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This is the accepted version of a paper published in *Industry and Innovation*. This paper has been peer-reviewed but does not include the final publisher proof-corrections or journal pagination.

Citation for the original published paper (version of record):

Skog, D A. (2016)

Local game, global rules: exploring technological heterogeneity exploitation in digital creative cluster evolution.

*Industry and Innovation*, 23(6): 531-550

<https://doi.org/10.1080/13662716.2016.1185358>

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-124500>

**Local game, global rules: Exploring technological heterogeneity exploitation in digital creative cluster evolution**

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**This is an accepted manuscript of an article published by Taylor & Francis in *Industry and Innovation* (2016), no 23(6), p. 531-550.**

**Available at:** <http://dx.doi.org/10.1080/13662716.2016.1185358>

*Abstract:* Cluster evolution research suggests that maintaining an optimal technological heterogeneity that is exploitable by cluster actors is key to sustainable cluster development. This paper argues that exploring this optimal span and its influence on local synergy creation calls for understanding the interaction between cluster actions, local conditions for collaboration, and heterogeneity requirements over time. For this purpose, a longitudinal case study is conducted, tracing the development of a digital creative cluster that has experienced the initiation, rise, and decline of local technological heterogeneity exploitation. By applying institutional logics as a sensitizing device, the analysis explores how actors interact with local and theme structures in this process. Findings show how hub-firms draw on creative norms and technologies to produce situated heterogeneity requirements. These are assessed with co-location factors and accumulated experience of local collaboration to produce local organizing rationales that guides decisions to engage in local collaboration.

Key words: Cluster evolution, creative industries, network dynamics, institutional logics

## **1 Introduction**

Clusters have become popularly adopted as a policy tool in recent years. Explained as groups of interconnected actors within the same geographical region that use complementary skills and technologies within a common theme (Porter 2000), clusters afford the advantage of leveraging aspects of geographical proximity to produce synergies within a common theme (Menzel and Fornahl 2010). Therefore, clusters are perceived as beneficial to regional development, firm productivity, and innovation, leading to significant amounts of both private and public funding being invested in initiatives to foster their emergence, growth, and sustainability. Hence, comprehensive knowledge of why and how clusters emerge and

develop over time is imperative.

Recently, a particular stream of research has begun to identify and theorize the dynamics involved in cluster evolution (e.g. Boschma and Fornahl 2011, Maskell and Malmberg 2007). Within this stream, explanations of cluster development have become centered on the interaction of four key factors: actors, networks, institutions, and technological heterogeneity, that drive clusters through life cycles of emergence, growth, sustainment, and decline (Menzel and Fornahl 2010, Fornahl, Hassink, and Menzel 2015). In growing stages, clusters actors are able to exploit commonalities, complementarities, and co-location factors to produce relational-value around focal points of activity within a particular theme (Menzel and Fornahl 2010). Through localized networks, actors can efficiently extend internal firm capabilities with additional resources, information, and knowledge (Krätke 2002, Scott 2002, Sydow and Staber 2002), facilitated by spatial proximity and shared institutional frameworks that ensure similarity in cultural traditions and cognitive framing of technologies (Bathelt 2005). Paradoxically, mechanisms of similarity also lead to cluster decline over time. Through intense local interactions characterized by heightened absorptive capacities (Menzel and Fornahl 2010), myopic behaviors (Maskell and Malmberg 2007), and favorable conditions for local information exchange (Pouder and St. John 1996), isomorphic pressures become prevalent in clusters and render actors increasingly homogenous. Over time, clusters risk becoming locked-in to established networks and technological trajectories, and therefore become vulnerable to externally driven change in technologies, industries, and markets. Consequently, a key to sustainable cluster growth lies in the ability to generate and sustain an optimal technological heterogeneity (Menzel and Fornahl 2010).

Besides initial attempts to outline this paradox in cluster evolution, limited empirical efforts

have been directed towards examining it in detail. As a result, what to consider optimal heterogeneity remains in ambiguity. To this end, Sinosic and Tödtling (2015) provide a notable exception by suggesting that while local heterogeneity is important, its actual impact on cluster evolution lies in the extent to which actors are able to exploit it. Exploitation, they argue, is dependent on local factors and resources, but also upon dynamics within the particular theme of joint enterprise. To this end, extant cluster research has emphasized technological resemblance and common institutional frameworks as local factors enabling and constraining exploitation. In explaining theme dynamics and their effects, extant literature has relied heavily on industry life cycle theory (e.g. Audretsch and Feldman 1996, Ter Wal and Boschma 2011). While this approach has provided fundamental and highly generalizable explanations to the interaction between cluster development and theme dynamics, it also suggests a rather universal and deterministic process that leaves little room for actor agency. To this end, it has been suggested that institutions originating in different analytical levels intersect in clusters, yet we know little about their interaction and how they affect and are affected by local agency in specific empirical settings (Trippel et al. 2015). Indeed, extant research has indicated that some cluster themes are inextricably interconnected to innovation processes distributed across places and industries (Sinosic and Tödtling 2015), yet although certain evolutionary patterns manifest at the industry level, local industry instantiations may not follow them due to local processes and factors of mitigation (Krafft 2004, Sinosic and Tödtling 2015).

Against this backdrop, this paper builds on the view of exploitability as determinant to optimal technological heterogeneity in clusters and extends it through examining how exploitation emerges at the intersection of local conditions and theme requirements. For this purpose, institutional logics theory is drawn upon as a sensitizing device to understand and

analyze how actors, as embedded within their spatial and theme contexts, decide whether or not to engage in localized vertical collaboration. In so doing, the following research question is addressed: *How does required local technological heterogeneity emerge, evolve and influence vertical collaboration in cluster evolution?*

This question is investigated through a longitudinal case study, tracing the development of a digital creative cluster in northern Sweden over the course of ten years. Exploitation of technological heterogeneity is instantiated in the case through recurrent collaborative projects involving technologically specialized firms to develop digital creative products and services. Findings demonstrate how, while local heterogeneity remained largely intact over time, the enactment of multiple multi-scalar principles and practices pertained to both spatial and theme dimensions lead to it being continuously reassessed. In this process, hub-firms that were densely connected within the cluster and also provided market and industry links drew upon theme-related norms and technologies, an accumulated experience of local collaboration, and co-location factors in the ongoing construction of local organizing rationales. These in turn served as a logical basis for evaluating if local heterogeneity were perceived as beneficially exploitable for synergy creation at specific points in time.

