuals and organizations in a certain activity domain (Leblebici et al. 1991). In project businesses, fields are critical repositories of knowledge and practices (Grabher, 2004), including project management and network-building practices, which may provide 'swift trust' under conditions of uncertainty (Meyerson et al., 1996) and which assist complex tasks such as inter-organizational team-building among partners who often lack collaborative experience and who rely on criteria such as field status, professional norms and standards (Sydow and Staber, 2002). Fields and related institutions are thus important rather permanent background structures that enable and constrain the initiation and implementation of project ideas (Manning, 2008).

While PBFs, networks and field structures are important contexts for project organizing (figure 1), I argue that another, 'intermediate' context deserves greater attention: *project network organizations* (PNOs). In general, network organizations denote often longer-term sets of alliances or collaborative arrangements between legally independent organizations or individuals (Borgatti and Foster, 2003). Specifically, PNOs are network organizations that are 'project-based' in the sense that network relations emerge through and get activated for particular projects, yet they get reproduced and sustain *beyond* the time limitations of any one project (Windeler and Sydow, 2001; Manning, 2005, 2010; Foster et al., 2015). Examples include TV production networks formed by particular film producers, TV channels and creative artists across projects; alliances of researchers from multiple institutions spanning multiple joint projects; and long-term client-supplier networks in construction. The importance of PNOs as organizational forms has grown with increasing professionalization and organizational specialization in project businesses (see e.g.

Windeler and Sydow, 2001; Starkey et al., 2000). Manning (2010) identifies three major properties of PNOs. First, they are strategically coordinated by either one or a group of PBFs or project entrepreneurs. Second, they include rather stable teams of core partners (Blair, 2001). Third, core partner teams are connected to rather flexible pools of complementary project partners that are hired on an ad-hoc basis. Importantly, PNOs are *inter*-organizational arrangements between organizations and individuals facilitating mainly the recurrent initiation of *inter*-organizational projects.

PNOs combine properties of both PBFs and emergent networks (see also Table 1). Similar to PBFs, PNOs feature a certain coordination capacity beyond the time limitation of particular projects (Manning, 2010), including the capacity to learn and allocate resources across projects. Yet, unlike in PBFs, this capacity is shared and negotiated among multiple legally independent partners, e.g. producers, TV channels, and directors, which requires a balancing of critical tensions e.g. between autonomy and dependence, informal trust and formal control (Bouncken, 2011). Similar to emergent networks, PNOs allow core partners access to a variety of resources through network ties, such as specialized vendors and experts. Yet, PNOs are neither 'boundary-less' nor purely 'emergent', since PNOs are typically formed within specific collaborative domains, such as a TV movie series (Stjerne and Svejenova, 2016), and since ties within PNOs are often intentionally built up, managed and utilized by project entrepreneurs. Yet, since hierarchical control within PNOs is typically lower than within PBFs, core network partners also rely on emergent 'network mechanisms', such as reciprocity, trust, and interdependence (see Powell, 1990; Gulati and Gargiulo, 1999), to sustain PNO relations. In a way, PNOs can be thought of as strategically coordinated 'sub-sets' of wider networks that PBFs and project entrepreneurs get embedded in. Table 1 compares some key structural features of PBFs, PNOs and emergent networks.

In many project businesses, PNOs have thus become an important context of project organizing – in addition to PBFs and wider networks – since they help participating parties manage 'latent' or 'sleeping'

ties between former project partners across organizations for new inter-organizational projects (Windeler and Sydow, 2001; Manning and Sydow, 2011; Hadjikhani, 1996; Cova and Salle, 2000; Soederlund and Andersson, 1998). Accordingly, PNOs have also been called 'latent organizations' (Starkey et al., 2000). Yet, we still lack a differentiated understanding of how and with what properties PNOs emerge in different fields thus allowing their participants to initiate and manage inter-organizational projects over time. Most prior research has studied PNOs in particular fields (see e.g. Windeler and Sydow, 2001, for TV production; Grabher, 2004, for advertising; Berggren et al., 2001, for construction). We know little about how PNOs are similar or different across contexts, and what some of the core differentiating factors are. Learning about these factors is critical to better understand how PBFs manage inter-organizational projects and how they access network resources in the process. This comparative review contributes to understanding this question. In line with Ibert (2004), I focus on two groups of factors: socio-technical properties of projects, and economic organization of the field. This reflects the fact that project organizing is strongly affected by technical or task-related demands, and resource management needs.

As for *socio-technical properties*, projects share certain features, but also show important differences which may impact PNOs. Projects, no matter what kind – construction, film, R&D – are limited in time; involve complex, interdependent tasks; and are to some degree unique and novel (Goodman and Goodman, 1976; Lundin and Soederholm, 1995; Whitley, 2006). Furthermore, inter-organizational projects, for which PNOs are particularly relevant, typically involve teams from different organizations (Manning, 2008; Johnson, 2011; Levering et al., 2013; Brady and Davies, 2010, 2014). However, inter-organizational projects may also differ in complexity, seriality, variety and other aspects, which are likely to affect the way PNOs emerge. One central objective of this paper is to identify key socio-technical dimensions affecting the emergence and properties of PNOs across project businesses.

In terms of *economic organization*, project businesses are characterized by a certain, more or less stable 'industry architecture' in which capabilities are distributed and organizations are specialized in particular ways (Johns, 2010; Johnson, 2011; see in general Jacobides and Winter, 2005, 2012; Jacobides, 2008; Argyres and Bigelow, 2010). This architecture affects the way projects are organized and is expected to also shape the structure of PNOs. Especially in the context of film and TV production, scholars have pointed out how changes in industry architecture, following deregulation and the emergence of new specialized production firms, have led to the emergence of network forms of organizing projects (Barnatt and Starkey, 1994; Starkey and Barnett, 1997; Christopherson and Storper, 1989). However, different project businesses, like any industries, may differ in how skills and capabilities are distributed and in how specialized particular organizations are. Whereas some might be characterized by rather high levels of vertical integration, others may have gone through a process of disintegration where suppliers and clients exploit economies of specialization (Jacobides and Winter, 2005). In addition, capabilities and resources may not only be distributed between different organizations but also different regions (see e.g. Bresnahan et al., 2001), affecting the way PNOs are managed (Foster et al., 2015). A key objective of this paper is to better understand how economic organization in general, and level of specialization and geographic concentration in particular, affect the formation and properties of PNOs.

PROJECT NETWORK ORGANIZATIONS ACROSS FIELDS: A COMPARATIVE REVIEW

Next, I compare PNO configurations in various project businesses based on prior research. The selection of fields is based on a number of criteria. Most basically, all fields share a project-based character of production, a certain degree of inter-organizational specialization between field participants, and the emergence of longer-term project-based relationships and networks. At the same time, comparing these project businesses allows to identify core dimensions and contingencies along which PNOs might differ – specifically: level of project variety and connectivity (socio-technical properties), level of organizational

specialization and geographic concentration of project resources (economic organization). These dimensions will be introduced, discussed and compared in detail next.

Film and TV Production

The concept of PNO was arguably first developed and elaborated by studies in the film and TV industry (Starkey et al., 2000; Windeler and Sydow, 2001; Manning, 2005). In fact, even beyond the specific context of project organizing, this field has long been the empirical home of research on project-based network dynamics (Baker and Faulkner, 1991; Soda et al., 2004; Schwab and Miner, 2008; Johns, 2010), network strategies of entrepreneurs (DeFillippi and Arthur, 1998; Ferriani et al., 2009), network-based careers (Faulkner and Andersson, 1987; Jones, 1996; Blair, 2001; Zuckerman et al., 2003) and dynamic organizational forms (Mintzberg and McHugh, 1985).

Importantly, film and TV production belong to so-called cultural industries which share certain features: they produce so-called "experience goods" (Lampel et al., 2000) which are partially intangible and which combine symbolic (or: artistic) and economic (or: commercial) value (Hirsch, 1972). Examples include film, music, theater, event organizing, and book publishing. Some scholars refer to these also as "creative industries" (Drake, 2003; Lawrence and Phillips, 2002), but I prefer "cultural industries" which characterize the product rather than the process, since a range of other industries rely on "creativity" to some degree, such as research, design and animation (Johnson, 2011). Also, while creativity remains an important ingredient of cultural products, within cultural *industries* their design is typically targeting a sufficiently large commercial customer base (Peltoniemi, 2015), thus generating a central tension between 'artistic' and 'commercial' value (Bourdieu, 1993). Within cultural industries, PNO forms have been observed in particular in film, TV production, advertising and event production (see e.g., Grabher, 2002; Moeran, 2003; Larson, 2000; Pitsis et al., 2003). Because of their importance in the literature, I introduce PNOs in the context of film and TV production in greater detail first.

>>>>>>>>>>>>>>>> FIGURE 1 <<<<<<<<<<<<<<<<<<<<

Figure 1 displays a model of a typical PNO in TV movie production (Windeler and Sydow, 2001; Manning and Sydow, 2011). In this field context, PNOs can be described as longer-term, yet project-based sets of relationships between film producers, client channels or studios, directors, script writers, actors and technical service providers. They typically emerge within regional film production clusters (Sydow and Staber, 2002; Foster et al., 2015), and share three features that are typical of PNOs: strategic coordination; stable core project teams; and flexible pools of complementary partners.

