

# Papers in Evolutionary Economic Geography

# 11.08

**Knowledge in the air and cooperation between firms:  
Traditions of secrecy and the reluctant emergence of specialization in the  
ceramic manufacturing district of Lampang, Thailand**

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**Knowledge in the air and cooperation between firms:  
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April, 2011

In the study of industrial clusters, the relative importance, and possible interrelationship, of inter-firm cooperation in production and broad knowledge transfers (both unintentional spillovers and intentional sharing) have long been disputed. To shed light on this we study ceramic tableware manufacturers in the city of Lampang, Thailand. Data consist of face-to-face interviews with principals in thirty-four manufacturers, and with representatives of supporting institutions. We find that an unwillingness to share knowledge with potential competitors retards the development of specialization in production; the outcome of efforts by various government actors and some manufacturers to change this situation is uncertain.

## 1. Introduction

The literature on specialized industrial agglomerations, or 'clusters', describes two forms of positive externality arising from interactions between the co-located firms. One is the division of production between firms, on the basis either of specialization in particular functions or stages of production (specialist subcontracting), or of matching excess customer demand with excess capacity (capacity subcontracting). The other is the sharing or spill-over (where sharing is deliberate and spill-overs are inadvertent) of knowledge between firms, whether or not they are doing business with each other: this is Marshall's 'knowledge in the air'.

The early literature on neo-Marshallian industrial districts (we'll call them NMIDs; see, notably, Becattini, 1979; Piore and Sabel, 1984; Best, 1990; and Pyke, Becattini and Sengenberger, 1990; Saxenian, 1994; Humphrey and Schmitz, 1996) tended to treat the two as part of a package: both required a certain measure of openness and trust between firms that were potentially vulnerable - whether as competitors or as links in a supply chain - to each other; both facilitated ongoing product and process innovation through the interaction of specialists. Often, the two may be said to grow from a common cause - the same networks of civic engagement (Putnam, 1993), or the same institutional frameworks (Brusco, 1982); similarly, both may be undermined by the same power asymmetries between firms, whether due to size differentials or differences in access to markets (Schmitz, 1995; Nadvi, 1999; Farrell and Knight, 2003; Lazerson and Lorenzoni, 2005).

Yet dyadic business interactions, and the broad sharing of commercial or technical knowledge, are distinct phenomena; one does not need to look far at all to find firms which are doing one and not the other (under 'firms' we will include, unless stated otherwise, individuals working in or on behalf of firms). As the literature on interactions between firms in clusters has grown, and spread across several disciplines, these two aspects of the problem have come often to be addressed as separate subjects: some research deals specifically with dyadic interactions, or networks based on such interactions (e.g., Lorenz, 1988; Uzzi, 1997), while other deals with knowledge spill-overs (e.g., Breschi and Malerba, 2005; Belussi and Sammarra, 2010; D'Este, Iammarino and Guy, 2011). Typologies of clusters (Storper and Harrison, 1991; Breschi and Lissoni, 2003; Markusen, 1996; Gordon and McCann, 2000; Iammarino and McCann, 2006) call our attention to the wide variety of structures within them, and to the sometimes divergent evolution of the two characteristics under discussion.

Is, then, the *pairing* of networked production and knowledge in the air, two pillars of the NMID model, of any importance? Are they linked by any more than the facts that certain circumstances of history or industrial structure can produce them both at the same time, and that certain cities and industries in which they both occurred, notably in the Third Italy, got studied and came to be seen as embodying a model? Is this 'model' kept alive by anything more than the confirmation bias inherent in the scholarly process of scouring the world for cases of clusters with NMID characteristics? The stakes here are more than academic. Regional development agencies, national governments, and international institutions both governmental and non-governmental, have cluster development programs (Braczyk, Cook and Heidenreich, 1998; Ceglie and Dini, 1999; Potter and

Miranda, 2007; Borrás and Tsagdis, 2008). Some of these programs embrace the NMID model, others do not. The NMID model has proven difficult to replicate; it would help to know whether its constituent parts really are complementary.

Malmberg and Maskell (MM - 2002) have claimed that knowledge spillovers, and specialization and cooperation in production, *are* paired, but paired in an asymmetric way. Knowledge spillovers between firms engaged in the same stage(s) of production are, they say, the more powerful force, and come first; cooperation and specialization in production may (or may not) follow. MM further contend that knowledge spillovers are the reason clusters come into existence. Oinas and Marchionni (OM - 2010) argue that MM's theory is not really an explanation for the existence of clusters, but an argument about what makes them competitive. We think that OM are correct in their recasting of MM. Moreover, when interpreted in OM's way, MM's theory provides a useful starting point for understanding the case we present below. The *existence* of the cluster we are studying is easily explained without any reference either to knowledge spillovers, or to vertical specialization or inter-firm cooperation within the basic production process; however, the weakness of knowledge spillovers appears to inhibit the development of vertical specialization, and to be a limiting factor in the cluster's dynamic competitiveness in the face of growing international competition.

MM are not concerned with deliberate knowledge sharing, but to them this is a non-issue because they assume that spatial proximity brings spillovers: "colocated firms undertaking similar activities find themselves in a situation where every difference in the solutions chosen, however small, can be observed and compared. ... spatial proximity brings with it the special feature of spontaneous automatic observation" (MM, p. 439). Others, however, have found great variability between

clusters in this regard: Best (1990) contrasts the secretive (and declining) furniture manufacturing cluster in north London with the open (and, at the time, thriving) ones of the Third Italy; Saxenian (1994) draws a similar contrast between the high-tech clusters of Route 128 and the Silicon Valley. More recent research has tended to focus on different forms of proximity (spatial, cognitive, organizational...) any of which may facilitate knowledge transfer (Boschma, 2004; D'Este et al, 2011); in this sense, a low level of localized knowledge spillover could be attributed to the absence of necessary complementary forms of proximity. In the case studied here: many of the SMEs in the cluster studied are run by people who lack the technical background (cognitive proximity, or what Cohen and Levinthal (1990) would call absorptive capacity) to make the necessary spillovers happen, or even to be on the receiving end of intentional knowledge sharing. MM incorporate such considerations tangentially, as institutional features whose failure may lead to the decline of a cluster. In any case, we should distinguish between these non-spatial types of proximity (indicative of an opportunity, or ability, to share knowledge) and the issue of agency, or willingness to share knowledge, which is a central question for Best and Saxenian.