## **2 Cluster dynamics**

Clusters are understood here as interconnected actors that group together “*around a focal point within a spatial and thematic boundary*” (Menzel and Fornahl 2010, p.213). The spatial boundary refers to co-location in space (e.g. a city, region, or nation) while the thematic boundary refers to the use of common inputs or techniques (Turok 2003) or a technological proximity (Menzel and Fornahl 2010) that underpins a synergy potential. Hence, cluster evolution concerns the process whereby co-located actors and the regional networks in which

they participate emerge and develop over time in the context of a particular geographical region and a particular theme. Research on cluster evolution principally aims to provide a dynamic view on the long-term development of clusters and the driving factors and mechanisms behind it. For this purpose, the dominant approach has been to conceptualize the evolution of clusters in terms of life cycles, where clusters progress through predetermined stages of emergence, growth, sustainment, and decline (Trippel et al. 2015). Over time, research within this area has come to emphasize four main dynamics that influence clusters in this process: actors, networks, institutions, and technological heterogeneity (Menzel and Fornahl 2010, Fornahl, Hassink, and Menzel 2015).

Situating these dynamics in cluster evolution, extant research suggests that certain factors pertaining to the spatial boundary of clusters often provide important antecedent conditions. To this end, research has shown how access to local social networks (Kasabov 2011), regional labor mobility (Saxenian 1994), or decisions from policy makers (Feldman, Francis, and Bercovitz 2005) may trigger cluster emergence. In latent clusters, one or a few small firms start to utilize such existing resources to instigate economic activities, and as they do, they produce new resources for others to use (Feldman, Francis, and Bercovitz 2005) and may invest in regional labor markets and infrastructures (Maskell and Malmberg 2007). While such co-location externalities serve to explain why and how clusters emerge, their continued growth is often derived from the exploitation of co-location factors within the thematic boundary. In their seminal paper, Menzel and Fornahl (2010) emphasize that the establishment of a common focal point and the development of a technological relatedness is a crucial factor for clusters to grow. Whereas firms in emerging clusters are often too heterogeneous for engaging in local networks, uniting on a common theme enables synergy creation, collaboration, and a local division of labor according to firm specializations. By

building on common underlying social and historical relationships, cluster actors can leverage a common managerial mindset (Pouder and St. John 1996) along with shared values, attitudes and interpretative schemes (Bathelt, Malmberg, and Maskell 2004) in the formation and development of specialized regional networks. In local networks, shared institutional frameworks promotes knowledge transfer, learning, and innovation (Audretsch and Feldman 1996, Giuliani 2011) and recurrent within-theme interactions acts to further diffuse theme-specific cultural traditions and ways of interpreting theme-related technologies (Bathelt 2005).

Paradoxically, the literature maintains that aspects of geographical proximity and intense within-theme interactions that foster cluster growth produce inertia and homogeneity over time and ultimately leads to cluster decline. To this end, Menzel and Fornahl (2010) argue that clusters development halts when actors become too biased towards a technological focal point. This bias unfolds as the result of a heightened absorptive capacity amongst co-located firms that triggers isomorphic processes. At this point, stable local networks may inhibit actors from seeking new knowledge sources and markets, and from changing the nature of their business activities. Comparably, Maskell and Malmberg (2007) argue that exploitation of local collaboration may over time lead to a lack of variety, a technological lock-in, and an insular mindset within firms. In a similar vein, Ter Wal and Boschma (2011) maintain that increasingly stable regional networks and lengthy interactions within can decrease variety in firm capabilities and lead to a cognitive lock-in. Consequently, clusters are assumed to decline when local technological heterogeneity is too low, networks are too rigid, and behaviors too institutionalized for responding to external shocks.

Together, this indicates that while mechanisms of geographical proximity produce benefits to clustered actors at the offset, they initiate a tendency towards decreased heterogeneity in clusters over time. Hence, the capacity for clusters to extract value from local relationships gradually deteriorates, and they become increasingly vulnerable to change. In light of this, recent research has argued that a key to cluster sustainability is to maintain an optimal degree of local technological heterogeneity so as to enable exploitation of co-location while avoiding the long-term drawbacks (Menzel and Fornahl 2010). However, limited efforts have been directed to empirically examining the role of this paradox in detail. Notable exceptions include Sinovic and Tödtling (2015) who in their study of a new media cluster argued that local technological heterogeneity have little impact on cluster evolution in itself. Rather, they found that positive effects of heterogeneity are underpinned by its exploitation and local conditions for managing its uncertain nature. To this end, they echo the importance of a varied yet related local heterogeneity in clusters (Frenken, Van Oort, and Verburg 2007, Castaldi, Frenken, and Los 2015) but they also note upon the complexity involved in determining the situated optimality of heterogeneity, especially when cluster themes are inextricably interconnected with innovation processes distributed over geographical areas and industries.