First, PNOs in film and TV production PNOs are strategically built up and maintained by film production firms and individual film producers who act as 'project entrepreneurs' (see e.g. DeFillippi and Arthur, 1998; Ferriani et al., 2009). Their main role is to regularly develop and implement content for various studios and TV channels and thereby manage demands for creative variety and financial and operational risks by maintaining networks of freelance project partners. Historically, most creative professionals were directly employed by film and TV studios (Christopherson and Storper, 1989; Saundry 1998). However, following trends of deregulation and vertical disintegration in many countries, idea generation and implementation has been increasingly delegated by studios to independent producers who would develop and maintain networks of freelance creative and technical professionals to initiate projects for major clients (Jones, 2001; Starkey et al., 2000). The emergence of PNOs as organizational forms was thus directly linked to vertical disintegration and the emergence of independent film producers.

Second, PNOs in film and TV production typically develop around core project teams (see Figure 1; Blair, 2001). In feature film, core teams are often comprised of producer, studio, directors and/or script writers – sometimes with overlapping roles (Baker and Faulkner, 1991) – who jointly develop projects and often collaborate repeatedly over time. In TV movie production, core teams typically consist of producers, TV channel editors and either directors, script writers or particular actors whose work is affiliated with the

taste of the audience of a particular TV channel (Manning and Sydow, 2011). Importantly, especially in TV production, powerful channel clients play a key role in forming core teams and in co-producing and controlling the production of creative content (Saundry, 1998). Core teams thus typically develop both economic and creative interdependencies over time, whereby project-based relationships get reproduced and updated through each single project (Blair, 2001). Manning and Sydow (2011) further argue that these core teams often intentionally develop what they call "collaborative paths" which allow them to develop particular joint project capabilities over time within certain project domains, e.g. family-friendly movies for certain time slots. Core project teams thus allow for both explorative and exploitative learning across projects (see in general Brady and Davies, 2004), beyond project time limitations and firm boundaries. Whereas the field and creative community also plays a key role as repository of knowledge (Grabher, 2004), e.g. by maintaining genre and professional expectations, which may generate 'swift trust' between new project partners (Meyerson et al., 1996; Bechky, 2006), core teams in PNOs maintain more specific knowledge, e.g. related to producing for particular clients and audiences.

Third, core teams in PNOs maintain rather flexible pools of potential project partners who are recruited on demand, typically within certain project domains. In TV and film production, these pools are relatively large compared to rather small core teams, reflecting the volatility of the business, the demand for creative variety and the uncertainty around creative processes (Windeler and Sydow, 2001; Manning and Sydow, 2011). Prior research further suggests that through each project engagement, network partners may update their "pool position", in terms of their status e.g. as preferred or next-in-line director, script writer or actor for particular projects (Blair, 2001). In so far, core teams and network pools are important career-building structures within PNOs (Jones, 1996; Baker and Faulkner, 1991). Importantly, however, network participation does not imply regular collaboration. In particular, being "in the pool" of particular producers often implies that actual collaborations are followed by idle or latent relationships which can sometimes last for years until they get activated again (Starkey et al., 2000). Aside from project-specific

interdependencies, relational trust and reciprocity thus still play important roles as network resources not only in facilitating repeat collaboration (Meyerson et al., 1996; Sorensen and Waguespack, 2006), but in sustaining often longer-term latent relationships (Manning and Sydow, 2011).

To further understand the specific structure and properties of PNOs in this field, it is important to review socio-technical features and economic organization of film and TV production. From a *socio-technical* point of view, in particular the development of feature films and TV movies shares typical features of project-based organizing – a key precondition for PNOs to emerge as organizational forms. First, the development of a movie is limited in time. It is organized in a staged process, including pre-production, production and post-production (Storper, 1989; Faulkner and Anderson, 1987), which may take from half a year to a couple of years until completion. Second, the development process is fairly complex as it requires and integrates various tasks and processes – e.g. script development, shooting, and cutting – which is reflected by numerous professional roles within project teams, from "above-the-line" creative professionals, e.g. script writers, directors and actors, to "below-the-line" technical service providers, such as cutters, lighting, camera operators, special effects providers etc., and managerial functions, such as creative producers and editors (in TV production) (see e.g. Christopherson and Storper, 1989; Bechky, 2006). Third, each film project is to a great extent novel and unique as it recombines established techniques and templates with new creative elements and settings. In fact, more than other project businesses (see below), in film and TV production creative variety is an important guiding norm (DeFillippi and Arthur, 1998), which is why film producers maintain rather large network pools of creative professionals to meet changing demands. By comparison, certain formats in this industry, such as news production and soaps, follow a more serial production logic. In those cases, PNOs do not emerge as organizational forms. However, they do emerge in contexts, like TV movie shows (Stjerne and Svejenova, 2016), where single projects are unique, yet highly interconnected in terms of task and team

requirements. In such cases of high project connectivity highly stable core teams emerge that safeguard learning and practice transfer across projects (Manning and Sydow, 2011).

From an *economic organization perspective*, as mentioned above, both feature film and TV movie production have gone through a trend of vertical disintegration and organizational specialization in the 1970s and 1980s (Barnatt and Starkey, 1994; Storper, 1989; Christopherson and Storper, 1989), promoting the emergence of independent producers and PNOs as organizational forms (Starkey et al., 2000; Jones, 2001; Windeler and Sydow, 2001; Johns, 2010). Facilitated by deregulation (Saundry, 1998), especially film studios and TV channels have taken an interest in lowering the relatively high financial risk in this business, but also in better promoting and managing creative variety of content (Starkey and Barnatt 1998), by delegating idea development to independent contractors, while maintaining considerable control over the process (Starkey et al., 2000; Saundry, 1998). That is, even though TV channels and their editors are core members in project teams, the actual building and managing of PNOs is typically carried out by production firms and producers. At the same time, the film and TV industry is characterized by a high degree of regional concentration (Sydow and Staber, 2002; Scott, 2004; Lorenzen and Taeube, 2008; Johns, 2010), despite increasing trends towards 'run-away' productions (Christopherson and Rightor, 2010; Foster et al., 2015). Regional concentration has been promoted by the tendency of creative communities to co-locate for idea generation and team-building, and the co-location of important institutions, such as film academies, training institutes and studios (Sydow and Staber, 2002). Regional concentration also counterbalances – to some degree – job insecurities facing freelance professionals, as it provides local 'network-based' career opportunities (Jones, 1996; Blair, 2001).

This brief review of PNOs in film and TV production reveals a number of factors which seem to contribute to the emergence and properties of PNOs and which might be more or less similar in other project businesses. These include projects as dominant forms of collaborating and some degree of organizational

specialization as preconditions for PNOs to emerge. PNO properties seem to be further affected by project variety and connectivity, as well as regional concentration of resources. Next, I will review other project businesses and compare PNO structures and practices mainly across these dimensions.

Other Cultural Industries: The Case of Event Organizing

The importance of PNOs in cultural industries reaches beyond film and TV production, but not in every cultural field did PNO develop as organizational forms. For example, PNOs are less dominant in theater and concert production (Voss et al., 2000; Haunschild, 2003). In music and musicals, network dynamics have also been observed (Uzzi, 2004; Lingo and O'Mahony, 2010; Uzzi and Spiro, 2005), even if, to my knowledge, PNOs have not been explicitly studied.

One key differentiator between cultural industries where PNO have emerged and those where they have not is the degree of division of labor and organizational specialization. For example, fictional book production has a rather low division of labor, at least in the creative process. Books are typically written by single authors rather than 'author networks', which makes PNOs less 'necessary'. This is different for academic research which typically relies on collaborative networks that I discuss further below. Also, some forms of writing, such as journalism, show a higher degree of seriality (Ekynsmith, 2002), thus not strictly belonging to project businesses. Other cultural industries feature a higher division of labor, yet the level of organizational specialization may vary. For example, in cultural production there is typically a division between 'creative services', e.g. directing (film), composition (music), choreography (dance), and conducting (musical, concerts); and 'technical services', e.g. camera (film), lighting (theater, dance). Often, however, these various services are still highly vertically integrated, such as in theater, dance and classical music (see e.g. Voss et al., 2000; Haunschild, 2003; Uzzi, 2004; Glynn, 2000), thus generating little 'demand' for PNOs. By comparison, in film, advertising, and event organizing the level of organizational specialization is high, employment is often project-based, and professional intermediaries have emerged

that initiate and implement projects, and employ staff and contractors on a regular project basis (Lampel et al. 2000; Teece, 2003; Mumford et al., 2002; Woodman et al., 1993).

I have thus selected the case of professional event organizing to discuss the emergence of PNOs in a cultural field other than TV and film production. Events can take a variety of forms, fulfilling various purposes, from conferences and workshops, to ceremonies, festivals and sports events (Lampel and Meyer, 2008; Schuessler et al., 2014; Brady and Davies, 2014). I focus here specifically on professional event organizing, which requires the involvement of specialized event agencies taking conceptual and managerial roles (Mumford et al., 2002; Woodman et al., 1993). Agencies plan events, coordinate with clients and key stakeholders, and implement events by recruiting a variety of creative service providers, such as performers and speakers, and technical services, such as security and catering (Larson, 2000; Pitsis et al. 2003). Events feature typical characteristics of projects: time limitation, complex scheduling and coordination, and some degree of novelty compared to other events. Professional event organizing also involves a large number of contributors that are hired on a project basis.