Our case concerns a cluster of ceramic tableware manufacturers located in and around the city of Lampang in northern Thailand. Historically, firms in the cluster have integrated production vertically, avoided outsourcing, and been extremely reluctant to share technical or commercial information outside of very small circles of associates. After several decades of rapid growth, Lampang firms lost much of their domestic market in the wake of the Asian financial crisis of the late 1990s, and then saw first their export markets and then their domestic ones threatened by China and other emerging manufacturers. The Thai government,

with the cooperation of UNIDO and others from abroad, initiated a cluster development program in 2002. In 2005, we interviewed thirty-four manufacturers of ceramic tableware in and around the city of Lampang.

## **2. Data**

Ceramics manufacturers in Lampang specialize variously in tableware, gift and decorative items, sanitary ware, railing and insulators. This study focuses on tableware manufacturers. These are more differentiated in terms of size, market niche, and product quality than are producers in the other categories. Tableware is also interesting because of the segment's balance between international and domestic markets. 101 of Lampang's ceramics factories are listed by the Lampang Ceramic Association or the Ceramic Development Center as tableware manufacturers. In 2005, we approached owners of all of these, requesting interviews. Of the thirty four who agreed, four are large firms with over 500 employees, nine are medium-sized with between 100 and 499, seventeen are small firms of between ten and ninety-nine, and three are very small firms with fewer than ten employees (see Table 1); all are domestically owned. A few turned out not to manufacture tableware, but did manufacture other ceramic products (see Table 1, column 5). One of the owners was also the president of Lampang Ceramic Association. Also interviewed were the head of the Ceramic Development Center, and the IFCT's cluster development agent. Interviews were semi-structured, conducted face-to-face, and recorded, in Thai. They typically lasted about an hour. Quotations in this paper are translations from the recorded interviews. We should note that certain key English terms have entered the local vocabulary,



including 'cluster', and the names given to some of the loose cooperative groupings of firms, such as 'Trust' and 'Believe'.

[Table 1 about here]

The interviews addressed a range of concerns, including modes of access to foreign markets, sources of technology, the role of Chinese ethnicity in business relationships - and also the matters of inter-firm information sharing and cooperation in production, addressed in this paper.

### **3. The Thai Ceramic Industry and the Lampang Cluster**

Thailand is not historically a significant producer, or user, of ceramics. The modern Thai ceramics industry emerged after World War II, by immigrants from China (Social Research Institution, 2002). In 1947, Chinese immigrants found white clay being used to make sharpening stones in Lampang province, 600 km north of Bangkok. The discovery spurred the expansion of the ceramics tableware industry in Bangkok, and from 1957 in Lampang as well. Many Chinese immigrants relocated to the latter city, or came directly from China to establish factories. However, the factories in Lampang were small in scale and low in technology.

By the end of the 1980s, Thailand had emerged as an important player among global ceramic exporters. During the country's economic crisis in 1997-1998, domestic demand fell sharply, and many manufacturers collapsed. Exports, however, continued to grow. By 2002, Thailand was the world's eighth largest exporter of ceramic tiles and sanitary products, and the ninth in ceramic tableware. Thai ceramics exporters have faced increasing low-cost competition, however, particularly from China, and more recently Vietnam.

The principal concentration of ceramics manufacturing in Thailand remains in Bangkok. Lampang represents the second largest concentration. As of 2005, 258 registered manufacturers of tableware, gift and decorative items, sanitary, tiles and railings, and insulators - more than 30 percent of Thailand's ceramic manufacturers - were located within 20 kilometres of the center of Lampang. Many of the Lampang factories are quite small, and between them they employ 12,000 workers, less than 20 of Thailand's ceramic manufacturing workforce. By value, Lampang produces only 10 percent of Thailand's ceramic output; this does not speak quite as badly of the productivity of its workers as might first appear, since many switch seasonally between agriculture and manufacturing, in contrast with the year-round production typical of Bangkok. 80 percent of Lampang's ceramic tableware manufacturers are small firms, employing fewer than 100 people. Most of the owners are ethnic Chinese, and most of the employees are ethnic Thai. The Chinese in Lampang ceramics mostly trace their origins to Taipu, a traditional ceramics center in China.

Early Lampang tableware factories produced bowls decorated with pictures of chickens, called 'chicken bowl'. These are sold almost entirely within the domestic market, and remain the trademark of the Lampang ceramic industry. In the early years, ceramics from Lampang were infamous for their low quality. In 1967, Thai government started to support the Lampang ceramic by giving advice on production and marketing. Most government support, however, remained focused on Bangkok. In 1974, the cluster still consisted of just eighteen small firms, producing mainly chicken bowl and some decorative items such as vases and pottery.

In the late 1970s, the industry began to develop rapidly, and some factories began to export. In this period, wood-fired kilns began to be replaced by gas-fired ones, which allowed better and more consistent product quality and were suited to a wider range of products. Many new firms emerged to produce items such as railings, tiles, and sanitary fixtures. The existing tableware producers developed new lines of blue and white items in addition to the traditional chicken bowl.

As with the Thai economy and exports generally, the industry boomed from 1987 to 1997, and the number of manufacturers increased rapidly. The traditional chicken bowl and blue and white items were augmented by new western styles of dinnerware set. Some firms started to produce made-to-order items for export markets only. Competition in export markets in the early 1990s was relatively weak. The major ceramic exporters were Taiwan and Japan. Taiwan lost its General System of Preference (GSP) export rights to the US in this period, while Japanese makers focused on high-end technology and high-value added ceramics for medical instruments and electronics. In this period, too, the Thai government's industrial development policy finally reached beyond Bangkok, to support regional industries. Lampang ceramic was targeted for assistance in both productivity improvement and exports. The local institutional framework supporting the ceramics industry, developed during this period, is discussed below.

During this period there was also increased differentiation between small firms with low technology making poor quality chicken bowl for the domestic market, and larger firms with newer technology making better quality and newly designed products for export markets. The number of new SMEs increased, and large firms extended their business and improved quality to concentrate on export markets.

Domestic and regional markets were hard hit by the East Asian economic crisis of 1998 to 2000. Many manufacturers of railings and tiles - heavily dependent on building construction - went bankrupt; others were reduced in size. Among tableware producers, the large export-oriented firms benefited from the devaluation of the currency; medium sized firms who produced for domestic markets were pushed to improve their quality so that they could export; many small firms focusing on domestic market simply closed down.

In contrast to the 1987-1997 period, international competition in the early 2000s was fierce, not least because of growing competition from China. Lampang's exporters responded with an increased emphasis on design. At the same time, the demand for chicken bowl on the domestic market rose, after several decades of decline. One reason for this was that the new production technologies, together with design-led competition in the cluster, had renewed the product. Small firms re-emerged to produce chicken bowl for the low end of the domestic market.