While shared language and cognitive frames have been put forth as local factors delimiting the exploitation of local heterogeneity (e.g. Håkanson 2005) its interaction with external demands of specific industries and markets that condition the production and marketing of products and services is often ignored in the cluster literature (Bathelt 2005, Motoyama 2008). When approached analytically, theme dynamics is often captured by industry life-cycles, which in short, suggest that co-location factors can be leveraged in the early stages of an industry when the nature of knowledge is tacit and technological trajectories are uncertain

(Audretsch and Feldman 1996). However, these benefits of clustering diminish as industries mature, knowledge gets codified, and shakeout processes lead to a decrease in local heterogeneity (Ter Wal and Boschma 2011). While the value of these highly generalizable understandings of the interaction between global and localized patterns of industry evolution is substantial, research has also called attention to the importance of exploring this relationship more thoroughly by recognizing the specific contexts in which clusters evolve (Martin and Sunley 2011). Indeed, empirical observations have shown how clusters in the same industry can evolve in different ways (Saxenian 1994), that different co-location factors can be leveraged in different themes (De Vaan, Boschma, and Frenken 2012) and that global industry evolution patterns do not necessarily correspond to local instances due to local actions, actors and processes of mitigation (Krafft 2004, Sinozic and Tödting 2015).

In all, this suggests that while technological heterogeneity is a necessary condition for positive cluster development, it is insufficient for that purpose if it cannot be exploited. Exploitation, in turn, relies partly on the extent to which actors share institutional frameworks and technological commonalities that enable them to efficiently collaborate and exchange resources in networks. While seldom recognized in extant research, exploitation also relies on shifting demands emanating from markets and industries connected to a specific theme, yet these effects have been shown to be indirect and non-deterministic. Therefore, this paper builds on the view of exploitability as a measure of optimal heterogeneity and extends it by incorporating the demands and goals that a technological variety is supposed to be leveraged for.

Interest is thereby directed towards cluster actors that decide whether or not to exploit available heterogeneity at the intersection between spatial conditions and theme demands. In the following, I describe how institutional logics theory is used as a sensitizing device to

complement existing approaches for understanding this interaction as situated in digital creative clusters.

### **3 Institutional logics in digital creative cluster evolution**

Institutions on different levels intersect in clusters (Trippel et al. 2015) and present actors with various rationales and templates for action (Lawrence, Suddaby, and Leca 2010). Institutional environments are delineated by membership in groups of that share commonalities, and to this end, a shared theme and spatial location are particularly foregrounded boundaries to clusters (Menzel and Fornahl 2010). Hence, examining the factors that enable and constrain actors' to exploit local technological heterogeneity require a lens that allows investigating the interaction between local behavior and multi-scalar sources of rationales within both theme- and spatial dimensions of clusters. This section describes how and why institutional logics is a particularly useful lens for this purpose by first outlining the concept and its main principles followed by a brief overview of multi-scalar logics involved in cluster evolution.

#### **3.1 Institutional logics**

An institutional logics perspective is a theoretical framework for analyzing the relationship between institutions, organizations, and individuals in social systems. The framework is directed towards answering questions of how actors enact, are influenced by, and change surrounding institutions (Thornton, Ocasio, and Lounsbury 2012). Situated within the broader field of neoinstitutional approaches to organizations, it recognizes the contextual influence on actors by drawing attention to patterns of structuration across time, geographical boundaries, and analytical levels (Scott 2013). To this end, it draws attention to how actors interact with the institutional logics that develop at a variety of analytical levels, such as organizational, inter-organizational, geographic region, or societal levels (Thornton and Ocasio 2008).

In a broad sense, institutional logics may be defined as “*shared conceptual frameworks that provide guidelines for the behavior of field participants*” (Scott 2013, p.239). They comprise “*a set of material and symbolic practices and organizing principles that provide logics of action for organizations and individuals*” (Jarzabkowski, Matthiesen, and Van de Ven 2009, p.284) by specifying “*which issues to consider salient, which ends to pursue, which means to employ, and which standards to use to define success*” (Smets et al. 2014, p.934). Thornton et al (2012) outlines a number of core principles for the institutional logics perspective. First, it adopts a dualistic view on structures as simultaneously constraining and enabling the behavior of actors (Giddens 1984). While actors’ identities, values, and assumptions are embedded within prevailing institutional logics, actors are also partially autonomous in that they are able to grasp and draw upon alternative views of rationality from multiple logics in order to achieve a fit with situated practices and local settings. Agency, thus, depends on how actors are “*situated within and influenced by the spheres of different institutional orders, each of which presents a unique view of rationality*” (Thornton, Ocasio, and Lounsbury 2012, p.10). Second, logics carry both material and symbolic aspects. While symbolic aspects provide meaning to material structures and practices, meanings are in turn expressed through, and affected by, material structures and practices. Third, the meaning and effects of institutions are historically contingent. Finally, the logics perspective recognizes that institutions operate at different analytical levels. Therefore, actors are presented with several, often conflicting and competing, higher-level logics that suggest inconsistent meanings, norms, goals and means to achieve them. While such institutional complexity can generate challenging tensions for actors to manage (Greenwood et al. 2011) it can also benefit organizations if managed and harnessed (Jarzabkowski et al. 2013) or balanced (Smets et al. 2014).

### **3.2 Multi-scalar logics in cluster evolution**

Reflecting the multi-level nature of institutional logics, recent research has emphasized that cluster evolution is a process situated in a wider context that enables and constrains it (Trippel et al. 2015, Motoyama 2008). With regard to this, institutional logic applications often refer to the influence of societal logics that provide specific building blocks that actors can draw on to enact practices and organizing principles locally (Thornton, Ocasio, and Lounsbury 2012). At the industry level, technologies have been found to serve as a material and symbolic foundation on which to base local practices and organizing principles (Garud, Jain, and Kumaraswamy 2002, Gawer and Phillips 2013) and as mediators of institutionalized practices and policies across sectors and places (Mangematin, Sapsed, and Schüßler 2014). For example, Gawer and Phillips (2013) show how a shift to platform logic in the computer industry manifested in the enactment of new practices, types of inter-firm relationships, perceptions on value, and power structures. Further, Garud et al. (2002) argue for the institutional role of technological standards that ensure compatibility between means, ends, and the surrounding technological environment in the development of products and services.

