

## **A New View on Management Decisions that Lead to Locating Facilities in Industrial Clusters**

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*Industrial clusters are geographical groupings of firms in a similar industry. Much work has gone into describing individual clusters and into understanding some of the forces that affect clusters. This paper coalesces this research into a typology of clusters that is based on the reasons for managers to locate operations within a cluster. The three types of clusters are cost based, resources based, and innovation based. Many clusters are a combination of these types of clusters. Cost-based clusters are easily supplanted by other lower cost locations, but innovation-based clusters are the most robust. This typology can be used by both managers and policy makers to improve economic decisions.*

**Keywords:** Industrial Cluster, Innovation, Labor, Managers, Resources, Transaction Costs

JEL Classification: M10

### **I. Introduction**

An industry cluster is a small geographic area that hosts a significant number of a given industry's competitors, suppliers, and/or distributors (Porter, 1998). Bresnahan et al. (2001) defined a cluster as "a spatial and sectoral concentration of firms." Industrial clusters can be found in Detroit, Michigan for automobiles; York, England for candy; and Dalton, Georgia for carpeting. Many clusters are quite famous and have their own names, such as Hollywood, Silicon Valley, and the Garment District of New York City.

Some of the earliest descriptions of clusters come from Marshall (1920) who described how competitors tended to cluster in the same cities to take advantage of specialized suppliers and labor pools. Although many have described clusters and detailed their structures (Breshnahan et al., 2001; Enright and Roberts, 2001; Glazier, 2008; Hodgetts, 1993; Ivarsson, 1999; Paci and Usai, 2000; Pandit et al., 2001; Porter, 1986, 1998; Powell et al., 1996; Saxenian, and 1994; Palazuelos, 2005) understanding how and why they form is much more difficult. This paper proposes to further understanding on how and why clusters form.

When policy makers seek to create or improve clusters, they usually study the structure of successful clusters and try to mimic the environment they see. However, these efforts are usually unsuccessful because most studies of cluster structures ignore the fact that ultimately clusters are formed because of individual decisions made by managers of firms to locate new operations in industrial clusters because of the advantages they perceive will accrue to their firms in doing so. In this paper I make three propositions:

*Proposition 1: Managers will chose to locate facilities in clusters in order to lower costs.*

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*Proposition 2: Managers will chose to locate facilities in clusters in order to gain greater access to resources.*

*Proposition 3: Managers will chose to locate facilities in clusters in order to better collaborate with other firms in innovations.*

The main contribution of this paper is a typology that takes a new approach by classifying industrial clusters according to the main reasons managers have for choosing to locate operations within a cluster. This new approach provides a better understanding of managers' motivation for choosing a cluster and gives insights into cluster formation. This typology can help guide managers and policy makers while informing future research.

This paper will begin with a brief review of the literature on industrial clusters, with a special emphasis on Markusen's 1996 typology related to the internal structure of clusters. Then the proposed Cost-Resources-Innovation Cluster Typology will be presented. The paper will then discuss mixed clusters and their durability before a final section on applications for the typology.

## II. Background on Clusters

### *A. Origins and Definitions*

Alfred Marshall (1920, p. 271) claimed that in specific locations "the mysteries of industry are... in the air" and described an "atmosphere" in which a particular industry could thrive. He referred to these locations as industrial districts and some economic geographers believe his work to be the origin of interest in industrial clusters (Brechi and Lissoni, 2001). After the Second World War, Francois Perroux called dynamic urban areas growth poles and described uneven economic development across regions (Perroux, 1955; Parr, 1999).

Marshall (1920) described the industrial district as a group of firms in a particular industry. Although many of these companies may be competitors, the cluster usually includes specialized firms that complement other businesses in the district. Together these firms contract with each other to make the various components, materials, and equipment needed to make a finished product. The close proximity reduces the transportation costs among these firms (Glazier, 2008, p. 117; Krugman, 1991), although this is no longer considered a major factor for most industries (Glaeser and Gottlieb, 2009). By locating inside the district, companies in the industry can more easily find the trained labor that is skilled in the processes particular to a given industry (Marchall, 1920; Fallick, Fleischman, and Rebitzer, 2006). The physical proximity of firms also facilitates both formal and informal communications among the firms (Marshall, 1920).