The development of the Lampang cluster can be easily explained without invoking knowledge sharing between firms, or cooperation or specialization in production: the local availability of good quality clay; in early decades, the low costs of wood to fuel kilns (this has since been supplanted by gas), of labor and of real estate, relative to Bangkok; then, after the initial formation of the cluster, proximity to specialized suppliers of machinery, materials, and skilled labor; inertia, favoring the co-location of new firms established both by younger generations of factory-owning families, and former employees of the established firms; and government support (credit, technical services) aimed at developing the cluster. Both the circulation of knowledge and cooperation in production have

come to be of interest, however, to a range of public actors and to some Lampang manufacturers, as factors affecting the competitive position of the cluster.

#### **4. Promoting the NMID model in Lampang**

The institutional support provided to Lampang ceramics manufacturers has grown, first as regional (non-Bangkok) industry came to be regarded by the government as important, and more recently as Lampang has been identified as an important and promising specialized industrial cluster. We will discuss the roles played by three institutions: the Ceramic Association (CA), the Ceramic Development Center (CDC), and the Industrial Finance Corporation of Thailand (IFCT).

The CA, founded in 1975, represents most of the ceramics manufacturers in the Lampang area, the principal exceptions being household-based micro-firms. The CA has provided various forms of support to manufacturers: at one time, it negotiated with the gas suppliers on behalf of its members; like most trade associations, it lobbies the government to secure decisions favorable to its members; co-ordinating with government and private organizations, it organizes events, trade fairs, seminars, and training sessions. Most of the more active participants in the affairs of the association represent large and medium-sized firms, and some smaller firms interviewed see the association as a tool of the larger firms to negotiate benefits for themselves from the government.

The CDC, established in 1989, reports to the Ministry of Industry; initial financing, together with equipment and training, was provided by the Japan International Cooperation Agency. The CDC is a center for research and

development of ceramics, particularly in production and design. Its library, laboratory, equipment, CAD program and training courses are available to all ceramic makers. A small firm might use the center's laboratory to develop new glaze, and a medium-sized firm the center's computer and mould making machine to build up a new sample for a customer. The CDC also promotes new technology to firms and collaborates with them in developing product and export marketing. However, larger firms often told us that the center cannot keep up with changing technology as quickly as it should, and they tend to rely on other sources of information.

The Industrial Finance Corporation of Thailand (IFCT) (now merged with the Thai Military Bank) is a national leading financial institution supporting industrial entrepreneurs. Its mission is to enhance competitiveness of industrial firms through credit, business advice, and training programs.

Working together, the CA, CDC and IFCT set goals for increasing industry's productivity, output, and exports, and adopted the aim of making Lampang the ceramic hub of ASEAN by 2012. Part of this effort, from 2002, has been the Lampang Cluster Development Program (Cluster Program), in which the IFCT takes the lead role.

As we detail below, Lampang manufacturers describe their cluster as one in which firms avoid sharing information with competitors beyond a very close circle; avoid, for that reason and others, horizontal subcontracting; and prefer to integrate the major steps of ceramic production within a single factory and firm, whether large or small. The Cluster Program promotes practices which would reshape the district in the direction of an NMID. To design the Cluster Program, the

IFCT enlisted the help of United Nations Industrial Development Organization (UNIDO). UNIDO trained several IFCT staff members as ‘ceramic development agents’ (CDAs); the role of coordinating the Cluster Program was, as of 2005, a half time job for an IFCT loan officer. The CDAs’ role is to work as co-ordinators between the firms, government and supporting institutions, identifying the strengths and weaknesses of the Lampang firms, and helping them overcome the constraints by encouraging them to co-operate with each other. They do this through seminar workshops; round table meetings; tours of selected factories and of ceramic market places in Bangkok, and even of exemplary manufacturing clusters in Italy and India; and also the promotion of small networking groups among manufacturers. The round table meeting is held every three months for the firms in the cluster, mainly as a forum for discussion of production and employment problems. The workshop disseminates knowledge in the areas of design, factory management, and production.

The Cluster program focuses on the problems of SMEs, but several large firms take part. CDAs co-ordinate with a group of Lampang firms called Lampang Ceramic Cluster Development Working Group (LCDG) to conduct surveys, analyze and identify common problems and solutions, as well as outline work plans.

Even within vertically integrated factories, the ceramic production process is divided into distinct stages: clay must be mixed, then formed; it is then typically given a biscuit (or bisque) firing, which hardens the clay but does not vitrify it; after glazing it is given a final firing (see Table 2). As an industry, entry and exit barriers are low, in part because of the ready market for used equipment. Indeed, in Lampang, the larger and more technically sophisticated firms tend to purchase used equipment from Japanese, Taiwanese and German sources, modifying it to

meet their own needs. Small firms tend to purchase equipment, often new, from Thai manufacturers. The Thai equipment manufacturers imitate foreign designs; their quality is regarded as lower, but for a ceramics manufacturer without its own technicians they offer the advantage of ready service. The IFCT and the Cluster Project help small firms with equipment purchases, further lowering entry barriers. The most salient remaining barrier to market entry and successful operation is, from most accounts, the scarcity of experience and technical knowledge on the part of small factory owners and staff.

[Table 2 about here]

## **5. Secrecy and subcontracting**

### **5.1 Sharing knowledge in small circles**

Lampang firms typically integrate production vertically, so that little or no information needs to be shared with other manufacturers on a routine basis. Many report little co-operation or voluntary information sharing beyond a small group of trusted firms. One representative of the traditional pattern is Firm 1, the largest in the cluster. One of its principals tells us:

*My family has been producing chicken bowl for 30 years. In my generation, I set up a new company to produce contemporary tableware products for export markets. One of my brothers also set up his own company manufacturing porcelain tableware. My father's factory is still running, and has developed design and production to capture with the changing market demand. The factory is making almost the same products as mine. Among our group, we meet up every day to*



*exchange information, as well as help each other to solve problems. We also share orders sometimes - I produce my father's items and vice versa.*

In contrast to the close relations between Firm 1 and other firms in the family group, its relations with other producers in Lampang are described as negligible:

*We do not co-operate with other firms in the cluster, because we do not have time to look after other smaller manufacturers. We do not share information or orders with other producers, except those in our group. We have enough volume to buy raw material at a lower price. We can stay with our own group.*