Technological aspects aside, industries may also suggest certain rationales based on prevalent organizational forms and market norms. To this end, two key aspects stand out in relation to digital creative clusters. First, creative practice often enacts a project organizing logic (Whitley 2006) where the development of products and services plays out in temporary yet recurring inter-organizational structures that include individuals, firms, and clients (Sinozic and Tödtling 2015). Second, creative projects aspire to produce outputs that are both novel and appropriate: they need to be recognized as unique and valuable within their wider social contexts (Belussi and Sedita 2008).

On a local level, the influence of local institutions at the level of inter-firm networks and local organizational fields are often emphasized in the cluster evolution literature (Fornahl, Hassink, and Menzel 2015, Trippel et al. 2015). Of particular interest to digital creative clusters are factors within local networks and the wider local context that support or contradict the enactment of project organizing logics and creativity norms. To this end, repetitive localized interactions between actors in projects lead to the emergence of more or less stable project network organizations in which actors continuously produce and revise collective and relational identities, shared norms and cognitive frames. Local networks, in turn, rely on local and national institutional environments to uphold a spatial and theme-related culture that benefits localized synergy potential, resource and knowledge exchange, and value appropriation (Bathelt 2005, Sydow and Staber 2002).

In sum, this suggests that institutional logics constitutes a viable lens for the study of cluster evolution. To this regard, it affords investigating the interaction between local actors and multi-scalar structures across the theme- and spatial dimensions of clusters. In supplement to explanations provided by industry life cycles, absorptive capacities, and isomorphic pressures, it allows investigating the situated dynamics of internal conditions and external demands that condition the exploitation of heterogeneity bottom-up. Through directing focus to how actors draw upon different rationales for action at the intersection of multiple logics, it affords embedded agency to cluster actors in the creation and maintenance of common focal point for synergy creation.

#### **4 Method**

This research adopts a longitudinal single-case study design to understand a developmental course and the conditions affecting it (Yin 2013). This approach is particularly useful for

studying cluster evolution as it enables taking a holistic perspective on the process that remains sensitive to situated complexity while it avoids reducing explanations to single mechanisms (Boschma and Fornahl 2011, Martin and Sunley 2011).

#### **4.1 Case selection and description**

The study aims to understand and explain how requirements for technological heterogeneity emerge and evolve in the evolution of a digital creative cluster in a small Swedish town by tracing its development from 2003 to 2013. Given this focus, interest is directed towards actors that have been members of the regional production network or the regional industry association. This amounts to 19 firms, of which 16 have been active in the production network. These actors are distributed across related industries, with specializations including web design and development, advertising, photography, video and music production, software development, and graphical design. These specializations have been leveraged in the production network to produce websites, computer games, mobile and web browser applications, and different forms of digital artwork for local, national and global clients. This includes recurring projects for 5 fortune 500 companies. Between 2004 and 2013, the 19 firms have grown from employing around 70 individuals in total to employing 240, and increased their total yearly turnover from 8 million to 28 million euro.

The case was chosen based on its potential for shedding empirical light on local technological heterogeneity exploitation in cluster evolution in order to advance current theory (Yin 2013). Being based in a small town, the cluster lacks the substantial support from local institutions that previous studies have shown to be important for sustaining relational value creation from local heterogeneity (Sinozic and Tödtling 2015). On the other hand, the cluster has been able to establish trans-local ties to external partners and customers, which has been put forth as key to avoiding local homogeneity in clusters (Bathelt 2005, Maskell and Malmberg 2007,

Menzel and Fornahl 2010). Despite this, the case shows the initiation and rise, as well as decline, of collaborative projects, hence providing the opportunity to explore enabling and constraining conditions of heterogeneity exploitation over time. During the first two years, the production network undertook 8 projects involving from 2 to 4 local firms. These activities were most intense in 2009 and 2010 as 11 projects were undertaken in total, involving between 2 to 6 local firms. During 2012 and 2013, production network activities had declined to 3 projects that were limited to engaging 2 local actors each.

## **4.2 Data collection**

This study draws on interviews and secondary data. In total, 11 semi-structured interviews were conducted with 9 different key individuals (1 informant was interviewed at three occasions, see table 1). They lasted from approximately 45 to 75 minutes and each was recorded and transcribed. Informants were selected based on criteria that favored centrality, power over decision-making, and experience. To this end, individuals in firms that had been most active in initiating collaboration within the production network and the local industry association were prioritized. DeltaFirm and the local university provided exceptions to this principle. The reason for including DeltaFirm was to investigate why, while having an active role in the industry association, it did not participate in production network activities. The university was included to illuminate its role in the cluster. On a firm level, key informants with formal legitimacy to influence the developmental paths of firms and projects were sought, thus leading to the selection of individuals with organizational, technological, and creative lead positions. As interviews were partly retrospective in nature, informants who had been employed in the companies for extended periods of time were preferred. As interviews were conducted at different points in time, knowledge gained from previous interviews and secondary data was used to inform interview-guides for subsequent interviews. This allowed

for a focused and in-depth collection of data related to conditions influencing the exploitation of local technological heterogeneity over time.

Actor	Role	Abbreviation	Year for interview
AlphaFirm	Manager1	AFM1	2012, 2013 & 2014
AlphaFirm	Manager2	AFM2	2014
AlphaFirm	Lead programmer	AFLP	2014
AlphaFirm	Creative director	AFLP	2014
BetaFirm	Manager	BFM	2012
GammaFirm	Manager	GFM	2012
GammaFirm	Creative director	GCD	2012
DeltaFirm	Manager	DFM	2012
University	Program Manager	UPM	2012

Table 1. List of informants

To inform the development of interview guides, include multiple perspectives on cluster dynamics, and enable data triangulation, a significant amount of secondary data was collected from several sources (see Table 2). Project documents from all actors engaged in the production network were collected, which contained information of when projects had taken place, outputs, the actors involved and their roles, the identity of the client, and technologies applied. Press articles were collected through searching a news archive for entries with cluster actors, projects, and the local industry association between 1995 and 2013.