These districts can be in the same city, but they usually extend beyond a single city such that the physical boundaries of the district are hard to define (Porter, 1998). These industrial districts go by many names such as "clusters," "valleys," "triangles," or even "forests" to capture the surrounding areas (Bradshaw, King, and Wahlstrom, 1999; Markusen, 1996; Porter, 1998). These industrial clusters should not be confused with the more broad economic zones or "urbanization economies" of general manufacturing, services, processing of agricultural products, etc. in which there is little or no linkage among firms within the zone (Maskell, 2001). When the industry aggregation is too broad, as in general economic zones, the analysis drifts away into generalities of what attracts factories or businesses, rather than an analysis of why a particular industry is found in clusters and why a cluster is in a particular location (Porter, 2000).

Clusters are interesting to business strategists, because firms and plants often perform differently depending on whether they are located in a cluster or isolated. Marshall (1920) and



Porter (2000) have proposed that firms perform better when located in a cluster. However, Suarez-Villa and Walrod (1997) claim that it can be a disadvantage to be in a cluster. Poudier and St. John (1996) propose that there is a time in the life cycle of a cluster when it is good to be located there, and a time when it becomes a disadvantage.

Clusters have attracted the attention of governments because of the economic vibrancy that a successful cluster can give an area. Many governments have used industrial targeting in an attempt to create clusters that create hegemony in a particular field or to breathe new economic life into impoverished areas. Policy makers often analyze the structure of successful clusters and seek to make an environment that mimics those of vibrant clusters. Unfortunately, these efforts are often unsuccessful because they ignore the motivations of the business managers that ultimately make the decisions as to where to locate facilities. To this body of work I propose a new typology of industrial clusters that incorporates the various views of the reasons for clusters into a cohesive structure based upon the reasons firms decide to location operations in a particular cluster. A better understanding of why decision makers chose to locate new facilities in clusters can improve government efforts to create, improve, and maintain vibrant industrial clusters.

### *B. The Markusen Typology*

Markusen (1996) organized clusters into four types according to the structure of the firms in the cluster and their relationship to each other. Markusen's typology does not propose to be exhaustive of all possible types of clusters, but does propose to encompass all of the main structures. The first type of cluster is the Marshallian version. This relates to the works of Marshall (1920) in which he described British industrial districts of small companies that colocated to closely cooperate in an industry. Markusen describes these clusters as consisting of mainly small, locally owned business which are not dominated by large firms. These industries typically have low scale economies, which prevent large-scale, vertically-integrated firms from taking business away from the cluster to some lower-cost area.

The Marshallian district has its own cultural identity and a very stable work force. Few workers migrate out of the cluster, and many move in as the industry grows. Financing for development in the industry usually comes from the small firms within the district and is focused on the industry. This "patient capital" will wait out lulls in the industry and not go outside of the district in search of better returns.

Markusen identified an Italianate variation of the Marshallian district. This takes its name from the examples of several tightly-knit clusters found in Italy. These clusters are also characterized by a high degree of sharing of designs and innovations among competitors. Cooperation is formally encouraged by government sponsored industry organizations. This high level of cooperation is often accompanied by frequent exchanges of personnel among firms in the cluster.

The second cluster type described by Markusen is the hub-and-spoke district. These clusters are dominated by one or a few large firms with some level of vertical integration that are surrounded by suppliers. This industry has a high scale economy that requires significant investment, usually from outside of the cluster. This makes for "impatient capital" in that during a lull in the industry financing will go elsewhere looking for better investments.

The hub-and-spoke cluster has a high degree of cooperation between the hub firm and the spoke firms, but often little cooperation among the spoke firms. Often employees from spoke firms will take up positions in the hub firm while the spoke firms pull in new employees from



outside of the cluster. However, the movement of labor is not as flexible as found in a Marshallian cluster. Local and regional governments are often involved in regulating the large hub firms and in developing infrastructure, but not in formally coordinating among the firms of the cluster.