The importance of a small, trusted circle is typical of Lampang, but the definition of this circle in terms of kinship is not. Many of the owners are second or third generation Lampang ceramics manufacturers, and most of them describe sharing information or work with a close group of other firms; more often than not, however, the other members of that close group are described in terms of friendship rather than kinship. Firm 12's owner studied chemistry at university in Bangkok before succeeding other family members in running the business, and provides this description of the layering of his information sharing:

*I share some information with some of the manufacturers here who are my good friends, six or seven people. However, I will share some secret things to two or three manufacturers who are quite close to me. We usually talk about it during dinner. I will teach the others some techniques as well, but not in depth. For example, I will not tell them how to have such a shiny glaze, but I can give some suggestion if they have a problem with pinholes. I will tell them how to check at points which may cause pinholes. Every manufacturer is the same, because they will find the solution of their problem by themselves. ... With the university, we*

*have discussed the course content in ceramics... The university asked us ... to let some students work with us during their training. We did not talk with them about technology and production, because we know more than them.*

Meetings organized by the CA, and social meetings - for dinner or golf - with other factory owners, are often explicitly described in terms of *not* sharing information. Firm 6:

*I am on the committee of the CA. We have meetings often. However, in our particular group we never talk about business. After an association meeting, we will eat, drink and talk to build social relationships. I try to get some information which might be useful for my business, but I cannot ask anything that goes too deep, and they will not reveal much.*

What is a declaration of business practice or attitude from the owners of large firms, is presented as an unavoidable fact of the social environment by the owners of micro-factories. Firm 33 is in the village of Sala-Buabok, which has several small ceramics factories, including one run by the village head. Firm 33 has nine employees ('who are the people around the house' during the interview) and produces vases, coin banks and souvenir items for domestic markets. Asked 'do you cooperate with other local household factories?', the owner told us:

*Not much. We do not share information with others or help each other with products, techniques, or market development. We do not discuss anything about business even when they are our neighbor. We do not train or buy raw material with other. Sometime, we lend gas to each other. However, we often have meeting called by the head of the village. It is a kind of training. For example, today we are having a guest speaker to tell us something about ceramics. The*

*local government sometimes sends someone to tell us something about marketing or quality improvement. We do talk about market selling price, increasing costs and defective goods. Sometimes, we talk about technique with a person that we are very close to, such as a relative.*

Firm 33 made clear elsewhere in the interview that ‘talk about market selling price’ refers to price fixing among producers in the village. Thus we see small firms availing themselves of the public support provided for their industry, and cooperating to fix prices, but refusing to share knowledge of production techniques, design, or markets.

Firm 34, the smallest interviewed (‘no employees - just grandma, my sister, and me’) described how knowledge is gained from working in larger factories; from talking with employees of such factories; from her kiln supplier (a local manufacturer); from the larger ceramics factory that supplies her with raw materials; but not from other small factories in the same village:

*The household factories will not openly share information. If they know that I am making the same item as them, they will not talk to me even though we know each other well and we are neighbors.*

*On the other hand, I can ask for help from people outside my village. For instance, someone I know in another village came to teach me about firing techniques. [ ...] It is better if we talk with a factory that produces a different item than us.*

One of the aims of the Cluster project is to change this culture of secrecy. This goal is not universally shared. Large firms tend to be particularly averse. Firm 3 says:

*I do not take part in the cluster project. .. We do not want to have 'cluster', we are happy with what we are doing now. Having subcontractors is enough. We do not want to give our technology to others ...*

A notable exception among large firms is Firm 2. The owner is the head of the LCDG, and actively promotes the Cluster project. He sees normal inter-firm relations in Lampang as more open than others do, but sees room - and need - for improvement:

*... Lampang ceramics has a loose big network of the whole industry, as most of the manufacturers know each other and cooperate with each other in some way. If we look into the cluster, we will see strong networks between some small factories.*

*For me, I have my own loose network with factories that I am close to. We help each other when needed. For example, when I want to order a machine and I know that this factory can order in a cheaper price, I will ask this factory a favor to order for me. Yes, it is a kind of giving each other favors.*

*I think, the reason that we have not had strong cooperation is attitude and culture. We always help each other but we do not cooperate in order to develop the business and industry. We try to encourage people to understand the cluster idea. We try to make it formal and make people know about Cluster.<sup>1</sup>*

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<sup>1</sup> That the head of the Cluster project uses 'cluster' both to describe the simple fact of a specialized industrial agglomeration and also a normative concept of how inter-firm relations within the cluster should be conducted, tells us something about the many ways in which that term can be used. Those familiar with Martin and Sunley's (2003) critique of Porter's deployment of 'cluster' will appreciate Firm 21's view:

*The government's cluster policy comes from the presentation by Michael Porter in Thailand three years ago. Porter talked about clusters and his diamond model for increasing national competitive advantage. Since then 'cluster' become the hot new issue for Thai government, which*

As part of his role, the owner of Firm 2 hosts open factory visits, a conspicuous violation of the cluster's norms. Yet when describing his sharing of knowledge, even he seems uncertain, alternating his expressions of enthusiasm for openness with qualifications:

*I participate in the CA and have the contact with many members. I talk with them in general about the idea and market/industry situation. With closer friends, I will talk more in detail.*

*I always share information on current ceramics situation with people in the industry. I am often a guest speaker for seminars and training, and I write articles about the ceramics industry situation in local and national ceramics newsletters. Also, in the CA, we have round table meetings for members on particular issues such as labor. However, I seldom talk about my business problems or develop projects with others.*

It appears, however, that for one reason or another, the norm of secrecy is loosening its grip. Sometimes this is presented as a matter of generational change. We heard this from people who told us that they were not inclined to share information with other manufacturers, such as the owner of Firm 10:

*It is a rule that the owner of a factory should not go into other factories. This is the current situation, but it is better than before: in my father's generation, the owners even did not even talk to each other.*

We also heard it from the owner of Firm 19, perhaps the most enthusiastic co-operator interviewed. In addition to his participation in the Believe group (see

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*tries to implement clusters in Thai industry. However, no one actually knows what 'cluster' is. The officers who receive the policy from the government do not know enough or do not understand clusters. [...] Actually ... the IFCT started the cluster idea before Michael Porter talked about it in Thailand. UNIDO designed the Lampang cluster program.*

section 5.3, below), he subcontracts much of his production to small household factories, who are not members of that group, but are located in the village of which he is the head. Using the example of a large order, he tells us:

*I do not want to reject this order and I do not want to increase my capacity only for this order. Then the best solution is to share the order with others. In this way, everybody is happy. ... I show [the subcontractors] the price and purchasing order. In my father's generation, he would not have given the order to anybody, he would do it all by himself even if he knew that he could not make it. For me, I do not do like that... I will do what I can do. ... If I increase capacity by employing more workers in order to do this order, then what if the next order is not as large? I had better share the order with others, no headache.*

## **5.2 Subcontracting and specialization**

Firm 19 is at the lower end of the market, producing cheap chicken bowl for domestic customers; his subcontracting is essentially a putting out system, employing household micro-factories. Firms serving higher-priced, design-driven export markets have different requirements when sharing work. Most firms, however, either subcontract some work to others, or take work in from others; some do both. Interviewees often referred to subcontracting as something done of necessity, and best avoided.