As for specific *socio-technical features*, events may vary in their degree of novelty and variety, as well as the degree of 'seriality', which affects the way PNOs are structured. For example, annual academic conferences typically show a low level of variety and a high degree of seriality in being typically scheduled in the same way every year, and in focusing on similar domains of exchange. In the process of event organizing, common elements are typically re-combined in a modular fashion (Unsworth, 2001), whereby 'novelty' is promoted through marketing and branding (see in general Ford, 1996; Drazin et al., 1999). Similar examples include annual award ceremonies in academia and film (Anand and Watson, 2004), and political summits (Schuessler et al., 2014). In cases where events are rather serial, core teams and partners organizing such events typically remain rather stable, with often rather limited pools of complementary ad-hoc partners, e.g. special speakers or performers. Good examples are the Academic Awards, cultural

festivals or local trade shows. Other types of events might be less repetitive, e.g. problem-centered facilitated multi-stakeholder meetings (see e.g. Weisbord and Janoff, 2005), or one-off cultural or sports events. In those cases, event agencies typically mobilize very event-specific partners, such as – in the case of community workshops – hosting locations, local technical assistants (e.g. volunteers), domain-specific speakers and participants, most of whom are unlikely to join core teams beyond this particular project, but might join the larger pool of ad-hoc partners for future events.

In terms of *economic organization*, professional event organizing shows some important similarities with film and TV production, specifically a relatively high degree of organizational specialization (Starkey et al., 2000; Larson, 2000; Pitsis et al., 2003). This explains why, similar to film and TV, in professional event organizing, projects are initiated, planned and implemented by professional agencies that are specialized in mobilizing and coordinating various creative and technical partners to make events happen. Often, event agencies co-organize events with other important 'coordinating parties', such as departments in city administrations or construction firms, e.g. for events that involve rather comprehensive infrastructure development, such as in the case of Olympic games (Pitsis et al., 2000; Brady and Davies, 2014). The latter would in turn manage their own networks of partners, e.g. highly specialized technical service providers (Teece, 2003). One rather important difference from typical PNOs in film and TV production is that many regular events switch locations and are thus not as bounded to particular cities or regions. One good example are major annual academic conferences that typically serve global communities of researchers and thus switch locations to allow for better participation and more effective community-building (see e.g. Wuehrer and Smejkal, 2013). In these contexts, PNOs often develop a more distributed structure where the main event organization develops and maintains relationships with local organizing teams, which, in turn mobilize networks of local partners and staff (e.g. volunteers, security, video/multi-media). The Academy of International Business (AIB) is a good example: whereas the main concept, website infrastructure and budgeting are provided by the main AIB organizing body, the contracting with local

hosts, catering, local panelists etc. is often done by regional AIB chapter organizations, which serve as intermediaries and are legally independent from the main AIB administration (AIB, 2017).

In sum, looking at cultural industries beyond TV and film production adds nuance to our understanding of PNOs. First of all, not in every cultural domain, PNOs have established as organizational forms. For example, not every 'cultural product' is produced in a project-based fashion. Also, cultural industries vary in the level of organizational specialization. PNOs seem to establish only when cultural production is project- and team-based, and when organizational specialization is sufficiently high. One example is professional event organizing, which shows several similarities with film and TV production, e.g. in terms of the importance of specialized agencies and core teams that repeatedly organize annual events. However, PNOs in international event organizing differ from many film PNOs in having distributed structures that help balance 'central coordination' with 'local implementation'.

Construction Business

Beside cultural industries, construction is perhaps the most frequently studied sector in terms of PNOs. Even though early related studies (e.g. Stinchcombe, 1959; Eccles, 1981) used different terms, they make the general observation that certain PNO-like organizational forms exist in construction: sets of longer-term relationships between legally independent partners, e.g. general contractors and suppliers, which are typically strategically coordinated (see e.g. Van Marrewijk et al., 2016; Ebers and Maurer, 2016). Eccles (1981) calls these forms 'quasi-firms'. In general, construction involves the development and provision of physical infrastructures, such as buildings, tracks, canals, bridges and airports (see e.g. Brady and Davies 2010, 2014; Van Marrewijk et al., 2016). Unlike cultural goods, physical infrastructures are relatively easy to 'measure' in terms of their utility, convenience of use, and resilience. They can however be more or less location- and client-specific (Winch, 1995; Shenhar, 2001).

In terms of *socio-technical features*, construction, quite similar to film production, is a step-wise, collective process, which is rather temporary, complex and at least to some extent unique. It is temporary in the sense that the design and implementation of a new infrastructure takes place within a limited amount of time. After completion, infrastructures need to be maintained, which however is typically done by service organizations. Construction is typically a complex collective process involving a multiplicity of specialized contributors: architects and/or consultants, general contractors and suppliers (Carillo et al., 2004; Newcombe, 1996; Ebers and Maurer, 2016). However, whereas construction shares typical project features – time limitation and complexity – it can vary substantially in degree of 'uniqueness' or 'novelty'. As Shenhar (2001) notes, the share of routine activities within construction projects can be relatively high, even if the outcome appears to be fairly unique (Winch, 1995) – a phenomenon Langlois (2003) would describe as 'mass customization'.

In terms of *economic organization*, the construction business is characterized by a relatively high degree of organizational specialization. Single projects as well as longer-term PNO relations are typically coordinated either by architects, general construction firms or alliances between the two (see e.g. Eccles, 1981; Berggren et al., 2001; Shoesmith, 1996; Bresnen and Marshall, 2000). Clients set up contracts with construction firms and/or architects for particular projects. Sometimes, they do not interact with contractors directly but through specialized consultants (Berggren et al., 2001). Unlike in TV production, where client organizations (TV channels) typically establish longer-term project-based relationships with production firms, in construction 'client fluctuation' is typically relatively high. Some, in particular private, clients often work together with construction firms only once. Others, e.g. local governments, may establish longer-term relationships. Because of high frequency of transactions and relatively high degree of repetition of many construction projects, general contractors typically develop stable relationships with selected sub-contractors to drive down coordination and transaction costs, and to leverage economies of repetition (Stinchcombe, 1959; Winch, 1995; Ebers and Maurer, 2016). These relationships tend to be

very hierarchical (Eccles, 1981), as general contractors retain the power of replacing sub-contractors and as the latter typically depend on repeat business with the same general contractors. Also, more than other project businesses, construction is very much affected by seasonal fluctuation (Ekstedt, 2002). This typically results in the constitution of external, seasonal labor markets of contract workers, who are kept in a 'pool' and hired for peak seasons. Finally, similar to film production, PNOs in construction are typically rather regionally bounded, even though there is also a trend towards international cooperation in construction (Van Marrewijk et al., 2016). In these contexts, general contractors play important roles as intermediaries between global and local partners.

Overall, relatively high predictability of demand and high degree of repetition across construction projects result in relatively stable relations – between architects, general contractors, and sub-contractors – who continuously work together on a project-by-project basis (Stinchcombe, 1959; Eccles, 1981; Ebers and Maurer, 2016). Whereas in film and TV production, due to uncertainty and demands for creative variety, core project teams tend to be rather small compared to a large flexible network pool of potential project partners, in construction, PNO relations tend to be more stable, favoring economies of scale, scope and repetition (Ebers and Maurer, 2016).

Complex Product and System (CoPS) development

More recently, a number of project and innovation scholars have started investigating project-based firms and relationships in complex product and system (CoPS) development (see e.g. Hobday, 2000; Geyer and Davis, 2000; Girard and Stark, 2002; Davies et al., 2011). CoPs include telecommunication exchanges, business information networks, flight simulators, high-speed trains, aircraft engines and ships (Levering et al., 2013; Ligthart et al., 2016). Unlike mass consumption goods, CoPS are often highly specific and customized products, whose development is project-based (Hobday, 2000). By comparison, mass production or even 'mass customization', e.g. of cars, would not fall under this category, even though

scholars have observed trends towards 'projectification' (Midler, 1995) even in car manufacturing. Importantly, whereas the initial 'design' of a new mass-manufactured product may be 'project-based' the actual production might not be, whereas in the case of CoPS it typically is.

More specifically, from a *socio-technical view*, CoPS development is a complex process involving the combination of hardware and software components, such as in the case of IT systems. The development and production process typically starts with a rather specific client request (e.g. new machinery or new software system), and then involves the allocation of a project-specific team working on the customized implementation of the system. Clients are typically highly involved in the development process (Hobday, 2000; Girard and Stark, 2002). Because of this, each project tends to be rather unique combining some standardized elements (e.g. hardware and software platforms) with high degrees of customization or even customer-specific designs. Interestingly, with regard to the third important project feature – time limitation – CoPS development is quite different from other projects. Although initial development resembles a typical time-limited project, system installation is typically followed by continuous servicing and maintenance (Gann and Salter, 2000). CoPS projects are what Alderman et al. (2005) call 'extended projects', i.e. they 'extend' beyond the typical time limitations of projects by transitioning into more continuous service relations. In addition, CoPS are typically upgraded following technology life-cycles, so that initial projects are followed by upgrading or expansion projects (Geyer and Davies, 2000). This has important implications, since it requires effective learning and knowledge transfer from project to project, thus favoring long-term stability of core team relations.