A typical example of the hub-and-spoke cluster is in the automobile industry. An automobile firm may locate a factory in a community far from other assembly factories. The automobile firm then encourages suppliers to build factories nearby to provide batteries, tires, glass, etc. that will be used by the assembly factory. The glass and battery factories work closely with the assembly plant, but have little to do with each other.

The third Markusen cluster is called a satellite industrial platform. This type of cluster is often created through government incentives such as tax holidays, inexpensive or free land, direct subsidies, etc. These clusters typically attract large firms that run medium to high economies of scale operations. However, there is very little cooperation among the firms inside of the cluster. Instead, these firms often obtain supplies from outside of the cluster, which may come from their own operations. The government provides little or no coordination role, rather it develops infrastructure and provides incentives for the firms to come and stay.

These satellite clusters have little or no local capital, except from the local governments. Capital will quickly leave the area if more productive investments present themselves. These clusters often dissipate when government incentives dry up or when economic conditions favor other areas.

The final cluster type mentioned by Markusen is the state-anchored industrial district. These clusters are built around a government institution such as a military base, university, research laboratory, or capital. Like the hub-and-spoke district, there is much cooperation between the anchoring institution and the supplying firms, but little among the supplying firms. The government often sponsors trade organization to coordinate among firms in the cluster, but they are weak. Capital is often not local and will move in and out of the cluster in search of the best opportunities.

### III. The Cost-Resources-Innovation Cluster Typology

Generally, other cluster typologies look at the structure of the clusters, but the formation of clusters ultimately stems from a collection of management decisions. Consequently, I propose a new cluster typology that takes the point of view of management deciding to enter a cluster. Categorizing these clusters based on the reasons for these decisions can inform research in industrial clustering, guide managers in making decisions about locating facilities, and direct policy makers that seek to strengthen clusters. The main reasons for entering a cluster from this perspective are: 1) cost based, 2) resources based, and 3) innovation based.

#### A. Cost-Based Clusters

Marshall (1920) discussed how suppliers and buyers often co-located to save on the time and expense of working with each other. Cost-based clusters exist to reduce the cost of doing business. One reason for industrial clustering is to economize on the cost of transporting and managing the cost of supplies from one factory to another. When suppliers and buyers locate near each other the costs of transportation are reduced (D'Aveni and Ravenscraft, 1994). Proximity allows inventories to be reduced, with resulting cost savings, because there is less fear of a



factory being stopped due to a delayed shipment of materials. Some auto manufacturers require that suppliers locate factories nearby for just these reasons. For example, Toyota's suppliers are located an average distance of 59.2 miles from Toyota assembly plants compared to 500 miles for Ford, GM and Chrysler (Dyer, 1996).

Another reason for a firm to locate in this type of cluster is to reduce transaction costs. This includes problems of asset specificity, contract uncertainty, and hold up while maintaining market arrangements in which individual firms can aggregate demand to make more efficient use of capital (Marshall, 1920; Scott and Storper, 2003). To accomplish this a cluster creates a social environment that will punish those that abuse their positions. Often this is done by damaging the reputation of offending members, but serious offenders may lose business for a time or even be ostracized from the other firms in the cluster (Jones et al., 1997).

Williamson (1985) described transactions costs as the "friction" that occurs as companies do business. This friction can slow down business operations and when it is too high companies often solve the problem by buying their suppliers or buyers to better manage those operations (Williamson, 1985). Through vertical integration many contractual problems are resolved by fiat from high level managers.

Harrigan (1986) defined vertical integration strategies as "a combination of decisions regarding whether the firm should provide goods and services in-house through its own business units, or purchase them from outsiders, instead." Companies look both up and down their supply chain to consider appropriate integration. These can include providing raw materials, semiprocessed goods, components, final products, distribution, sales, and other services. The firm can acquire the capability to supply these goods or services by purchasing a company that is currently in that spot of the supply chain, or by building the capability itself.