Subcontracting typically requires some sharing of technical knowledge, and also reveals to another manufacturer features of the customer's products and market. There was some concern expressed about copying of designs, but concern about copying by local competitors was primarily at the lower quality, domestic, end of

the market: in the export market, more restricted and formalized channels to buyers made copying less easy, and the principal threat was seen as coming from foreign competitors. And, while copying was rife at the low end of the market, it occurred with or without subcontracting.

While firms were reluctant to share technical knowledge with other firms as a general rule, none expressed any reservations about doing so with subcontractors.<sup>2</sup> The problem in dealing with subcontractors was finding ones with sufficient knowledge and appropriate equipment to make a product which would match others in the same product line, and which could reliably deliver good quality products on time. The question then was not what the customer was willing to tell the subcontractor, but how ready the subcontractor was to make use of any knowledge that was shared.

There is some indication that both horizontal (capacity) subcontracting and vertical (stage) specialization increased in the early 2000s. One reason for this is that pressure for subcontracting grows out of foreign customers' efforts to reduce inventory costs, and to remain free to make changes in their product lines. Both this pressure, and the difficulties it entails, are described by Firm 5:

*I started to subcontract 3 years ago when my customers started to put me under pressure by ordering large quantities with a short turnaround. I sometimes subcontract processes such as drawing, mould making, etc. [...] Nowadays,*

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<sup>2</sup> Some manufacturers avoided sharing proprietary information about clay and glaze formulae; this does not present a significant barrier to subcontracting, as the materials can be provided pre-mixed by the customer. Firm 21 supplies biscuitware based on customer specifications:

*When they come to us, they either tell us what kind of clay and what formula they are using, or they give us their mixing clay. It is up to each customer's attitude about trust. Some customers trust us, and tell us their formula, and some do not.*

*customers order large quantities in a limited time. For example, they ask for candle holders, 50,000 pieces, in 2 months lead-time. [...] I also subcontract when I receive an order that is difficult to do and does not offer much profit - an order that I do not want to do, but I do it to keep the customer with me and with Thailand.*

However, the same firm also tells us:

*I do not subcontract often, because it is headache. I have lots of work in my factory and I need to deal with my subcontractors. It is not fun. If there is something wrong with subcontracted items, the whole order and my company will be in trouble. I subcontract only when my capacity is insufficient. In a year, I may subcontract 2 or 3 times. I have 3 companies who are working as my subcontractors.*

Consistent with Lorenz's (1988) expression "neither friends nor strangers", trust between Firm 5 and its subcontractors is based on a history of good quality and timely delivery.

*I subcontract to the manufacturers who have products and quality similar to mine. The subcontractors do not have to have a close relationship to me. The main thing is that they are able to produce quality products and deliver on time at the agreed price. I tell my subcontracting firms everything, so they can produce the same product and quality that I do. Our work is based on oral agreement without paper contract. We have to trust each other, otherwise we cannot have business together. However, I put down a deposit when I tell them to produce the order.*



Firm 24 is another member of Trust, and works on both ends of the subcontracting relationship. Keeping this business within the Trust group when possible means “fewer headaches”.

Firms described three problems with subcontracting: the sheer work involved in supervising the relationship, the risk that the subcontractor will fail either to deliver a suitable product or fail to do so on time, and the worry that subcontractors may copy designs. We would expect all of these problems to be greater if subcontracting is exceptional, rather than routine. There are two distinct reasons for this: one, that there are certain skills and organizational capabilities involved in both ends of the subcontracting relationship, which would improve with practice; the other, the value which a firm places on its own reputational capital should increase as the proportion of its business done as a subcontractor increases.

Not surprisingly, firms which work in subcontracting or stage production relationships regularly, seem to be more at ease with it. Firm 21 decided, in 2000 (the wake of the Asian financial crisis) to specialize in biscuit ware, leaving the design, glazing, decoration and final firing to its customers. Most Lampang manufacturers do both the biscuit firing and subsequent stages such as glazing and the final firing; while some biscuit production is subcontracted to one manufacturer or another on an ad hoc basis, Firm 21 is the only biscuitware specialist in Thailand. The owner is an advocate for the benefits of stage production:

*Most of the factories here prefer to do everything in house, from cleaning & mixing raw material, biscuit, painting, glazing to finishing. The disadvantage of*

*this is rigidity. If you produce everything by yourself, it is hard to make a quick change to serve a customer's needs, or to control costs and time. If they think they cannot produce an order ... they come to us, since they think our factory can help them to have some flexibility in managing their costs and time.*

Firm 1, despite its protestations of not having time to cooperate with firms outside of its family group, does contract with Firm 21 for some of its biscuitware. Similarly, Firm 3, another large vertically integrated producer, skeptical of the cluster initiative and wary about sharing information with other firms generally, contracts out the production of some of its cups and tea pots which require special equipment to make. The owner of Firm 3 tells us:

*I subcontract only 5 percent of our total production to two factories. The subcontractors buy all raw materials and moulds from me, and they sell the finished items back to me. I sell the input materials without profits, and buy the items back at the agreed prices. I tell the subcontractors everything they need to know, in order to make sure they can produce a matching product and quality. [...] We worked under contractual agreement at the beginning. However, after six years of working, we do not have contract, as we trust each other. Actually, we are friends. I personally knew the owners of the subcontracting firms before, and I subcontracted to them due to their good reputation.*

One of the subcontractors mentioned by Firm 3 is Firm 28 which, like Firm 21, produces nothing for the end market. Firm 28 does not see the reluctance to share technical information as a direct obstacle to an outsourcing relationship. The problem, in his view, is a shortage of sufficiently skilled and knowledgeable ceramicists:

*We can tell them how to do it, but it is up to the subcontractor's knowledge and skill. We cannot tell them all the time with every step. ... Most of the ceramics factories which were not successful and had to close down lacked good ceramics knowledge and skilled workers. The ceramics industry in Thailand suffers from a lack of specialists.*

Failure to share information helps produce this shortage of specialists:

*As you know, it is our culture that professionals will not share knowledge and skill with others, as they are afraid of increasing the number of competitors. It is a major obstacle to the growth of the industry.*

The larger firms can hire specialists and can also, in classical mass production fashion, make better use of semi-skilled labor due to an elaborate internal division of labor. Smaller factories, faced by a shortage of skilled labor,

*... try to employ the employees who worked for large factories .... However, those employees are not capable enough, because they were doing only one process, maybe working as a material mixer: other processes they will not know.*

Firm 28 says that being a subcontractor “is, just say, less of a headache”, allowing him to avoid the costs associated with “marketing, packing, transportation, and so on.”