Data Source	Quantity / Length
Project documents	117 pages
Press articles	334 pages
Annual reports, corporation and industry charters	1315 pages
Video recordings	1.5 hours
Project documents	111 pages

Table 2. List of secondary sources

Annual reports and corporation charters provided firm-specific data, such as operational purpose and economic performance, from the period of 2000 to 2013. In addition, firm websites, recorded presentations and recorded interviews were analyzed to further complement an understanding of how, and under what conditions, local collaboration had evolved.

**4.3 Data analysis**

Data analysis followed a temporal bracketing strategy (Langley 1999). Although it was an iterative process, it is described here in progressive stages for the sake of clarity. First, data from all sources was compiled and organized in chronological order. This implied identifying and setting dates of occurrence to specific events and activities through triangulation. To this end, documents were crucial to establishing a comprehensive event-sequence and a view on the quantitative development of the cluster including collaboration-intensity, network evolution, and project demands over time with which to corroborate and inform interviews. Further, interviews provided in-depth descriptions of why and how events had occurred and turned out as they did. Second, the chronological data was decomposed into successive phases based on continuity of activities within phases, and discontinuity as their boundaries. The resulting boundaries were defined by shifts in intensity of collaboration between cluster firms and in centrality in the production network. A summary of the resulting three phases is presented in table 3.

Summaries	Interview extract examples
<p><i>Phase 1 (2003 – 2007): Formation</i></p> <p>This phase starts at the end of 2003 when the first collaborative project is executed. It is characterized by growing intensity in collaboration lead by AlphaFirm, network strengthening, and theme stability. The outcome was a highly efficient production network.</p>	<p><i>“The network was born with the way that AlphaFirm worked, and it has grown as AlphaFirm has grown”</i></p>

<p><i>Phase 2 (2008 – 2009): Peak</i></p> <p>This phase is characterized by very intense interactions within the production network, a dominant central actor, and consolidated network roles. At the end of the phase, a sense of strategic uncertainty emerges as the result of theme changes.</p>	<p><i>“[...] we have developed a good understanding of each other’s competences. To be able to rapidly assemble a team that knows exactly how we want things done is indispensable”</i></p>
<p><i>Phase 3 (2010 – 2013): Decline</i></p> <p>This phase is characterized by the entrance and disappearance of multiple central actors, increasing theme turbulence and complexity, and a dramatic decrease in collaborative activities.</p>	<p><i>“[...] we skip [the regional firms] already at an initial stage [...] I don’t know if they are as important as they used to be. Preferably they would be, but it’s all about quality in the end.”</i></p>

Table 3. Three analytical phases

Finally, the three phases were examined individually for emerging patterns of local technological heterogeneity exploitation. Guided by institutional logics as a sensitizing device, evidence of norms, beliefs, values and work practices (Jarzabkowski, Matthiesen, and Van de Ven 2009) that influenced actors in their decision to engage in local collaboration or not was sought. Of particular interest were the interaction between actors and logics associated with the theme and spatial dimensions of the cluster.

## 5 Results

### 5.1 Antecedent conditions

In creating antecedent conditions for cluster emergence, a local university program teaching digital design and development and a small digital design firm (henceforth AncestorFirm) played important roles. From the mid 90s, regional firms often hired program students and some also started their own firms within the region. Hence, at the start of the new millennium, the region held a sprawling creative industry with actors that, while being quite successful on their own, acted in isolation. At this time, AncestorFirm was the largest firm in the region,

employing over 40 people in 2001. In 2003, AncestorFirm experienced severe financial problems, which caused a number of key employees to leave the company, resulting in the formation of four new firms. One of these was AlphaFirm that would become a central actor in driving theme development and local collaboration. Paralleling this development, several new firms centered on video, photography and music production started in the region. In all, the region thereby comprised around twenty creative industry firms acting more or less in isolation from each other at the beginning of 2003.

## **5.2 Formation phase: 2003 - 2007**

### **5.2.1 Establishing a theme focal point for production network emergence**

AlphaFirm initiated formal collaboration between regional firms in a web design project in late 2003. The project required expertise in the Adobe Flash platform as well as in video production and editing. Such expertise was at this time lacking in AlphaFirm, which therefore decided to distribute programming and production activities to other local firms. Following this project, AlphaFirm established an increasing number of relationships with global agencies and enterprises through which new large projects were attained, and persisted in sharing most of them with other regional firms. Hence, the emerging production network enabled AlphaFirm to access resources for meeting complex project requirements, but it also provided the whole network with a connection to external markets.

While vertical collaboration in the production network was gaining momentum, individual firms simultaneously executed projects in-house. In contrast to production network projects, in-house projects were characterized by local competition, less technological complexity, and lower demands for creativity:

*“[...] when trying to acquire local projects, then you notice some competition [...] for these*

*small local firms wanting a small website, then you can't afford to be very innovative. Then you make these, shall we say 'three-chord-webs', as we call them"* (GFM)

While sometimes complex, both in-house and collaborative projects displayed a stable technological pattern; centered on websites using established technological standards (primarily HTML, CSS, JavaScript and Adobe Flash) that were designed for the PC. Importantly, this stability in project scopes allowed AlphaFirm to be consistent in its distribution of project elements to surrounding firms according to their specializations. It also implied that regional firms remained focused on, and could adapt to, limited incremental changes in specific standards:

*"You used to be quite specialized, I mean you had Flash-specialists and HTML-specialists and so on [...] if you knew Flash, what more was there to keep track of?"* (GFM)

The extent to which technological specializations of firms could complement others to achieve project goals became the basis for production network membership. Evidently, this implied that specializations needed to have both a relational fit with others and be of a high degree of proficiency to be considered eligible:

*"You can't join [the local production network] if you don't have the right type of competence, if you don't have a world-class specialization that you can contribute with to this network"* (BFM)

Once set in motion, production network development was largely the result of self-reinforcement. Based on technological project scopes, network roles were casted by the project-owning firm according to individual firm specializations. Consistency in scopes and casting-behavior thereby resulted in increasingly established roles, stronger inter-firm relationships, and a gradual refinement of the collaborative processes. Thereby, the network became progressively capable and efficient as long as project demands remained stable. As a result, the production network executed a total of 15 collaborative projects involving between

2 to 4 local firms during this phase, out of which AlphaFirm initiated 13 of them.