Firms integrate vertically for a variety of reasons. Lieberman (1991) and Williamson (1975, 1986) describe two situations in which one player can extract rents from another: 1) a small numbers of firms in the market, or 2) large sunk investments. The company that must pay these rents then has the incentive to buy the other company so as to avoid the rents. From the point of view of transaction cost economics, the company that must pay rents can lower transactions costs by acquiring the capability that is currently outsourced (Williamson, 1986).

Vertical integration can also reduce transaction costs by minimizing or eliminating the costs of finding suppliers, selling output, negotiating contracts, monitoring contracts, and settling disputes with other companies. By integrating the operations of another firm, negotiation and disputes can be resolved by fiat from a high level manager. Information flows are improved so that the contracting parties can sit down together with a common superior to determine the course of action that would maximize profits for the entire company, not just each division (D'Aveni and Ravenscraft, 1994).

This vertical integration is just one solution to the problem of high transaction costs. Another is for buyers and suppliers to locate together in physical proximity (Storper and Walker, 1989). The proximity makes coordination and policing of contracts much easier. Geographic clustering of industry players can accomplish many of the goals of vertical integration while aggregating demand across firms as in a true market situation. Colocated firms can form a type of social bond that helps to police activities that might otherwise go unpunished in an open market. Firms in a cluster will develop a reputation related to how well they honor contracts, and this reputation will be well known throughout the cluster or easily checked by members of the cluster. If a firm tries to hold up operations to benefit itself or abuses confidential information, other firms in the cluster will learn about it and will avoid doing business with the offending



firm. This policing reduces problems related to asset specificity and uncertainty in entering contracts that Williamson (1985) described as reasons for vertical integration.

Maskell (2001) offered the five following benefits of clusters over an unclustered market arrangement of firms: 1) reduced malfeasance, 2) increased volunteering of reliable information, 3) better honoring of agreements, 4) negotiations take place under a common environment and context, 5) the sharing of tacit knowledge is easier. The result of these advantages is to reduce transaction costs.

An example of this type of cluster can be seen in the garment district of New York City (Uzzi, 1997). The demand for particular clothing products gyrates with the whims of fashion. Manufacturers (or fashion designing firms) are constantly experimenting with different combinations of fabric, color, patterns, and designs that require the employ of a wide variety of suppliers and contractors. Successful designs require manufacturers to quickly increase production through its contractors to keep supplies in clients' stores. Because of the short runs of even successful products, even small problems with production runs or confusion on details of a particular contract can drain away all of the profit for a product. In New York, these problems are solved not through vertical integration, but through a tightly-knit network of vertically fragmented firms. So great is the trust in this network that often contractors start a job for a manufacturer and then negotiate the price of the contract. Reputation both assists in finding partners and in punishing those that abuse the trust of former partners. All of the interactions described by Uzzi (1997) are facilitated by the physical proximity of most of the key players in the industry.

Locating a facility in an industrial cluster can reduce operational costs by lowering transportation costs and by lowering transaction costs. Most firms carefully analyze their expenses and constantly seek ways to reduce the cost of doing business. Industrial clusters offer strong incentives for reducing costs that will attract the attention of managers as they make key decisions in locating new facilities and relocating existing ones. Hence, I offer the following proposition:

*Proposition 1: Managers will chose to locate facilities in clusters in order to lower costs.*

### *B. Resources-Based Clusters*

The second type of cluster is based on resources. These clusters attract firms because they offer particular resources that are hard or impossible to find elsewhere. A resource could be skilled labor, as when Tesla Motors located automobile research facilities in Michigan in order to "...have access to the great talent pool that exists here in automotive engineering and design" (Sutton, 2007). Illumination Entertainment decided to produce much of their animated movie "Despicable Me" in Paris, France not to save money but because of the shortage of skilled computer animators in the US and the available labor pool in Paris (Schuker 2010). A resource could also be a market as when a German bank opens an office in New York City to better serve that market. The market might be a single customer such as a government agency headquarters or a large car factory. In these cases the resources are specific and often openly identified by the firm.