From an *economic organization* perspective, CoPS development is a highly specialized project business. Depending on the degree of modularization of products and systems, particular projects may involve a number of sub-suppliers all of whom are coordinated by system integrator firms who coordinate projects with client organizations (Hobday, 2000). These integrators typically maintain project-based relationships

with core clients which extend particular projects and often develop into 'development and service networks' (Gann and Salter, 2000). In some contexts, technology consultants would play an additionally important role as intermediaries (Gann and Salter, 2000). In this regard, CoPS projects have a lot in common with consulting, in particular those focusing on complex applications (Sturdy 1997). Due to the technology focus of CoPS projects, PNOs in CoPS often co-evolve with technology advancements which regularly stimulate upgrading projects with the same clients (Kash and Rycroft, 2000). In so far, CoPS development also shows a lot of resemblance with software development, especially in the business-to-business domain (Grabher, 2004; Banker et al., 1998). Network-coordinating system integrator firms thereby play an important role as project entrepreneurs. Because of the need for servicing and upgrading, these integrator firms typically maintain relatively stable core team relations with clients, additional consultants, core technology sub-suppliers and servicing firms.

In sum, CoPS adds an important dimension to the study of PNOs: a high degree of interconnectedness of client projects which involves high upfront investments, regular technological advancements, upgrading and client customization that may jointly promote relatively stable project-based ties between clients and CoPS teams to facilitate follow-up projects. In addition, stability is promoted by continuous service relations in addition to time-limited projects.

Collaborative Research and Innovation

Another important context within which PNO structures have been observed is collaborative research (see e.g. Powell et al., 2005; Manning, 2010). I focus here on collaborative academic research and applied research, specifically open innovation. Both academic and applied research can be seen as processes of knowledge production, whereby the value of research is negotiated among experts and peer communities (see e.g. Katz and Martin, 1997; Willke, 1998). At its core, collaborative research projects involve multiple participants from legally independent organizations and/or freelancers. More often than not such

research projects are externally funded, which also co-determines project timelines. One new form of applied collaborative research is 'open innovation', i.e. practices of creating new technologies, products and solutions in which client firms interact with various external partners, in order to increase their innovation capacity and speed up innovation processes (Chesbrough, 2003).

From a *socio-technical* point of view, collaborative research meets typical qualities of projects. Research endeavors involving multiple collaborators are typically complex involving the integration and application of specialized expertise. In addition to domain expertise, in particular scientific research typically also relies on a sophisticated technical infrastructure, including labs and technical staff (Teece, 2003). Research by definition is expected to produce *new* knowledge and in so far is never entirely repetitive. In particular externally funded academic research is typically constrained by time limitations (funding periods) which co-determine the way research processes are organized (Manning, 2010). Accordingly, Katz and Martin (1997) noted that high degree of specialization, professionalization and need for external funding have promoted project-based forms of collaboration. Similar to academic research, open innovation is a largely project-based practice (Du et al., 2014) as it involves the temporary mobilization of project teams for typically rather unique and novel innovation tasks. However, both types also differ, since academic research typically aims for incremental knowledge production across multiple funding periods, which promotes longer-term project-based alliances that allow alliance partners to exploit knowledge, generate spin-off projects and extend research agendas (Owen-Smith and Powell, 2004; Godin and Gingras, 2000; Powell et al., 1996, 2005; Al-Laham and Amburgey, 2011). By contrast, open innovation projects are often much more ad-hoc and range significantly in terms of problems, technical specification and expertise required, scale and scope, duration etc. Due to large variety and, at the same time, a rather low likelihood of follow-up projects with similar objectives, PNOs in open innovation typically have rather large pools of potential project partners. For example, whereas academic research entrepreneurs have been observed to maintain pools of a few dozen potential collaborators, many of whom are part of core teams (Manning,

2010), open innovation agents, such as Innocentive, typically count several thousand potential collaborators in their networks (e.g. 375,000 in the case of Innocentive) which allows them to build teams around specific innovation problems (Lichtenthaler, 2011).

From an *economic organization* perspective, collaborative research, including open innovation, is typically conducted by researchers and research teams within and across large organizations, e.g. universities and applied research institutes. In particular in academic research, such organizations are more likely to be funded than small agencies or individual scholars (Landry and Amara, 1998; Hagedoorn et al., 2000; Manning, 2010). This is different for open innovation, where various problem-solvers participate in PNOs – either individually or in teams – no matter whether they are affiliated with larger organizations or not. Interestingly, however, more and more scholars, especially in science, become part of both 'academic' and open innovation PNOs, even though the two are managed very differently. Specifically, there is a stark contrast in degree of organizational specialization. In academic PNOs, participating organizations (research institutes) are typically rather similar, whereby some researchers play informal entrepreneurial roles by building and retaining research teams across organizations, and by building networks with potential substitute partners for single and series of projects (Manning, 2010). For example, Manning (2010) shows how an entrepreneurial European education researcher built a PNO with a core team of affiliated researchers at multiple European universities to secure project-based EU funding. By contrast, in open innovation, PNOs are either run by large client organizations, such as Procter and Gamble (Lichtenthaler, 2011), or by highly specialized open innovation agents that exploit economies of scale and repetition in framing problems, coaching clients and building teams. In terms of geographic reach, however, both academic research and open innovation have become highly internationalized, where strategic PNO coordinators and core teams play important intermediary roles between 'global teams' and 'local support networks'. For example, Manning (2010) shows how core teams seeking EU funding are mainly composed of 'representatives' of core funded regions to satisfy funding criteria and to operate as

intermediaries. Al-Laham and Amburgey (2011) further show for the case of biotech research how international core teams of researchers are essential repositories of knowledge across projects and regional contexts. In case of open innovation, this intermediary role is often taken by innovation agents, such as Gen3, whose main capacity is to connect clients with problem solvers from various parts of the world, e.g. Russian university researchers in the case of Gen3.

In sum, collaborative research showcases the emergence of PNOs in highly knowledge-intensive domains. Interestingly, PNO structures differ considerably depending on the likelihood of 'follow-up projects' and the degree of organizational specialization. In academic research, PNO partners are typically all affiliated with universities and research institutes, partly because of funding criteria, the ability of research institutions to incentivize research and 'host' teams beyond projects, and limited incentives for further specialization. In open innovation there is often high 'division of labor' between innovation agents in coordinating roles and researchers in creative/innovator roles.

International Development

More recently, PNOs have also been observed in international development (Manning and Von Hagen, 2010; Murphy et al. 2012; Manning and Roessler, 2014). Development projects are typically run by government agencies and NGOS, partially in collaboration with multinational firms and local partners, across the world (see also, Hirschman, 1967). They cut across domains, such as poverty alleviation, economic development, sustainability, education and others. Many development projects involve the design of new institutions, such as local laws and standards, and thus resemble institutional change projects (Tukiainen and Granqvist, 2016; Perkmann and Spicer, 2007; Lawrence et al., 2002).

From a *socio-technical* viewpoint, international development projects are highly complex endeavors that, increasingly, involve multiple stakeholders at both the global and local level (e.g. Geppert et al., 2006; Manning and Von Hagen, 2010; Stadtler and Probst, 2012). Development projects typically involve both

tangible and intangible elements, and their complexity arises partly from the local communities within which projects get embedded. Related to this, each development project tends to be rather unique in that it aims to accomplish particular objectives that are closely linked to rather idiosyncratic local or regional circumstances (Hirschman, 1967). In addition, similar to other fields, international development highly depends on external funding and funding cycles. This is why development projects are typically organized such that they can be 'completed' within one to three years, depending on funding criteria. Accordingly, teams are allocated for this particular time span. However, in particular larger, more global development initiatives as well as development processes aiming at deeper institutional change or transitions towards more sustainable modes of production (e.g. Manning and Reinecke, 2016) often go beyond the scope and time limitations of singular projects, while still building on the expertise developed in each project. In such contexts, very stable project-based alliances form that facilitate learning and knowledge transfer across projects (Manning and Von Hagen, 2010; Perkmann and Spicer, 2007).

In terms of *economic organization*, certain agencies, such as development agencies, play an important role not only in initiating and carrying out projects, but also in building longer-term PNOs with critical project partners, such as multinational corporations and/or international NGOs, across local contexts (Stadtler and Probst, 2012; Brown, 1991). In some cases, consultants also take a strategic role in development PNOs, but typically only when projects are rather repetitive and narrowly defined (e.g. vocational training projects), whereas more 'innovative' projects or series of projects are typically initiated by members of development agencies (Manning and Roessler, 2014). In any case, strategic coordinators in development PNOs build networks of project partners they regularly involve in projects within similar domains. For example, Manning and Von Hagen (2010) studied a longer-term global PNO which was coordinated by project managers at the German development agency GTZ and which features rather stable ties with major global coffee roasters who got repeatedly engaged in coffee sustainability projects in different regions. Whereas global partners would typically form stable project teams, local partners,

such as local coffee chambers and producers, would get embedded in the periphery of the PNO, since they would become critical stakeholders only in connection with certain projects within their region. In so far, the partner structure of PNOs in international development is not merely influenced by technical specialization, but by geographic presence and reach of project partners.