### **5.2.2 Spatial benefits and constraints to collaboration**

In this phase, factors of co-location and place were both enabling and constraining to local collaboration. At the offset, cluster firms were able to build on preexisting social relationships in forming the emerging network. Several key individuals knew each other from earlier experiences as coworkers in AncestorFirm, and were therefore well informed of each other's expertise:

*“This community that [AncestorFirm] had built meant that everybody knew everyone because they had worked at the same place. They continued working together because they knew what could be expected from each other”* (GFM)

In addition, relationships between cluster individuals had also formed through being students at the same local education:

*“I think that we have five people from [the educational program] today, and [AncestorFirm] had ten people from there for a while”* (AFM1)

As synergies started to produce and distribute economic returns amongst the local firms, the production network became increasingly characterized by trust, receptiveness, and responsiveness. However, the firms also experienced a gradual decline of specialized recruits coming from the local university, and particularly, informants expressed frustration over the fact that the specific educational program from which most talents had been recruited was canceled in 2007:

*“ it was really good for a couple of years [...] it was too bad that it dropped in quality and disappeared”* (AFM1)

As a response to local recruitment challenges, AlphaFirm decided to launch a second office outside the region in 2005. This issue was also the main underlying motivation for the formation of a local industry association in 2007.

### **5.3 Peak phase 2008 - 2009**

#### **5.3.1 Leveraging network stability for intense collaboration**

During this phase, members of the production network were able to fully exploit benefits resulting from four years of collaboration. The network structure was stable, actor roles were clear, knowledge of individual expertise was widely diffused, and collaborative processes were fine-tuned and efficient:

*“Most of us have worked together in different constellations since five years back and have developed a good understanding of each other’s competences and ways of working. To be able to rapidly assemble a team that knows exactly how we want things done is indispensable”*  
(AFM1)

Sustained network stability enabled an unprecedented intensity in collaborative projects within the region. During 2 years, 9 projects were executed, AlphaFirm initiated 6, and each project involved up to 6 regional firms.

#### **5.3.2 Facing emerging theme complexity**

The first projects executed during this phase remained true to the technological trajectory established during the previous phase. However, 2009 marked an evident shift as social media and mobile platforms rapidly became adopted as standard elements in project outputs. These changes were in part driven by client demands for novelty and reach, but it was also influenced by perceptions amongst firms regarding end-user preferences and behaviors:

*“What happened around 2009 was that social media was growing. You started to notice new user patterns on the web”* (BFM)

The extension of these new platforms to project scopes resulted in new resource requirements and adoption of new design and development approaches. This included adoption of responsive web design methods and relatively extensive testing procedures:

*“Everything had to be scaled-down and responsive after the mobile phones entered [...] it’s a lot more work involved in getting a website to look good and function in all browsers and on all platforms.”* (GFM)

As the new production dependencies did not match existing firm specializations, learning processes were initiated across cluster firms in order to cope with novel demands on production.

### **5.3.3 Spatial benefits and constraints to collaboration**

Since launching its external office, AlphaFirm’s collaboration with extra-local firms had intensified. However, partly due to the strong social connections established after years of close interactions, it clearly preferred engaging the local production network when possible:

*“The strength of smaller towns is that more meetings take place [...] Here, we get to know each other deeply and long-term, you know the parents and so on”* (AFM1)

This phase was also characterized by a growing sense of regional patriotism and increased trust in the local business community. Based on their collaborative achievements, cluster actors felt that they had overcome limitations pertained to being based in a small town geographically distanced from larger digital creative hubs in metropolitan areas.

Recruitment was, however, still a pressing issue and firms struggled with attracting and recruiting employees to match their growth. Since there was no longer a steady stream of potential co-workers from the local university, firms made ambitious yet largely unsuccessful attempts to recruit people from outside the region. Therefore, the local industry association initiated negotiations with the municipality and the local university during 2009 with the purpose of establishing new regional educational programs.

## 5.4 Decline phase 2010 - 2013

### 5.4.1 Diminishing production network activities

In this phase, 15 projects were executed by the production network involving between 2 and 3 firms, out of which AlphaFirm initiated 5. In 2010, collaborative projects within the cluster remained at an intense level, yet there were evident shifts in production network structure. While AlphaFirm had been the dominant central actor, it now increasingly engaged national and international partners in projects rather than local. This trend extended to the following three years, during which AlphaFirm projects containing local partners was limited to 2. The motive behind this shift in preference towards extra-regional partners was that it perceived its local partners as increasingly incapable of supplying resources aligned with project needs:

*“[...] it happens that we skip [the regional actors] already at an initial stage [...] I don't know if they are as important as they used to be. Preferably they would be, but it's all about quality in the end [...] as we are a global top achiever, our partners have to be as well” (AFM1)*

While local collaboration was no longer a feasible option, AlphaFirm still considered network organizing as key to its operations and therefore its engagement with extra-regional resources intensified:

*“You can't hold all competences today [...] we still often work in collaboration and networks. If there's some specific type of technology, because it's often a technology that's the case, then it's just a matter of finding a partner that's specialized in it” (AFM1)*

With AlphaFirm increasingly seeking collaboration outside, a reason for the sustained level of collaboration within the network during 2010 and 2011 can be traced to network entrants taking its central place. To this end, two local advertising firms started engaging with production network firms when developing campaigns for local clients. While this collaboration was intense during two years, they involved less firms than AlphaFirm projects often did, and they ceased after 2011. During 2012 and 2013, vertical collaboration in the

cluster was next to insignificant, as the production network executed just two projects involving two firms each during this period.