Zaheer and Manrakhan (2001) expanded upon Marshall's early descriptions of clusters and described why companies choose to locate facilities inside of a cluster. Their four main reasons were resource-seeking, market-seeking, efficiency-seeking, and strategic asset-seeking. Companies that deliberately choose to locate in a cluster are seeking something that the cluster offers.



Resources sought might be raw materials such as a supply of oil or iron ore, or they could be manufactured products such as steel, clothing, or electronic components. Specialized labor could be another resource that a company might seek in locating within a cluster. Firms that offer products or services used by a particular industry may decide to locate in a cluster to have closer access to customers. Strategic assets often include knowledge about markets and manufacturing techniques that can be acquired through regular contact with managers within the cluster (Saxenian, 1994).

When local resources become scarce firms must seek resources further from their facilities, develop their own, or find convenient substitutes. Under circumstances of scarce resources, managers considering establishing new operations or relocating existing ones will often establish facilities in industrial clusters to access the more abundant supply of resources found there. Therefore, I offer the following proposition:

*Proposition 2: Managers will choose to locate facilities in clusters in order to gain greater access to resources.*

### *C. Innovation-Based Clusters*

The third type of cluster is an innovation-based cluster. This cluster creates an environment in which talents and resources are shared among firms to solve a particular problem and bring innovations to market. The relations among firms are much deeper than just supplier and buyer. Each firm may offer a unique skill necessary to create a new product. Suppliers collaborate with buyers and competitors to create new product and services.

One of the main reasons proposed for the existence of clusters is that a particular industry has a body of tacit knowledge necessary for the operations in the industry (Porter, 1998). An example is the process of apprenticeship still practiced in many industries. Many quality string instruments such as violins are still made by hand by skilled artisans who apprenticed for several years before establishing their own shop (Kolstein, 1997; Villareal and Lopez-Levy, 1997). The process of apprenticeship allows the tacit knowledge to be passed on to others. Industries with significant levels of tacit knowledge for key functions often locate near each other in order to facilitate the movement of tacit knowledge by being physically close. This closeness allows for regular visits, both formal and informal, among competitors and players in the value chain (Porter, 1998).

Brown and Duguid (2001) discuss social practices associated with organizations. They explain that a new employee learns tacit knowledge over time by simply interacting with coworkers. However, such interaction is no guarantee that new tacit knowledge will flow across a company. For example, research divisions often have difficulty getting their ideas developed and to market (Brown and Duguid, 2001).

Brown and Duguid (2001) also describe how particular groups of people with similar jobs in companies form what are called "communities of practice." These communities can consist of accountants, engineers, sales people, etc. who work together in a particular field. In large firms many professions will form separate communities based on their particular subfield. For example, software programmers and electrical engineers of the same firm will form separate communities of practice as will accountants in payroll and accountants in accounts receivable. Although communities may have similar goals, tools, policies, and procedures, the combination of these will be distinct from other communities within the firm. A particular type of community will also identify with similar communities in other firms. This creates a "network of practice,"



which includes all of the communities of practice across an industry or even beyond an industry boundary. Many such networks have formal organizations with regular meetings, others just have informal connections. In either case, these networks of practice can be conduits for the transmission of information among companies. Brown and Duguid (2001) conclude that physical proximity of a large number of members of a network will facilitate the flow of information. Therefore firms within a cluster can benefit from better access to knowledge available in these networks of practice.

An interesting aspect of tacit knowledge is that it can "leak" to another company through the migration of personnel with the tacit knowledge (Brown and Duguid, 2001). This can happen when a company ignores the development of new tacit knowledge within their operations and their engineers leave to start or join another company to make use of that knowledge (Brown and Duguid, 2001). This movement of tacit knowledge is of particular interest in the creation of cluster industries. Many engineers that decide to start a company of their own stay in the same area for access to the same suppliers and service providers that the "mother" company had and for personal convenience (Almeida and Kogut, 1999; Saxenian, 1994; Zucker, Darby and Armstrong, 1998). Much of the development of Silicon Valley comes from this sort of movement (Brown and Duguid, 2001; Saxenian, 1994). Xerox's PARC research facility is famous for the initial development of the computer mouse and windows for computer operating systems. However, these inventions were first developed into commercial products not by Xerox, but by Apple Computer, which was located in the same general area (Brown and Duguid, 2001).