Taking the epidemiological liberty of generalizing from four mentions of headaches, we might say: ad hoc subcontracting to non-specialists causes headaches; regular sub-contracting between specialists can relieve them.

### **5.3 ‘Cluster groups’**

Firm 21, the biscuitware specialist, is a member of a group called Trust. It is a voluntary group, not based on family, shared ownership, or systematic integration of production. The other members of Trust produce tableware and decorative items, primarily for the domestic market. Although Firm 21 supplies some biscuitware to other members of Trust, these firms are small, and Firm 21's principal customers are larger firms outside of the group. The owners of the firms in Trust had been friends for some years before forming the group. Firm 21 tells us:

*We purchase raw materials together, and are very strong in negotiating and protection of our group's interests. The members meet regularly and call each other up every day, and we discuss product and production problems. We share information on production, products, and design. Whenever I develop a new product, I will discuss with my group.*

The members of Trust also share a booth at the Bangkok International Trade Fair. Some horizontal subcontracting occurs within the group, to relieve capacity constraints. Firm 21 again:

*We do not share many orders. Usually we try to do the order by ourselves. However, if one of us is overloaded the others will help. ... if one of our members knows that they do not have the capacity to produce this order on time, they will come to me and other members to solve the problem together. We will discuss who can, or wants to, produce this item, or I just supply them the biscuit. We always help each other.*

Of the approach taken by the Cluster Project, Firm 21 says:

*... I think it is quite difficult to make a cluster happen in Thai culture. We should do more in a kind of small network such as family network or area network. Four to five factories are in a small network and then link each network group together. The Thai government interprets cluster as a big industrial project.*

The Cluster Project, however, has involved many initiatives. These have included an ill-fated - and in Firm 21's view, grandiose - branding exercise called CeraLampang. But they have also included the promotion of small voluntary groupings of firms, patterned on Trust and referred to locally as Cluster groups. Five of these groups were formed between 2002 and 2005; membership was self-selected. The Cluster Project's aim is for the groups to stimulate sharing of ideas; collaboration in designing and producing new products; collaboration in purchasing and marketing; and the growth of the inter-firm division of labor. Members of these voluntary groups have been sent field trips to exemplary manufacturing clusters in India and Italy; been given subsidies to set up joint catalogues and booths at the international trade fair in Bangkok.

As ongoing networks, these groups did not meet with great success. Only three of the five were still active in 2005.

Firm 14 joined, together with six other companies range in size from 50 to 120 employees, a cluster group called 'Believe'. At the beginning of the project, the entrepreneurs had participated in a diagnostic study to identify strengths and weaknesses of their firms. Through this process the owners got to know one another better, and decided establish the network group. With financial support

from IFCT and the government's Department of Export Promotion, the group had an opportunity to attend the Bangkok international trade fair.

The owner of 14 told us:

*I shared ideas and information with other members on product design and on the concept of the group. Then, I produced a product to match with the group's concept. The members made a group catalogue. We set an agreement that if one of the members receives an order according to the product showing on the catalogue, that member will give 3-5 commissions to other members of the group. However, I have not received any orders yet and I do not know if other members have got any. After the Bangkok trade fair, I have received no feedback from customers. Last year, the members of the group jointly displayed products in the same booth at Bangkok international trade fair, but this year we will attend the fair separately.*

By 2005 Believe, as a group, was doing little that was not initiated by the CDA. Yet, while the formal activities of the group had not proved self-sustaining, one of the members saw it as a catalyst for a change in practice. Firm 19 manufactures mostly for the domestic market; its owner is an ethnic Thai:

*The members [Believe] just knew each other when we created the group; now, we are quite close, because we've spent a lot of time together. We went to the same seminars, had dinner and some drinks and discussed business and had general conversation together. ... We helped each other a lot. For example, I had problem with glaze, I just asked one of the member group for the suggestion. Or if one of the members has got the problem, I will give the support, if I can. ... It is better than staying alone.*

Another member of Believe, Firm 17, relates with satisfaction the sharing of information and orders within the group, but is has doubts about the future of inter-firm cooperation:

*I think cluster in ceramics is not easy. This is because the ... production of ceramics requires high skill and knowledge to develop. It is not easy to transfer ceramics experience and techniques to each other.*

Firm 17 also has doubts about Firm 21's strategy of specializing in biscuitware:

*I have talked to my friend who has the biscuitware factory about his value added in production. I advised him not to specialize in biscuitware, but also to make his own product. However, he thinks it would ruin customer trust in him. If he produces his own product, customers will not let him make biscuit for them. The customer will be afraid of being copied.*

Firm 17's account frames Firm 21's decision to forego production of finished products as an investment in a reputation as a reliable specialist partner (Dei Ottai, 1994). Firm 21 does not appear to see any conflict between acquiring a reputation for being a safe custodian of its clients' trade secrets, and an open display of sharing other technical knowledge:

*Our company is open to everybody, not only [Trust's] members or our customers. We try to support everyone who comes to us ... Many people come to us, as you can see from the [very large] pack of coffee. In a month, we finish more than three packs of coffee.*

The lack of perceived conflict is not surprising since, being a specialist in certain stages of production, Firm 21 is not seen by its customers as a competitor.

## 5. Conclusion

Ad-hoc cooperation in production is common in Lampang, and while it is often undertaken with reluctance there is reason to believe that it increased in the early 2000s - partly due to time pressure from buyers, and partly due to the efforts of the agencies and manufacturers associated with the Cluster Project. Almost all manufacturers - including all but two of those interviewed here - retain vertical integration from the preparation of clay to the sale of the finished product. The traditions of secrecy with regard to both technical and market knowledge are eroding, but remain dominant.

What constrains the emergence of new specialists, given the evident demand for subcontractors' services, and the apparent advantages of using *specialist* subcontractors?