#### **5.4.2 Theme complexity and multiple focal points**

In this phase, the scope of AlphaFirm's projects grew increasingly varied and complex. They included advanced web sites, computer games, TV advertisements, browser applications, digital art installations, and mobile applications (both native and web-based) for both Apple iOS and Android platforms. These often combined diverse web services, standards, digital platforms, and advanced technologies (such as 3D cameras). On the other hand, advertising firms' projects were remained directed towards developing web sites based on significantly fewer technological elements.

To this regard, which firm that acted as the central project-owner had a significant impact on project demands, and ultimately for whether local collaboration was viable. AlphaFirm and the advertising firms came to have very different views in this aspect based on their respective market and industry positions. The different character of clients (mainly local firms versus mainly global enterprises), and sometimes of their customers in turn, implied that project scopes were negotiated based on different views on the appropriate level of creativity:

*“It's their customers that decide. Look at [one of the advertising firms] for example, they have very traditional customers that want brochures and stuff [...] we often see that when we get sketches from them, that it's always the same. They don't leave the beaten path; they follow their pattern.”* (GCD)

For AlphaFirm, attaining recognition for their creative work from global industry and market actors was vital as it served as an advantage in recruitment and pitching efforts against global competition. To this end, the dramatic increase in technological options taking place during this time significantly improved opportunities for novelty creation. However, it was uncertain

which technologies would be publically adopted, their exploitation required resource variety, and while technological turbulence created new resource demands, it also disrupted established knowledge and skills. A key example was the emergence of the Apple iPad that, by not being designed to support content developed with Adobe Flash, rendered established knowledge and skills in the platform obsolete:

*“There was a period after Steve Jobs said that Flash sucks where we thought ‘we just have to do it’, so we started doing stuff with HTML5 [...] at the same time it became so much more that you needed to keep track on, as we could no longer do stuff for the web only. Instead, these apps became our new environment and we started trying different platforms [...] and we thought about how we should solve this, would we need to start an internal unit for mobile development? That never happened because in the end we often hired an external partner”*  
(AFLD)

As the dominant technological structure centered on the web site was exchanged for a multitude of possible outputs, firms in the production network found it increasingly difficult to specialize, and instead adopted more generic profiles:

*“We started out as a flash-bureau really and then it completely shifted [...] we are becoming more like decathletes; you are supposed to know so many parts that you become kind of mediocre at everything”* (GFM)

As a result, the local production network could no longer be leveraged to meet AlphaFirm project demands. However, the broader technological profiles improved the capability of individual firms to undertake in-house projects, and they remained viable to the advertising firms. The stability and relatively low demands for creativity in these projects sustained collaboration in the production network for two years. However, as their projects often required a limited set of knowledge and skills, the advertising agencies ultimately decided to launch their own web departments, thus removing the need to bring in network actors.

### **5.4.3 Spatial benefits and constraints to collaboration**

Recruitment remained a key issue in this phase. There was also a growing awareness of the fact that the region had been largely unable to produce new regional start-ups during the last decade. Therefore, the industry association's efforts in getting a new university program instated intensified:

*“It's considerably more complex today, it's considerably harder to know which technology that applies, what you need to have in-house and what you need to outsource. This has resulted in that less and less of the projects can be handled by [the network]. There is so much more complexity now and not enough firms with cutting edge competences have started here [...] I hope that will change, and the first step for that is of course this new educational program” (BFM)*

A new university program directed towards digital design was finally launched in 2011. Hopes and resources were invested in anticipation that it would reinvigorate the region with a strengthened labor pool and new collaboration partners. It did, however, attract limited attention from applicants, and it was finally cancelled in 2013. While the industry association continued to lobby local policy makers for further education initiatives, any tangible results from those efforts were not to be seen during the extent of this study.

## **6 Discussion**

Recent cluster evolution research emphasizes that sustainable cluster development lies in the ability to maintain an optimal technological distance between actors in clusters (Menzel and Fornahl 2010). To this regard, this paper argues that pinpointing when technological distances are too narrow or too wide cannot be done without examining the interaction between, on the one hand, the local factors that facilitate and restrain collaboration, and on the other, the demands and goals that a certain technological variety is supposed to be leveraged for. However, in terms of how heterogeneity requirements materialize and interact with local

conditions for its exploitation in cluster evolution, extant research offer limited insights. Hence, this paper attends to the research question: how does required local technological heterogeneity emerge, evolve and influence vertical collaboration in cluster evolution? This question is addressed in this section with the purpose of contributing to existing cluster evolution theory.

First, the study shows how projects and hub-firms became the focal points for collaboration within the theme of digital creative practice. The role of hub firms as knowledge gatekeepers has been well documented in previous research (e.g. Giuliani 2011, Kesidou and Snijders 2012). However, findings here suggest that they also play a key role in the construction of local organizing rationales that enable and constrain collaboration within clusters. The case shows how project-owning firms, in their position as acquirers and distributors of work, cast network roles according to identified requirements in project scopes. Hence, the situated requirement for local technological heterogeneity emerged as the result of technological specializations perceived as needed for fulfilling technological scopes and meeting creative norms in hub-firm projects.

Second, the lens of institutional logics enables understanding how this situated requirement changed over time and the conditions that influenced its development. Institutional logics posits that actors experience institutional pressures differently depending on the nature of work that they are in (Smets et al. 2014), and their field position, where central actors may be more exposed than peripheral actors (Greenwood et al. 2011). To this end, hub-firms decided which ends to pursue and which means to employ, and how to define success differently depending on the nature of its market and industry relationships. To this end, the case shows how a cluster initially settled on a common focal point for collaboration through the actions of

AlphaFirm, and how its role as a hub was key for maintaining local synergy-creation over time by acquiring projects from external markets and engaging local firms for their execution. In the first phase, all projects fell under a website category, which provided a stable principle for how to coordinate work. Web development and design practice was also guided by a limited amount of quite stable technological standards and design principles, which enabled cluster actors to maintain and develop their specializations. With global enterprises as clients, demands for creativity were high. However, these were initially centered on graphical design rather than innovative use of new technologies that, while challenging, did not require a wide variety of specialized technological knowledge. Thus, as long as requirements within the focal point remained stable and these matched firm specializations, network roles became increasingly established, and the collaborative process could be gradually refined. Over time, the reinforcement of common goals, network structures and roles guided sourcing behaviors towards searching for solutions to previously experienced problems by employing means used successfully in the past. Based on recurrent and fruitful collaborations, actors were able to leverage a common understanding of how project requirements should be achieved. This was in turn leveraged in the exploitation of current local heterogeneity, thus offering efficient access to resources aligned with current project requirements.