Tacit knowledge can also "leak" without the transfer of employment. Zaheer and Manrakhan (2001) refer to this as knowledge spillovers. Industry luncheons, evenings at a local bar, golf at a country club, and pancake breakfasts for the local scout troop all offer regular opportunities for people in the same industry to share knowledge. Explicit knowledge will flow freely in this environment, but it also offers a conduit for the slow dissemination of tacit knowledge. Saxenian (1994) gives many examples of this informal flow of knowledge among companies in Silicon Valley.

Some firms seek to obtain (perhaps steal) competitive knowledge by locating their operations within physical proximity to their leading rivals. The knowledge they seek can often be obtained by hiring away employees from rivals with that knowledge or employing them temporarily as consultants. Firms can also use social activities such as those mentioned above. Some have suggested that leading firms will seek to locate away from clusters to avoid this leakage of their competitive knowledge (Suarez-Villa and Walrod, 1997).

Silicon Valley and the biotechnology cluster in Orange County are examples of clusters in which the flow of knowledge, often tacit, among firms in the cluster allows groups of firms to create marketable innovations (Powell, Koput and Smith-Doerr, 1996; Saxenian, 1994).

Managers usually know well the location of innovation centers in their industries. They probably travel regularly to these industrial clusters as they collaborate with key partners, especially in highly innovative industries. When the time comes to consider the location for a new facility, or to relocate an existing one, moving to an industrial cluster for their industry is an obvious choice. The advantages to a manager will be seen as less time traveling to the industrial cluster, while benefitting from more frequent visits with key partners and keeping a close watch on competitors. All of this will benefit the firm by speeding the rate of innovation and avoiding being surprised by competitor activities. Hence, I propose the following:



*Proposition 3: Managers will chose to locate facilities in clusters in order to better collaborate with other firms in innovations and to more closely watch competitors.*

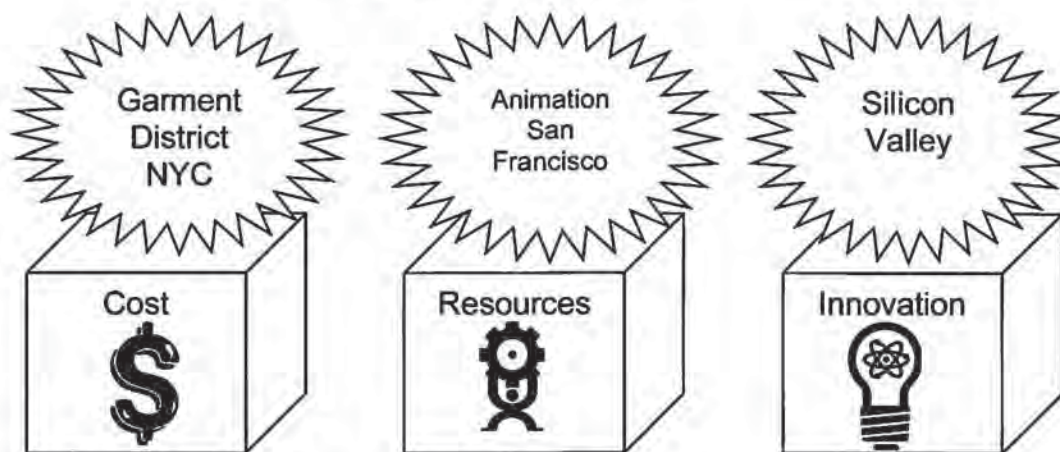
#### IV. Cluster Compositions

Figure 1 shows examples of three clusters each with its foundation. The garment district of New York City is an example of a cost-based cluster. The colocation of firms reduces transaction costs in an industry that has uncertain ventures, short production runs, and constant changes.