In sum, the case of international development presents a premier example of PNOs that develop geographically distributed structures. More concretely, globally operating partners seem to develop more stable ties than local partners within longer-term PNOs in international development. Also, similar to collaborative research and innovation, multiple PNO forms co-exist in international development with different degrees of organizational specialization. However, the 'source' of specialization is different – whereas in open innovation for example innovation agents specialize in routinely designing projects according to similar principles, yet *across* technical domains, in international development, consultants that build and manage PNOs typically do so in very narrow domains. Arguably, regional specificity and uncertainty coming from the participation of multiple local and global stakeholders in development only allows for limited economies of repetition.

EMERGENCE AND PROPERTIES OF PROJECT NETWORK ORGANIZATIONS ACROSS FIELDS

This empirical review suggests that PNOs have established as organizational forms in various fields. Despite differences in structure and dynamics, PNOs share certain generic features as organizational forms (Romanelli, 1991). Most fundamentally they emerge as sets of longer-term, yet project-based relationships between legally independent partners around particular collaborative domains and get reproduced on a project-by-project basis (Manning, 2010). That is, whether in film, CoPS, construction, collaborative research, or international development, PNOs are sustained based on past and potential future project endeavors, whereby each project is limited in time and shows a certain degree of

complexity and novelty. Specifically, PNOs seem to emerge in contexts where projects are 'inter-organizational' involving partners from multiple, legally independent, yet operationally interdependent organizations (Bakker et al., 2011). Also, PNOs typically form around series of projects within certain collaborative domains, such as series of TV projects (Stjerne and Svejenova, 2016), series of events (Anand and Watson, 2004), series of CoPS installations for particular clients (Geyer and Davies, 2000; Gann and Salter, 2000), series of research projects (Manning, 2010), or series of development projects (Manning and Von Hagen, 2010). Yet despite some degree of seriality, each project remains relatively unique.

In addition, PNOs share three features: strategic coordination by project entrepreneurs; core project teams; and flexible pools of complementary and/or substitute partners. Figure 3 displays a generic model of PNOs along with examples of clients/sponsors, coordinating agents (project entrepreneurs), and project partners who jointly participate and interconnect within PNOs. Accordingly, Table 1 specifies PNOs for film/TV production, cultural event organizing (as an example of other cultural industries), construction, complex product and system (CoPS) development, collaborative research, and international development. Next, I discuss how each key feature of PNOs manifests itself in different fields. Based on that, I discuss potential contingencies of PNO properties for future research.

>>>>>>>>>>>>>>>> FIGURE 3, TABLE 1 <<<<<<<<<<<<<<<<<<<<<

Across project businesses, PNOs are typically coordinated by particular PBFs or project entrepreneurs, e.g. film producers (DeFillippi and Arthur, 1998; Ferriani et al., 2009), entrepreneurial researchers (Manning, 2010), event agencies (Anand and Watson, 2004), international development agencies (Stadtler and Probst, 2012; Manning and Von Hagen, 2010), general contractors (Eccles, 1981; Stinchcombe, 1959), or innovation agents (Lichtenthaler, 2011). PNOs include relatively stable core project teams. In film production these typically involve producers, script writers and/or directors (Ferriani et al., 2009), and client channels in TV production (Starkey et al. 2000; Manning and Sydow, 2011); in collaborative research

these are core collaborators and co-author teams (Katz and Martin, 1997; Manning, 2010); in international development core teams typically involve development agencies and global NGOs or multinational corporations who get involved within series of projects of common interest (Manning and Von Hagen, 2010); in construction, core teams comprise of architects, general contractors, consultants and potentially some core clients (Ebers and Maurer, 2016). However, PNOs also include flexible pools of project partners on demand, be it cast, camera operators and cutters in film; sub-contractors in construction; junior researchers and research assistants; or problem-solvers in open innovation (see also Table 1).

Based on these observations, I propose that in any field in which inter-organizational projects are a dominant form of organizing activities, PNOs are likely to emerge. Thus, two properties need to co-exist: project-based organizing and inter-organizational collaboration. More specifically, for PNOs to emerge, fields or domains within fields must be characterized by projects as dominant organizational forms *and* there must be a certain level of organizational specialization where project-related capabilities and resources are distributed across organizations and professionals. Many fields show one property but not the other, in which case PNOs are unlikely to emerge. For example, automotive production and textiles manufacturing are characterized by a high level of specialization (Piore and Sabel, 1984; Dyer, 1996), with independent suppliers capitalizing on economies of scale and scope (see in general, Jacobides and Winter, 2005, 2012), but the dominant mode of production is mass manufacturing, even though trends towards greater 'projectification' (Midler, 1995) have been observed, reflecting changes in team work, product lifecycles and product customization. At the same time, in some fields, including some I discussed earlier, e.g. theatre and book writing, projects might be an important form of organizing, but organizational specialization is relatively low. Interestingly, even fields where PNOs are dominant today, such as TV and film production, used to be characterized historically by a high degree of vertical integration, where most project resources, e.g. creative and technical services, were located within the same organization, e.g. TV channel or film production firm (see Starkey et al., 2000; Storper, 1989). Various mechanisms can promote

vertical disintegration and organizational specialization, such as increasing cost pressure, deregulation, standardization and modularization of production and capabilities (see in general Jacobides and Winter, 2005, 2012; Langlois, 2003). In such cases, projects become more 'inter-organizational' and PNOs are more likely to emerge. I therefore propose:

> Proposition 1: PNOs are most likely to emerge as organizational forms in fields in which inter-organizational project-based collaboration is a dominant form of organizing activities.

However, despite important similarities between PNOs across project businesses, there are important differences in terms of how PNOs are structured and maintained. In the following, I will summarize some key differentiating dimensions and contingencies. These include: project variety, project connectivity, degree of organizational specialization and geographic concentration. Table 1 compares these dimensions across businesses. Importantly, although each field shows a certain tendency, there is also variety of PNOs within fields. Collaborative research and international development are examples of this. Also, as mentioned before, field properties can change over time, such as in case of TV production.

The first key dimension is *project variety*. Although projects by definition are to some extent unique and novel (Lundin and Soederholm, 1995; Obstfeld, 2012; Whitley, 2006), the empirical review above suggests that project businesses differ in how much projects vary in task and team requirements. In film, project variety is relatively high, which is partly a result of the norm of creative variety. In other words, the degree to which projects vary is interrelated with institutional norms within fields. But it is equally a result of client expectations – whereas in construction many clients may have standardized demands, in film and TV, viewers typically expect novel entertainment. Because of this, film producers are faced with high uncertainty as to when new project ideas will arise and whether or not these ideas will result in concrete projects. To manage this uncertainty, film producers on the one hand rely on the stability of core teams, but on the other hand need to build up a rather large pool of contacts with creative artists and technical service providers who can be hired on demand, and who can be replaced when needed. In other words,

in film, the size of core project teams, i.e. teams that sustain and regularly initiate projects together, is relatively small compared to the pool of complementary project partners in the network (Manning, 2005). This is also true for open innovation, in which projects vary greatly in the expertise needed for particular solutions. Reflecting this variety, open innovation agents and platforms develop and maintain rather large pools of potential problem solvers (Lichtenthaler, 2011).

By contrast, in other project businesses project variety may be lower, as projects are fairly standardized and demand for these projects is fairly steady. Example of this are annual academic conferences or similar events, as well as construction projects. In the latter, projects are characterized by a high level of routine, even when project outcomes may be rather unique (Winch, 1995; Shenhar, 2001). Because of this, construction firms can maintain themselves by running very similar projects over time – albeit at new locations or construction sites. Accordingly, their relationships with core sub-contractors tend to be relatively stable (Ebers and Maurer, 2016), which drives down transaction costs, increases economies of repetition, and allows for exploitative learning and capability development across projects (Grabher, 2002, 2004; Brady and Davies, 2004). Eccles (1981) captured this in the notion of the 'quasi-firm'. Similar to automotive firms, however, general contractors maintain small pools of alternative suppliers in order to apply cost pressure and to manage potential contingencies. Yet, unlike film producers, construction firms do not depend on large pools of ad-hoc service providers to maintain their business. Similarly, many event agencies maintain rather stable relations with catering, security and other service providers. In other words, the size of PNOs in construction and event organizing are often not much greater than the typical size of project teams, whereas in film and open innovation, the number of potential partners in the pool exceeds by far the number of team members for particular projects. I therefore propose:

> Proposition 2: The greater project variety in terms of task and/or team requirements over time, the smaller are core project teams in relation to flexible pools of fluctuating ad-hoc partners across projects within particular PNOs.

The second differentiating dimension is what I call *project connectivity*. Although projects are limited in time they may differ in terms of how much they are connected with one another. For example, in collaborative research and CoPS development, singular projects typically build on previous projects – not just in terms of reutilizing prior expertise (Davis and Brady, 2004; Manning and Sydow, 2011), but in terms of extending or upgrading technology and knowledge generated previously (see Table 1). For example, initial CoPS client projects are often followed up by technology upgrading projects which can be more or less client-specific (Geyer and Davies, 2000); similarly, collaborative research projects that are based on external funding often build on each other and develop a stream of reports and publications (Katz and Martin, 1997; Manning, 2010). Especially in fields driven by technological advancements (such as CoPS) and cumulative knowledge production (such as research), projects typically 'build' on prior project expertise. However, connectivity also results from intentional 'connecting efforts' of participating partners who share an interest in sustaining alliances and securing follow-up funding, and therefore purposefully draw connections between task, team and knowledge requirements of past, current and potential future projects (Manning and Sydow, 2011). As a result, projects may develop a high degree of historical context specificity. Switching costs are relatively high for project partners, so that core project teams tend to be rather stable and enduring. Thereby, stable core teams are critical repositories of learning and capability development, especially since the development of project capabilities requires resources and expertise beyond the boundaries of any particular organization (Schwab and Miner; 2011; Schuessler et al., 2012). Even when new projects require the addition of new expertise, core teams are important mechanisms by which new knowledge gets absorbed and combined with established expertise (Schwab and Miner; 2011; Manning and Sydow, 2011).