However, this reinforcement process became destabilized following changes in the thematic focal point triggered by the emergence of new technologies. These were integrated into project scopes based on client demands for extending the reach of campaigns, because technological complexity provided opportunities for novelty creation that could position the firm more prominently in its market and industry, and for responding to perceived changes in end-user behaviors. With new ends to pursue, different means were required. Further, technology emergence also caused the disruption of established industry standards that

rendered established means for production obsolete. As a result, the situated technological heterogeneity requirement of the AlphaFirm focal point was no longer aligned with technological specializations in the cluster. On the other hand, the advertising firms, which were active as hub-firms in the production network in the third phase, pursued somewhat different ends than AlphaFirm, and thus produced a focal point for activity with other requirements for technological heterogeneity. Working with local customers to produce websites, these projects never had the ambition to stand out and create global attention and budget conditions did not allow for much novelty creation. Therefore, while not operable within the AlphaFirm focal point, the current local technological heterogeneity could still be exploited in advertising firms' projects.

In sum, this suggests that a viable approach for understanding how requirements for technological heterogeneity emerge and evolve in digital creative cluster evolution is to view them as originating in situated requirements for technological specializations. In setting and changing these requirements, hub-firms that connect cluster networks with markets and industries play a key role, as they together with clients draw on different standards, norms, means, and ends in negotiating project scopes. Certain theme-related conditions are influential in producing outcomes of this process. First, the project-driven nature of digital creative work suggests that these negotiations will reoccur over time. Second, the situated nature of creativity norms in creative markets (Belussi and Sedita 2008) suggests that different perspectives on what is seen as appropriate novelty will be employed. Finally, in seeking novelty, the digital creative industry characterized by dynamism and fussy boundaries enables actors to employ an increasing variety of digital technologies in the creation of new creative products and services. At the same time, industry standards detail if and how these technologies can interact (Garud, Jain, and Kumaraswamy 2002) and individual technologies

often specify particular principles for interaction and collaboration amongst actors using it (Gawer and Phillips 2013). From this perspective, whether local technological heterogeneity will be exploited in collaborative projects at a given point in time depends on its perceived ability to be successfully coordinated for the purpose of ensuring compatibility and appropriate novelty given a current project scope.

Finally, the study shows how the situated requirement for technological heterogeneity in project scopes constitute one important aspect which is assessed in the ongoing construction of a local organizing rationale that guides hub-firms in their decision to engage in local vertical collaboration or not. Another key aspect that is weighed in is the efficiencies produced by co-location factors and the cumulative experience of successful local collaboration. To this end, research has argued that local networking stimulates the production of a common institutional structure that facilitates communication, uniting on common goals, and labor distribution amongst participants (Bathelt 2005, Sydow and Staber 2002). In line with this argument, there was a clear preference amongst hub-firms towards engaging local firms due to the perceived ease with which they could be engaged to do high quality project work, which remained viable as long as the required specializations were lacking internally but could be found in the cluster.

This study builds on a single longitudinal case study with the purpose of extending existing theory on the role of technological heterogeneity in cluster evolution. In so doing, the aim is to generalize to other theoretical contexts rather than a population. In generalizing to cluster evolution theory, the nature of creative work and the market and industry position of hub-actors constitute important boundary conditions. While findings here can also be generalized to other situations of technological heterogeneity exploitation, e.g. the innovation network

literature, the interaction between conditions described here may produce different results based on the constitution of actors and contextual factors. To this regard, a promising avenue for future research would be to explore how technological heterogeneity requirements emerge and evolve and influence the evolution of clusters with themes centered on product or manufacturing logics. Second, the methodological approach and reliance on a limited amount of interviews provide this study with certain limitations. While confident that the combination of different data sources has allowed for making valid contributions to existing theory, a focus on technological heterogeneity requirements and firms that have actually engaged in heterogeneity exploitation through vertical collaboration implies that limited attention has been directed at local conditions that enable and constrain exploitation, and the role of non-collaborating actors and institutional actors. To this end, interesting issues for future research to address could be to further explore why local firms, while having compatible knowledge and skills, does not engage in local relational value creation. Such in-depth studies of enabling and constraining factors to operationalizing similarities amongst local firm would be of particular interest in relation to the growing research area of related variety in regions (e.g. Frenken, Van Oort, and Verburg 2007, Castaldi, Frenken, and Los 2015).

## **7 Conclusion**

This study examined how required local technological heterogeneity emerge, evolve, and influence vertical collaboration in digital creative cluster evolution. To this end, this study has shown how hub-firms and their projects become focal points of collaborative activity in which situated requirements for technological knowledge and skills emerge as a part of project scopes. The study suggests that actors interact with certain conditions pertained to a digital creative theme that influence the construction of these scopes. First, a project-driven logic provides an opportunity to recurrently assess principles and practices. Second, depending on the market and industry position of hub-firms, different creativity norms may

be enacted to guide technology search behaviors. Third, the dynamic character of digital creative theme technologies provide ample opportunities for novelty creation, while it also enables and constrains means and ends of digital creative practice. Together with co-location factors and accumulated experience of local collaboration, project scopes are drawn upon to produce local organizing rationales that guide hub-firms in their decision to initiate, maintain, or end their engagement with other local firms.

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