The pool of animation programmers in San Francisco is an example of a resources-based cluster. The rise in popularity of using computers to animate characters, rather than hand-drawn pictures, has created a shortage of skilled workers in the industry. Movie companies are locating their animation studios around San Francisco in order to gain access to the trained and experienced labor pool.

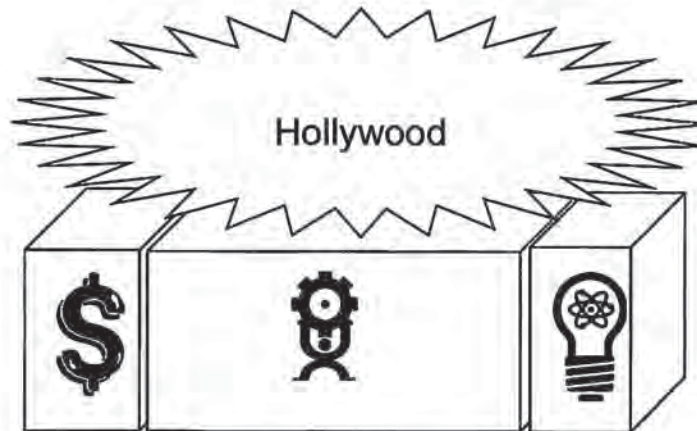
Silicon Valley is an example of an innovation-based cluster. By locating close to each other, firms can share or even steal tacit knowledge from each other. Many of the operations in this cluster are only related to research and development with manufacturing being done outside the cluster, often in other clusters that offer advantages for manufacturing.

**Figure 1: Examples of Types of Clusters**



However, many clusters show characteristics of two or all three types of clusters, with each type having varying levels of influence. Figure 2 shows that the Hollywood film cluster is mainly founded upon its resources such as actors, technicians, and sound stages. However, there is some factor of costs in the form of reduced transaction costs. Films, like new garments styles, are unique, short-run ventures with uncertain outcomes. Close physical proximity facilitates solving unforeseen problems and managing unfamiliar partners. Hollywood also employs some element of innovation as firms work together to develop new special effects and other film technology.



**Figure 2: The Hollywood Cluster**

### V. The Durability of Clusters

A successful cluster can bring significant financial benefits to a city or region. For this reason, many governments try to help struggling clusters or develop new ones. However, most governmental efforts are done without understanding clusters themselves. The Cost-Resources-Innovation Cluster Typology can help inform policy makers that seek to develop clusters in their regions. In particular, understanding the durability of each type of cluster is important to making these policy decisions.

Cost-based clusters are easily displaced by less expensive operations in other centers. From the point of view of the manufacturer, the reason for locating in a particular cluster is based on costs, so any other location that offers lower overall costs will attract new operations, while facilities in more expensive locations will close.

Transaction costs are certainly a part of the cost structure of doing business in a particular location, and lowering transactions costs is often the reason for forming a cluster (Storper and Walker, 1989). However, lower costs for labor, capital, supplies, or other factors can overwhelm the overall savings in transaction costs offered by a particular cluster. New sources of lower-cost labor have been the undoing of many clusters, despite the higher transaction costs related to the new locations.

Resources-based clusters are harder to displace than cost-based clusters because of the need to develop new resources elsewhere or the need for the introduction of technology that makes the existing resources obsolete. In some cases there is no reasonable alternative resource. A government capital that is a prime customer or a nice beach near a major metropolitan area are not likely to be displaced as clusters. However, the skills of a specialized labor pool could be learned by another group of workers and dissipate the cluster. India's education of software engineers has greatly reduced clusters of programmers in Texas, Arizona, and Utah.