In addition, the empirical review above indicates that in contexts where projects build on each other in terms of expertise, such as in collaborative academic research and international development, core team

members in PNOs are typically affiliated with larger organizations, rather than being freelancers or highly specialized project entrepreneurs. For example, in the field of European education research, Manning (2010) studied a PNO where all core team members hold permanent positions in research institutions. As prior project research has shown, permanent organizations are important infrastructures for knowledge creation, learning and capability development (Nightingale et al., 2011; Cattani et al., 2011; Brady and Davies, 2004). This capacity seems particularly critical for highly knowledge-intensive projects. In those contexts, inter-organizational core project teams would combine access to more formal organizational knowledge repositories (e.g. databases, knowledge management system) with informal access to expertise across organizations through membership in core teams (Schuessler et al., 2012). This may explain why in international development, for example, more complex series of projects are typically managed by internal experts of larger development agencies, whereas more repetitive, smaller-scale projects are outsourced to specialized consultants (Manning and Roessler, 2014). By comparison, TV and film projects may reutilize certain resources and capabilities but typically do not expand knowledge, thus not requiring a large organizational knowledge support infrastructure.

Another important driver of stability of core teams and organizational embeddedness of core team members is the fact that highly connected projects typically do not 'follow up' one another immediately. In fact, in certain fields, such as international development, project entrepreneurs may need to manage high project variety and high project connectivity at the same time, which requires building long-lasting core teams and extensive pools of potential ad-hoc partners (see above). Often times, a long time may pass between related projects, which results in the development of 'sleeping relationships' (Hadjikhani, 1996) or 'latent relationships' (Jack, 2005; Mariotti and Delbridge, 2012). For example, Manning and Von Hagen (2010) describe how in the process of the development of the Common Code for the Coffee Community, initial pilot projects with private partners in the 1990s were not followed up on until several years later a new funding model allowed prior project partners to reconnect. In order to connect and

'enact' knowledge from past for future projects, project entrepreneurs, such as the German development agency GIZ in this case, would rely on organizationally embedded project expertise and resources, such as technical knowledge of coffee growing, as well as established trust with external partners, such as Kraft Foods, who themselves have access to complex internal knowledge on food production. Maintaining internal access to expertise and cultivating informal external relationships becomes equally important (Schuessler et al., 2012). In sum, I propose:

> Proposition 3: The more projects within PNOs build and expand on knowledge and capabilities from previous projects, the more stable are core teams and the more likely are individual core team members embedded in larger (rather than small/one-person) organizations.

The third and fourth differentiating dimensions I focus on relate to features of economic organization. One important dimension is *degree of organizational specialization*. As noted earlier, PNOs are most likely to emerge and establish as organizational forms in project businesses that are characterized by a certain degree of vertical disintegration and distribution of capabilities among different specialized organizations and professionals who collaborate on a project-by-project basis. Yet, some project businesses have co-evolved with a higher degree of organizational specialization than others.

Film and TV production, event organizing, construction and CoPS development are all examples of high degrees of specialization. Whereas some decades ago film and TV production were characterized by high degree of vertical integration (Storper, 1989; Christopherson and Storper, 1989; Windeler and Sydow, 2001), recently, independent producers established as project entrepreneurs along with their PNO relations with clients, funding bodies, creative and technical suppliers (Jones, 2001; Starkey et al. 2000). Whereas certain drivers, e.g. deregulation, might be industry-specific (see e.g. for film/TV, Saundry, 1998), others are more generic and include increasing industry maturity, product standardization and modularization (Stigler, 1951; Langlois, 2003), which results in the emergence of specialized supplier firms

that generate gains from trade by reducing costs, and increasing economies of scale and scope (Jacobides and Winter, 2005; Helfat, 2015). Now, whereas all fields in which PNOs emerge share a certain degree of organizational specialization and distribution of capabilities, only in some contexts do specialized PBFs emerge whose main role is to initiate projects and manage PNOs. Film production, event organizing and open innovation are examples of this. In all these fields, clients outsource managerial capabilities to specialized PBFs that exploit economies of repetition in project initiation, planning, team building and network management, and are able to apply those capabilities across clients (Ethiraj et al., 2005). Interestingly, in most of these cases PBFs with strategic coordination roles in PNOs are typically rather small, while maintaining large external networks of clients and suppliers.

By contrast, in some project businesses the degree of organizational specialization is lower which implies that specialized entrepreneurial roles in PNOs are less institutionalized. For example, in academic research and international development, typically particular individuals, such as certain researchers and domain experts, take on the role of project entrepreneurs informally on behalf of their employers (e.g. research institutes, development agencies), while also fulfilling other functions in the organizations they work for, such as academic research or technical consulting (Manning, 2010; Katz and Martin, 1997; Manning and Roessler, 2014). In these cases, projects are typically more client-specific, involving intangible knowledge of client processes, and/or project routines. Economies of repetition are more difficult to establish, which lowers the chance of specialized PBFs to establish. Interestingly, however, in some of these fields, different governance models for PNOs co-exist. For example, in international development, certain projects involving public and private partners are outsourced to specialized consultants when projects are rather routine and repetitive, such as in the case of industry-specific vocational training projects (Manning and Roessler, 2014). In contrast, more unique and complex projects are managed from within development agencies. Similarly, in open innovation, clients may maintain their own open innovation platform (e.g. Procter and Gamble), or they prefer to outsource projects as well as the management to

PNOs to external agencies, such as innocentive.com, especially when they lack operational and technical expertise (Lichtenthaler, 2011). In sum, the emergence of independently managed PNOs – and thus a high level of specialization – seems to correlate with the ability to generate project capabilities that are applicable across clients, economies of repetition, a relatively high level of project routines and relatively low project complexity. I propose:

> Proposition 4: The more replicable project-related capabilities and the less complex projects are the higher the degree of organizational specialization and the more likely will PNOs be built up and coordinated by specialized PBFs rather than informally by entrepreneurial individuals.

A second interesting economic organizational dimension I derive from the empirical comparison above is the *degree of geographic concentration* of PNOs. Above, I described how some project businesses are deeply embedded within particular regions or regional clusters, such as TV and film production and other creative industries (Johnson, 2011; Grabher, 2002, 2004; Sydow and Staber, 2002). By contrast, in other project businesses, such as collaborative research, global event organizing, international development, and open innovation, PNOs often stretch beyond local or regional boundaries.

Two major reasons become apparent in the empirical review: digitization and level of dependence on geographically dispersed resources. On the one hand, project businesses differ in the extent to which project task requirements and deliverables are digitized. One extreme example is open innovation which is a highly digitized process – from posting technical problems or project requests, to submitting solutions and monitoring project progress. Academic collaborative research similarly benefits from digital content and email communication facilitating cross-border projects. Studies have shown that process digitization has been a major facilitator for the relocation and geographic distribution of processes (Apte and Mason, 1995; Sinha and Van de Ven, 2005; Mithas and Whitaker, 2007). Similarly, digitization in projects allows for the inclusion of project partners that are geographically distant from project initiators. By contrast,

especially film and cultural industries, where project tasks have both tangible and intangible elements, tend to be more regionally concentrated (Johnson, 2011; Storper and Christopherson, 1987). However, even in film, digital content, such as special effects or animated films, is increasingly outsourced to specialized suppliers outside of established film production clusters (Scott, 2002, 2004).

On the other hand, project businesses differ in the extent to which project implementation depends on geographically dispersed resources. In some businesses, such as many cultural industries, critical resources, such as talent, funding, clients, and key suppliers, tend to be regionally concentrated (see e.g. Johnson, 2011; Grabher, 2002, 2004). Because of this, PNOs in these businesses are also typically regionally bounded (Sydow and Staber, 2002). By comparison, in other fields, project resources are geographically distributed to a much larger degree, in part facilitated by digitization. For example, open innovation platforms such as Innocentive and Procter and Gamble make use of problem solvers based all over the world (Lichtenthaler, 2011). Similarly, international development and conference organizing in academia, partly because of their international scope, typically involve both globally and locally operating project partners (Manning and Von Hagen, 2010). EU research projects, in order to get funding, need to involve partners from all major European regions (Manning, 2010). Even projects in traditionally locally embedded businesses, such as film, increasingly utilize resources beyond regional boundaries. For example, Hollywood producers increasingly select lower-cost shooting locations, thereby exploiting tax incentives and tapping into remote talent pools (Foster et al., 2015).