An explanation might start from the self-reproducing nature of the cluster's industrial organization. First, given that most manufacturers internalize the various stages of ceramics production, there is not a sufficiently large niche in which specialists can emerge, and possibly a low return to investment in reputation (Lazerson and Lorenzoni, 2005). Second, the larger manufacturers have different needs from the small and medium-sized ones, and are disinclined either to share their expertise with smaller firms which have nothing to offer in return, or to promote public provision of expertise - a situation often reported in clusters in developing countries (e.g. Schmitz, 1995; Nadvi, 1999). The policy of most large Lampang manufacturers is, to invert Marshall's phrase, to keep their own knowledge out of the air. Though this behavior would appear to reflect the interests of large firms, it is reproduced down to micro-firms at the village level.



Third, the primary source of technical and industry knowledge for both employees and owners is from working in the vertically integrated production systems which exist - most training is done by employers; small factories in Lampang are typically started by former employees of larger ones; and small manufacturers seek to hire employees previously trained by larger ones, and seek advice from employees of larger ones. The larger Lampang manufacturers are essentially mass producers and, as such, economize on skilled production labor through standardization of process and product, and through extensive internal divisions of labor.

To some extent, these same factors can be understood as obstacles to buzz, to spillovers and sharing, to knowledge-in-the-air. However we conceptualize the causes - or preventatives - of localized knowledge spillovers and sharing, it does appear that limited circulation of technical and market knowledge is one factor inhibiting the emergence of specialist manufacturers. The two specialist manufacturers interviewed are, in the sense of Piore and Sabel (1984), *flexible specialists*: they are run by people with the technical background and experience needed to meet the varied production specifications of demanding customers. Most of the smaller Lampang manufacturers are not in a position to offer such services. In this sense, Malmberg and Maskell are correct in putting horizontal knowledge transfer first, with the possibility that vertical specialization will follow. However, contrary to MM, knowledge transfer does not follow reliably from spatial proximity. To some extent this is due to lack of cognitive proximity (firms - usually smaller ones - with insufficient technical capabilities may not be in a position to glean knowledge from the air, or even to make use of information which is deliberately offered to them), and part due to a practice of secrecy. These two obstacles to knowledge transfer are complementary - the decision to keep secrets helps

maintain cognitive distance, and the cognitive distance makes it easier to keep secrets - but distinct. Consistent with the NMID model, broad knowledge transfer and productive specialization are part of a package: the problem here is not the logic of the package, but the obstacles to its delivery.

The Cluster Project can be understood as an effort to break out of the self-sustaining cycle of secrecy and vertically integrated production. It has promoted networks of SMEs, and also a shift toward the wide sharing of technical knowledge. It builds on pre-existing programs, notably the CDC, which provide technical resources geared to the needs of small and medium manufacturers. These appear to be appropriate measures if the objective is to shift production to a system of specialized SMEs operating in networks. The question, which we can only leave to time and further research, is whether they will be adequate.

Table 1. Companies interviewed

Firm #	No. of Employees	Year Established	Owner's Ethnicity <sup>i</sup>	Main product <sup>ii</sup>	Export %	Any sharing orders / contracting out of basic production?	Any contract in?	Own design % (vs. customer's design)	Own group?	Cluster group?
1	1500	1987	C	T	100	yes	yes	95	Family	No
2	680	1977	C	T	90+	no	no	85	Loose network	No
3	580	1993	C	T	100	yes	?	100	No	No
4	554	1989	C	T	100	no	?	47	No	No
5	300	1997	C	T	90	yes	yes	50	No	No
6	280	1990	C	T	50	no	yes	mix	No	No
7	260	1965	C	T, D	80	yes	no	99	No	No
8	250	1993	C	T, S	20	yes	yes	0	No	No
9	249	1982	C	CB	5	no	yes	100 domestic 50 export	No	No
10	200	1980	C	T, CB	60	yes	?	50	Peers	Was
11	150	2001	C	T	100	no	no	50	Family	No
12	120*	1989	C	CB, T	50	yes	yes	little	Peers	Was
13	120	1963	C	CB	0	no	yes	0 (copies)	No	No
14	120	1992	C	T, R	10	yes	yes	30	Peers	Believe
15	80	1979	C	P	60	no	no	100	No	No
16	75	1992	T	T, D	90	yes	yes	80	Peers	Yes
17	60	1987	T	T, D	30	yes	yes	most	Friends	Believe
18	60	1994	C	T	80	no	no	100	No	No
19	50	1988	T	CB, G	15+	yes	yes	little	Peers	Believe
20	35	1967	C	T	0	no	no	?	Family	No
21	34	1997	C	B	n/a	no	yes (all )	0	Friends	Trust
22	30	1993	C	P	95	yes		0	Peers	No
23	26	2000	T	CB	0	no	no	100	No	No
24	25	1998	C	D	30	yes	yes	100	Friends	Trust
25	25	2003	T	T	70	yes	no	90	No	No
26	20	1978	T	CB	0	yes	no	design doesn't change	No	No
27	17	1996	C	CB	20	yes	yes	little	No	No
28	15	1997	T	T	n/a	no	yes (all )	0	No	No
29	12	1989	T	T	4	yes	yes	0	No	No
30	10	1995	T	T, D	50	yes	yes	95	Peers	Believe
31	10	1999	T	T	100	yes	no	70	Peers	No
32	9	1999	T	G	0	no	yes	mix	No	No
33	9	1990	T	CB, G	0	no	no	100	No	No
34	2	2003	T	G	0	yes	no	0 (copies)	No	No

<sup>i</sup> C = Chinese, T = Thai

<sup>ii</sup> T: tableware generally. CB: chicken bowl. P: plant pots. D: decorative items. G: gifts. B: biscuit (any product). S: sanitary. R: railings.