Innovation-based clusters would be the most persistent because these clusters create innovations through a system of shifting alliances that require a critical mass of firms. Creating this critical mass of companies is very difficult. Often government efforts to create innovation-based clusters fail because firms in such clusters seem to need some danger of bankruptcy to spur the innovation. Government efforts to support weak firms until a cluster is developed actually remove this element of fear that seems to be an important motivator in innovation. Even when a



government can encourage the development of dynamic firms, innovations follow unpredictable paths and supplanting the hegemony of existing innovation-based clusters through any directed effort will often fail from bad guesses as to what the next innovation direction is.

## **VI. Application of the Typology**

For managers that are considering the location of their next facilities, using this typology can assist in making better decisions. Initially managers should assess why they would want to move into a cluster according to the typology of cost, resources, and innovation. Companies in industries with short production specialty production runs will benefit from reduced transaction costs found in a cluster. Firms that have large manufacturing operations and are in mature industries may also find significant savings in locating in a cluster; however, cost savings can quickly erode with advances in production technology and access to much lower cost labor (often through international political treaties).

Managers may consider moving operations into a cluster to access resources such as labor and customers. The need to have access to a better labor pool is usually obvious to managers when persistent challenges in filling positions exist. Firms will often initially locate a small operation in the cluster to confirm that there is a sufficient supply of labor and to assess its quality. Once the small operation is successful, more facilities can be established in the cluster. The need to have better access to customers is usually noted when opportunities are lost because of infrequent access to customers or delays in responding to customer requests because of the need for direct contact. If customers are physically clustered, then managers should consider moving appropriate operations (whether sales, management, design, or manufacturing) to better meet their needs.

Innovation activities can be improved by locating research and development operations in a cluster. The movement of tacit knowledge can flow more easily between a firm and its partners and even "leak" from its competitors. If manufacturing technology is also advancing rapidly, then a firm might also consider moving these operations to a cluster. However, some innovative industries have relatively mature manufacturing techniques that may benefit more from cost savings in other areas.

Government leaders and policy makers that seek to enhance and maintain clusters in their areas can also benefit from understanding the Cost-Resources-Innovation Cluster Typology. If a cluster is cost based, then it will be vulnerable to the rise of other centers with lower costs. These lower costs can be in the form of tax incentives, subsidies, or other governmental incentives. Often foreign policy changes can open up new production locations in other countries where salaries are a fraction of local salaries. Mature industries with long production runs are especially vulnerable to the rise of lower cost centers. When the major reason for a cluster's cost advantage is reduced transaction costs, then the cluster will be more durable. However, even these advantages can be insufficient to prevent the demise of a cluster if new locations have significantly lower costs for labor, facilities, and other factors.

Policy makers should encourage the development of a skilled and specialized labor pool. This can be done through the development of formal educational programs at colleges and universities, as well as through the development and support of industry organizations that encourage individuals to share knowledge and experiences in their industries. An industrial cluster based on a large pool of specialized labor is more sustainable than one based solely on low cost.



The most durable clusters are those based on innovation, but these are also the most rare and hardest to develop. Investment in university research and the development of research parks for the industry will help to develop an innovation cluster. Industry organizations are also valuable because they encourage the flow of knowledge among firms that bring together independent innovations into new inventions that keep the industrial cluster strong.

## VII. Conclusion

The Cost-Resources-Innovation Cluster Typology presents a new perspective on the fundamental reasons for the formation of clusters that considers the reasons why managers chose to locate operations inside of an industrial cluster. The three types of clusters are 1) cost based, to reduce the costs of doing business; 2) resources based, to obtain access to scarce resources including labor and markets; and 3) innovation based, to collaborate with other firms to produce new and complex products and services. Many clusters are made up of a mix these three types, but one type usually dominates.

This system pulls together the work of other researchers into a comprehensive typology of the motivation managers have for locating new operations in a cluster. This new structure brings insights into why some clusters dissipate and others persist and points to how these clusters function. Governments often try to revive weak clusters or sustain existing ones, but without the understanding this new structure brings, they often fail. By using the Cost-Resources-Innovation Cluster Typology, managers and policy makers can better understand the advantages offered by a cluster and make better-informed decisions.

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