I therefore propose that both digitization of project content and dependence on geographically dispersed resources produces PNO structures that are geographically distributed. More specifically, empirical evidence also suggests *how* PNO are distributed: In particular, there is typically a 'divide' between core teams that span regional boundaries, and flexible resource pools that are mostly locally embedded. For example, in international development, core team members of PNOs are typically 'global players', e.g.

development agencies and multinational corporations, who repeatedly collaborate and thereby draw from local networks of partners depending on where projects are situated (Manning and Von Hagen, 2010). Similarly, in open innovation, core team members – innovation agents, such as Innocentive, and major clients – are typically 'global' in reach, whereas problem-solvers, who are part of the larger pool, typically work locally. At first sight, this situation seems different for collaborative academic research and cross-regional TV production. In the former, individual members of core teams are typically embedded in certain localized research institutions (Manning, 2010); in the latter, producers from Hollywood would typically establish core alliances with other locally embedded producers (Skilton, 2011) or with film offices in different cities and regions (Foster et al., 2015).

However, no matter whether core team members are 'global players' or more 'locally embedded', they fulfill a similar role in geographically distributed PNOs: as intermediaries between local and global resources and networks. The reason why for example Kraft Foods repeatedly collaborated with the development agency GIZ to experiment with 'sustainable' coffee is because of GIZ's networks of local partners in major coffee producing countries (Manning and Von Hagen, 2010). Similarly, the main reason why longer-term project-based alliances form between Hollywood producers and film offices is because the former can activate creative resources in Hollywood and the latter can connect producers with studios and technical services in particular locations (Foster et al. 2015). In other words, core team members in geographically distributed PNOs engage in 'nexus work' (Lingo and O'Mahony, 2010), in bringing project partners and their resources from different locations together (Obstfeld, 2005). Prior studies further suggest that in geographically distributed PNOs stable alliances of 'local-global intermediaries' are not only critical infrastructures for mobilizing local partners, but also for stimulating project-based learning and capability development across locations (Skilton, 2011). Especially when projects build on each other, such as in international development, knowledge 'transfer' across locations can be critical, whereby core team members are located at the intersection of 'local' and 'global' knowledge creation (Manning and

Von Hagen, 2010). This also implies that global PNO partners are structurally advantaged compared to local players, in being able to take on those intermediary positions, which, aside from facilitating learning also gives them the power to impose their project agenda on local actors. I propose:

> Proposition 5: Increasing digitization and dependence on geographically dispersed resources lowers the degree of geographic concentration of PNOs. The more geographically distributed PNOs are the more likely will core team members take local-global intermediary roles, whereas pools of complementary partners will be mostly local.

IMPLICATIONS FOR FUTURE RESEARCH

This study has focused on identifying drivers of the emergence of project network organizations (PNOs) as generic organizational forms across project businesses, and on identifying important differentiating properties of PNOs and their underlying drivers. Findings have important implications for research on project organizing and the role of PBFs, as well as network dynamics in project businesses.

As for research on *project organizing and the coordinating role of PBFs*, findings promote an extended understanding of 'coordination' in project businesses beyond the boundaries of PBFs (Hobday, 2000; Whitley, 2006; Soederlund, 2008; Bakker et al., 2016) – especially in contexts where projects are inter-organizational (Bakker et al., 2011; Levering et al., 2013). In such contexts, PBFs, e.g. film production firms, development agencies and knowledge integrators in CoPS development, continue to play a key role – not only as they initiate and implement projects for various clients, but as they build network relations with critical clients, project partners and suppliers within particular project domains. Thereby, the coordination capacity of PNOs greatly depends on the ability of PBFs within PNOs to competently take on strategic coordination roles. Aside from initiating and managing inter-organizational projects, PBFs in coordinating roles within PNOs typically develop the ability to (1) build and manage core project teams across organizational boundaries, including the maintenance of 'latent' or 'sleeping' relationships (Starkey et al. 2000; Hadjikhani, 1996), and (2) build and manage pools of fluctuating project partners, freelancers and

contingent labor. Both 'partnership' and 'pool' management thus become central management functions in PBFs. Also, the extent to which PBFs dedicate resources and coordination capacity to managing both stable relationships and more flexible pools may depend on project variety and connectivity, thus requiring different sets of skills from managers employed at PBFs.

Another central implication of this empirical review is the importance of balancing and combining formal and informal, intra- and inter-organizational, local and global mechanisms of project-based learning and capability development. Within PNOs, all these can be important. PBFs continue to play a central role in facilitating rather formal mechanisms of learning, e.g. through the institutionalization of routines and the formalization of project evaluation practices (Brady and Davies, 2004; Nightingale et al. 2011; Schuessler et al., 2012), which are very important not least in knowledge-intensive sectors and collaborative contexts. Not surprisingly, core team members in many PNOs studied here, e.g. EU-funded academic research networks, are typically affiliated with larger organizations that possess the capacity to learn and coordinate (Manning, 2010). At the same time, especially stable core teams of project partners across organizational boundaries serve as important informal repositories of shared knowledge around managing certain types of inter-organizational projects (Schwab and Miner, 2011; Schuessler et al., 2012). Retaining core team partners is thereby critical to bridge time periods of latency (Starkey et al., 2000; Hadjikhani et al., 1996), but also competently integrate new ideas into established series of projects (Manning and Sydow, 2011; Schwab and Miner, 2011). Another important aspect is the balance between 'local' and 'global' learning especially when PNOs are geographically distributed. Thereby, PBFs within core teams play a key role as 'knowledge intermediaries' between local project contexts and global alliances of core project partners. One critical example are PNOs in international development, where both development agencies and multinational corporations fulfill this role.

In combination, this study suggests to shift attention not only from PBFs to PNOs in terms of contexts of project organizing, but from project management in PBFs (Blindenbach-Driessen and van der Ende, 2006) to project *network* management (Bouncken, 2011; Schuessler et al., 2012). Part of this shift is a greater acknowledgment of the need to manage projects and project partners at multiple levels simultaneously – the actual projects, participating PBFs, and core alliances and teams across PBFs. Certain management functions, such as hiring and partner selection, resource allocation, process regulation and evaluation seem equally important at all levels (see also Sydow and Windeler, 1998). Depending on the degree of organizational specialization, managerial tasks at the network level may be undertaken either by (groups of) entrepreneurial individuals within PBFs or by specialized PBFs in coordinating roles. In this regard, it will be important to study in the future to what extent a high degree of specialization, especially of coordinating roles, may contribute to the stability, adaptability or effectiveness of PNOs. However, at the level of inter-organizational project alliances and core teams, the fact that collaborating parties are legally independent yet operationally interdependent adds another layer of complexity (Bakker et al., 2011). For example, in managing PNO relationships, network partners need to negotiate a fine balance between the need for formal contracts, including the specification of gain/loss sharing, principles of voice and exit, distribution of responsibilities etc., and the need for more informal mechanisms of trust and reciprocity, which for example become important during idle or uncertain times between projects (Bouncken, 2011; Manning and Sydow, 2011). Finally, focusing on management at the PNO level may also involve paying more attention to relationships between globally distributed partners. Arguably, PNOs may increase the reach, scale and scope of project operations, not least geographically. However, this capacity comes with added management complexity, not just coming from inter-organizational tensions, but also from potential conflicts of interests between local and global partners.

As for research on *network dynamics in project businesses*, this study helps better contextualize prior findings on network structures and dynamics in project businesses. For example, ‘strong ties’ are often

explained by prior collaborative experience and established trust (Gulati, 1995; Schwab and Miner, 2008). This study however suggests that the existence of 'strong' project-based ties also reflects network organizing practices in response to multiple factors other than just trust or experience (Manning, 2010). For example, project-based ties seem stronger in contexts where project variety is low and project connectivity is high. In turn, in contexts where projects vary a lot or are largely unrelated, 'strong ties' may be in fact counter-productive. Although they help enact qualities such as trust and reciprocity, fluctuations in project demand may diminish the benefits of 'trust-based' repeat collaboration (see also Sorenson and Waguespack, 2006). Whereas strong project-based ties continue to be important to absorb and integrate new ideas, partner flexibility may become equally important in increasing creative variety and adaptive capacity of PNO relations (Schwab and Miner, 2011). At the same time, rather than associating weak ties with 'less frequent' or 'less intense' interaction (Granovetter, 1973), in project businesses, weak ties may be highly organized within PNO pools where each pool member more specifically takes the role as a potential substitute or additional partner for project-specific functions. Depending on the degree of specialization, these roles (and pool positions) are more or less institutionalized.

In this regard, focusing on PNOs may also help integrate research on PBFs with research on project entrepreneurship. Whereas research on PBFs would regard alliances and network relationships as of secondary importance, despite growing interest in inter-organizational projects (Bakker et al., 2011; Bouncken, 2011; Levering et al., 2013), research on project entrepreneurship would largely focus on the building and management of partnership networks outside the boundary of PBFs (DeFillippi and Arthur, 1998; Ferriani et al., 2009; Manning, 2010). Relatedly, PBF research has maintained largely a functional perspective on project or firm-level contingencies of project organizing, whereas network research, including research on 'project entrepreneurship' in networks, has focused on the emergence of tie structures, opportunities and dynamics affecting collaboration, innovation and other outcomes. Instead, more integrated research is needed, which recognizes the need for strategic management and direction

(Cattani et al., 2011), while also pointing out the limits of control in an often highly volatile and uncertain project environment. Similarly, a more integrated perspective of PNOs as both 'managed' and 'emerging' may add nuance to research on project-based career-making (Jones, 1996). For example, Manning (2010) suggests in his study of European researchers how intra-organizational and project-based 'network' careers are often intertwined. Future research needs to better understand the interplay of 'network opportunities' and 'organizational incentives' in such fields.