Table 2

## The ceramic production process in Lampang

Production stages typically integrated within a single Lampang company	Some common external supply arrangements			
1. Clay or slip preparation (slip is clay suspended in water, so that it can be poured into a mould)	<ul style="list-style-type: none"> <li>• Clay is supplied either directly by mining companies, or by compound suppliers which do more of the preparation; small manufacturers often buy prepared clay from larger manufacturers.</li> <li>• Subcontracting of production may or may not include subcontracting of clay preparation (if so, formulae are provided).</li> </ul>			
2. Forming clay: slip casting, jollying, jiggering (the latter two are machine methods of turning a ball of clay in a plaster mould).	Plaster moulds often supplied by specialists.	Some small manufacturers making cheap goods for the domestic market put out slip casting and greenware decoration to households.	Forming the clay and biscuit firing may be outsourced together, either to factories with spare capacity or to the specialist bisucuit supplier.	The basic production process, including clay formation, decoration / glazing, and both firings, is often subcontracted. Usually this is ad hoc, due to the lead firm's capacity constraints; sometimes it is because the subcontractor has specialized equipment the lead firm lacks.
3. Greenware (the formed clay, air-dried) may be decorated.				
4. First (biscuit, or bisque) firing. This makes a hard, but still porous (e.g., terracotta), reducing breakage during glazing / transportation / final firing.				
5. Painting / glazing.	<ul style="list-style-type: none"> <li>• Larger manufacturers usually formulate their own glaze; small manufacturers often buy it from larger ones. At the time of the interviews, Lampang did not have a specialist glaze supplier, though it had had in the past.</li> <li>• Firms contracting out production generally supply glaze to the subcontractor.</li> </ul>			
6. Final firing				

## References

- Becattini, Giacomo. 1979. Dal settore industriale al distretto industriale: alcune considerazioni sull'unità di indagine dell'economia industriale. *Rivista di economia e politica industriale* 1:7-21.
- Belussi, F., and A. Sammarra, eds. 2010. *Business Clusters and Industrial Districts: The Governance of the Global Value Chain*. London: Routledge.
- Best, Michael H. 1990. *The new competition: institutions of industrial restructuring*. Cambridge, Mass.: Harvard University Press.
- Borras, Susana, and Dimitrios Tsagdis. 2008. *Cluster Policies in Europe: Firms, Institutions, and Governance*. Cheltenham: Edward Elgar.
- Boschma, Ron A. 2005. Proximity and innovation: A critical assessment. *Regional Studies* 39 (1):61-74.
- Braczyk, Hans-Joachim, Philip Cooke, and Martin Heidenreich, eds. 1998. *Regional Innovation Systems*. London: UCL Press.
- Breschi, S., and F. Lissoni. 2003. Knowledge Spillovers and Local Innovation Systems: A Critical Survey. *Industrial and Corporate Change* 10 (4):975-1005.
- Breschi, Stefano, and Franco Malerba, eds. 2005. *Clusters, Networks, and Innovation*. Oxford: Oxford University Press.
- Brusco, Sebastiano. 1982. The Emilian Model - Productive Decentralization and Social Integration. *Cambridge Journal of Economics* 6 (2):167-184.
- Ceglie, Giovanna, and Marco Dini. 1999. SME Cluster and Network Development in Developing Countries: The Experience of UNIDO. Vienna: UNIDO.
- Cohen, Wesley M, and Daniel A Levinthal. 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 35:128-152.
- Dei Ottati, Gabi. 1994. Trust, interlinking transactions, and credit in industrial districts. *Cambridge Journal of Economics* 18:529-546.
- D'Este, Pablo, Frederick Guy, and Simona Iammarino. 2011. Shaping the formation of university-industry research collaborations: what type of proximity does really matter? *Papers in Evolutionary Economic Geography* 11.06 - Department of Human Geography & Urban & Regional Planning, University of Utrecht.
- Farrell, Henry, and Jack Knight. 2003. Trust, Institutions, and Institutional Change: Industrial Districts and the Social Capital Hypothesis. *Politics and Society* 31 (4):537-566.
- Gordon, Ian R., and Philip McCann. 2000. Industrial Clusters: Complexes, Agglomeration and/or Social Networks? *Urban Studies* 37 (3):513-532.
- Humphrey, John, and Hubert Schmitz. 1996. The Triple C Approach to Local Industrial Policy. *World Development* 24 (12):1859-1877.

- Iammarino, Simona, and Philip McCann. 2006. The structure and evolution of industrial clusters: Transactions, technology, and knowledge spillovers. *Research Policy* 35 (7):1018-1036.
- Lazerson, Mark H, and Gianni Lorenzoni. 2005. The Firms that Feed Industrial Districts: a Return to the Italian Source. In *Clusters, Networks, and Innovation*, edited by S. Breschi and F. Malerba. Oxford: Oxford University Press.
- Lorenz, Edward H. 1988. Neither friends nor strangers: Informal networks of subcontracting in French industry. In *Trust: Making and Breaking Cooperative Relations*, edited by D. Gambetta. Oxford: Blackwell.
- Markusen, Ann. 1996. Sticky Places in Slippery Space: A Typology of Industrial Districts. *Economic Geography* 72 (3):293-313.
- Malmberg, Anders, and Peter Maskell. 2002. The elusive concept of localization economies: towards a knowledge-based theory of spatial clustering. *Environment and Planning A* 34:429-449.
- Martin, Ron, and Peter Sunley. 2005. Deconstructing Clusters: Chaotic Concept or Policy Panacea? In *Clusters, Networks, and Innovation*, edited by S. Breschi and F. Malerba. Oxford: Oxford University Press.
- Nadvi, Khalid. 1999. Collective Efficiency and Collective Failure: The Response of the Sialkot Surgical Instrument Cluster to Global Quality Pressures. *World Development* 27 (9):1605-1626.
- Oinas, Päivi, and Caterina Marchionni. 2010. How to make progress in theories of spatial clustering: a case study of Malmberg and Maskell's emerging theory. *Environment and Planning A* 42:805-820.
- Piore, Michael J., and Charles Sabel. 1984. *The second industrial divide: possibilities for prosperity*. New York: Basic Books.
- Potter, Jonathan, and Gabriela Miranda, eds. 2007. *Clusters, Innovation, and Entrepreneurship*. Paris: OECD.
- Putnam, Robert D. 1993. *Making Democracy Work: Civic Traditions in Modern Italy*. Princeton: Princeton University Press.
- Pyke, Frank, Giacomo Becattini, and Werner Sengenberger, eds. 1990. *Industrial Districts and Inter-Firm Co-operation in Italy*. Geneva: ILO.
- Saxenian, Annalee. 1994. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge, Massachusetts: Harvard University Press.
- Schmitz, Hubert. 1995. Small shoemakers and Fordist giants: tale of a supercluster. *World Development* 23 (1):9-28.
- Social Research Institution. 2002. Report for Industrial Policy Project on Ceramics and Glass Industry. Chiang Mai: Chiang Mai University.
- Storper, Michael, and Bennett Harrison. 1991. Flexibility, hierarchy and regional development: The changing structure of industrial production systems and their forms of governance in the 1990s. *Research Policy* 20:407-422.
- Uzzi, B. 1997. Title: Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly* 42 (1):35-67.