In sum, this study has taken on the rather complex task of identifying and specifying PNOs as organizational forms across project businesses, thereby interlinking research on projects, PBFs and project-based networks. By elaborating commonalities and differences between PNOs in various industries, a more integrated understanding of this important organizational form has been promoted. Also, this study has demonstrated how different project businesses and their organizing practices can be compared in meaningful ways – a rather rare endeavor in the project literature. Both quantitative and qualitative comparative studies may help further refine the propositions introduced and discussed in this study. For example, it will be essential to better capture similarities and differences between intra- and inter-organizational learning processes across projects. Also, the way accountability, power and risks are shared and distributed in PNOs will be an important avenue for future research. In addition, the role of economic, institutional and technological changes in promoting and affecting PNO emergence needs to be better understood. For example, to what extent have trends in the contemporary global economy, such as global outsourcing, distribution of resources and increasing cost competition, promoted the emergence of PNOs? This study may also have important implications for managers at project-based firms who have been operating within networks across firms for a long time, but whose formal training has been focusing on project-internal management techniques and firm-internal staffing and recruiting. Promoting a more holistic understanding of PNOs as another important managerial context may help extend professional project management to the network domain.

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FIGURES AND TABLES

Figure 1: Embeddedness of Projects in Multiple Contexts

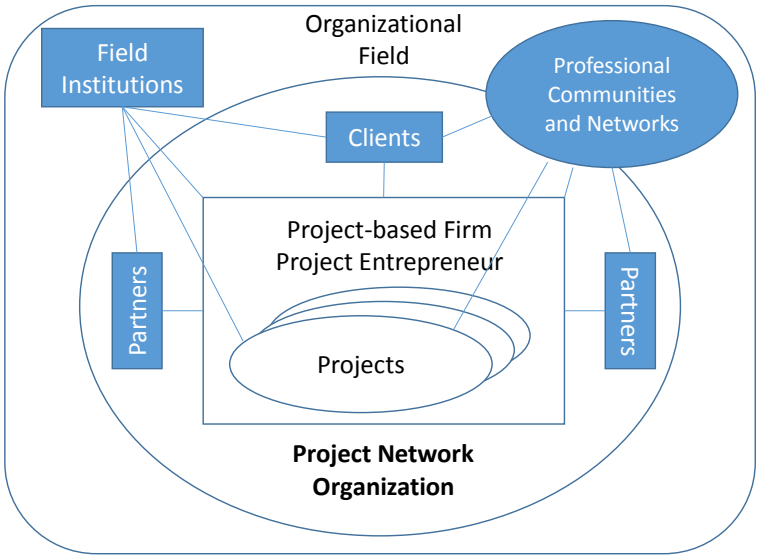


Figure 2: Project Network Organization in TV Production

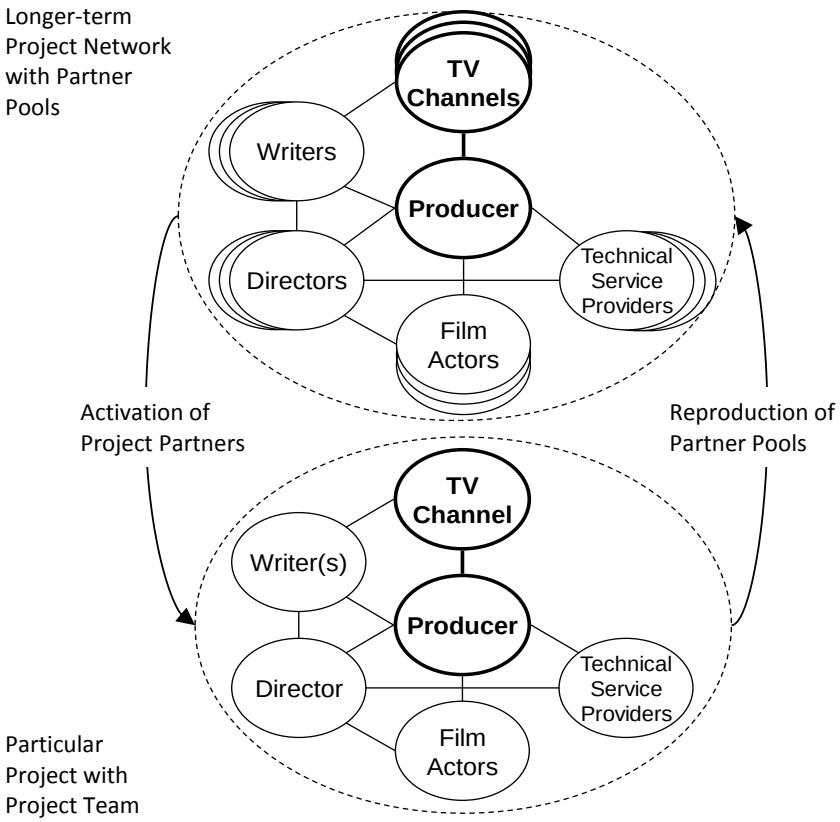
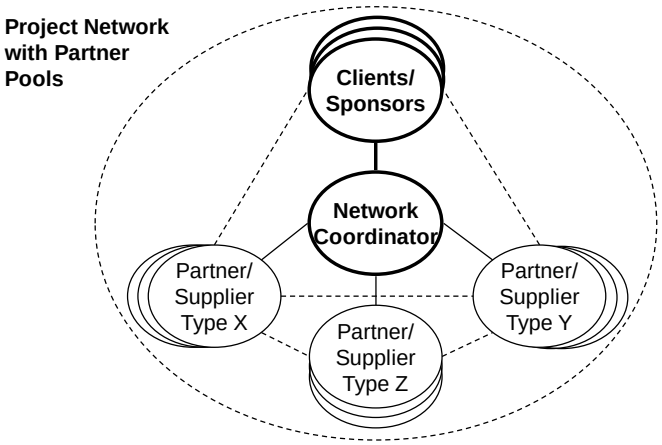


Figure 3: Project Network Organization as Generic Form



Clients/sponsors:
TV channels, funding agency, CoPS user, local administration (e.g. construction)

Network coordinator:
Production firm/producer, development agency, system integrator, consultancy/consultant, general contractor, innovation agency

Partners/suppliers:
Creative professionals (script writers, directors, architects, researchers, problem-solvers…), technical service providers, sub-contractors

Table 1: Comparison of PBFs, PNOs, and Professional Networks

Dimension	**Project-based Firms**	**Project Network Organizations**	**Emergent Communities and Networks**
Participants	Managerial and technical staff; size can range from functionally differentiated to entrepreneurial with limited managerial positions	Strategic network coordinator, core project partners, and flexible pools of ad-hoc partners qualified for particular types of projects	Individuals and organizations with different roles in particular project businesses who share norms and practices of particular business
Systemic boundaries	Rather fix; longer-term employment contracts beyond particular projects	Semi-fluid; formal and informal ties between legally independent partners beyond singular projects	Fluid; regional and/or field-specific identity and mutual recognition of shared ties and project experiences
Principles of coordination	Hierarchical control	Strategic network control and interdependence	Mainly professional trust and reciprocity
Level of strategic control	High, based on hierarchy and employment contracts	Medium, based on degree of interdependence	Low, network formation based on dispersed individual interaction

Table 2: Features of Project Network Organizations in Different Project Businesses

Features of Project Network Organizations	**Cultural Industries**		**Construction**	**Complex Product & System Development**	**Collaborative Research and Innovation**		**International Development**
	Film/TV Production	**Event Organizing**			**Academic Research**	**Open Innovation**	
Types of projects or collaborative domain around which project networks form	Feature Film projects for particular clients / audiences	Recurrent events for same or similar audience / with same or similar content	Particular types of buildings or physical infrastructures for particular types of client	System development and upgrades for particular clients	Development of knowledge within similar domains / using similar funding	Development of scientific solutions, technologies using various external partners	Series of projects in particular development domain with same or similar partners
Strategic Coordination	Film producer / production firm	Event agency	General contractor / architect / consultant	System integrator firm	Individual researchers;	Client firm, innovation agency	Development agencies, consultants
Core Project Teams	Producer – Director or Writer – Client (e.g. TV channel)	Agency – public administration – core event participants	Contractor – architect – consultant – core suppliers	Integrator – Client – Core suppliers	Core group of researchers;	Client firm and innovation agency	Development agency – NGOs/MNC partners
Flexible Partner Pools	Large pool of actors, writers, camera ops, cutters, others	Often local pools of event-specific performers, security, catering	Sub-suppliers, service firms, external labor pools	Software providers, contractors, IT service firms	Research assistants, additional researchers	Pool of ad-hoc partners, problem-solvers	Local project partners, consultants
Differentiators							
Project variety	HIGH	MEDIUM	LOW TO MEDIUM	MEDIUM	LOW TO MEDIUM	HIGH	MEDIUM TO HIGH
Project connectivity	LOW TO MEDIUM	MEDIUM	LOW TO MEDIUM	HIGH	HIGH	LOW	MEDIUM TO HIGH
Organizational specialization	HIGH	HIGH	HIGH	HIGH	LOW TO MEDIUM	MEDIUM TO HIGH	MEDIUM TO HIGH
Geographic concentration	MEDIUM TO HIGH	LOW TO HIGH	MEDIUM TO HIGH	MEDIUM	LOW TO MEDIUM	LOW	LOW