Recipe V: The Cluster and Inverted S Model

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On Strategy & Competitiveness

10 RECIPES FOR ANALYTICAL SUCCESS

V The Cluster and Inverted S Model

Ingredients:

- ✓ *Geographically proximate firms*
- ✓ *Research institutions*
- ✓ *Educational institutions*
- ✓ *Capital providers*
- ✓ *Public actors and government*
- ✓ *Organizations for collaboration*

First, let me make one thing clear: not everything in an economy is clustered. Typically, for most national economies, about two-thirds of employment involves local industries. If you make a map of the distribution of people in a particular nation or region, these local industries (retail businesses, health care providers, restaurants, etc.) will closely mimic the same distribution as the population, and there is not a trace of agglomeration into one or a few areas. On the other hand, about one-third of industrial activity will exhibit different degrees of agglomeration. And this applies both to high-tech (e.g., life sciences, ICT) and more traditional industries (e.g., paper, automotive, shoes) as well as manufacturing and service industries (e.g., business services, banking). The cluster mapping methodology

developed by Professor Porter uses some 50 broader cluster categories (so-called traded industries where firms can choose a locality).[31]

Clusters represent a type of agglomeration consisting of firms in related industries (competitors, buyers, suppliers, firms in related technologies, etc.) and a range of other supporting organizations and actors. In order to separate out different types of agglomeration economies, one can make a simple classification scheme delineating efficiency advantages (largely economies of scale) versus innovation advantages on the one hand, and agglomeration in general versus agglomeration of technologically related actors on the other. This division leads to four main types of agglomerations[32].

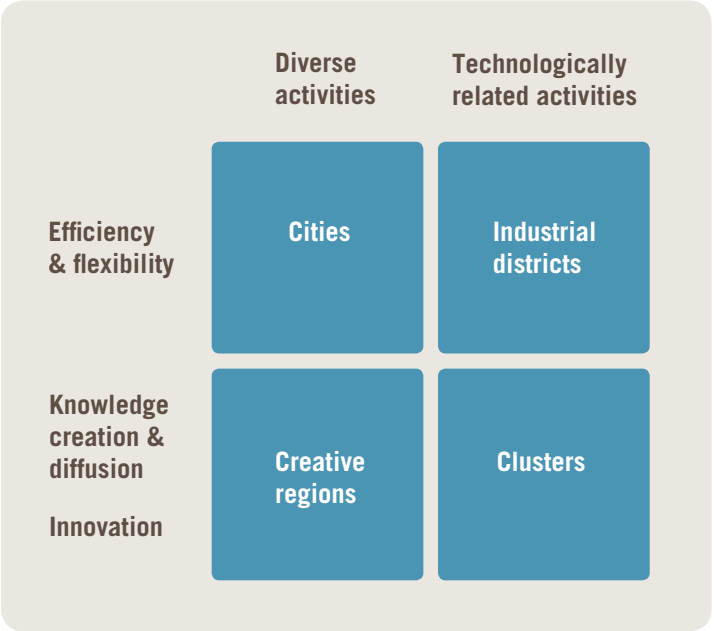


Figure 1. Four Types of Agglomerations

The first type relates to general economies of regional and urban concentration that apply to all firms and industries in a single location (urbanization economies), representing those external economies passed on to firms within the agglomeration. These are the forces that lead to the emergence of industrial core regions, manufacturing belts and metropolitan regions. City agglomerations and regions attract a wide range of economic activity. More important cities, such as capital cities, represent political power and markets for public projects, and are therefore particularly attractive to host headquarter functions of large corporations.

A second agglomeration type involves economies that relate to firms engaged in similar or inter-linked business activities, leading to the emergence of industrial districts. Such districts constitute a base for flexible production systems that can meet volatile markets. In both cases, agglomeration economies have their roots in processes whereby linkages among firms, institutions and infrastructures within a geographic area give rise to economies of scale and scope; the development of general labor markets and pools of specialized skills; enhanced interaction between local suppliers and customers; shared infrastructure; knowledge spillovers and other localized externalities. Agglomeration economies are believed to arise when such links either lower the costs or increase the revenues (or both) of the firms taking part in the local exchange. Presence in an agglomeration is, in other words, held to improve performance by reducing the costs of transactions for both tangibles and intangibles. The formation of regionalized industrial systems will be particularly intense where linkages tend to be small-scale, unstable and unpredictable, and hence subject to high transaction costs.

In addition to these two types of agglomerations, explained mostly by efficiency gains and flexibility, one can distinguish two types of agglomerations explained as centers of innovation. The first type we refer to as clusters, where sustained competitiveness is based on innovation capabilities linked to a particular location. Clusters are not seen as fixed flows of goods and services but rather dynamic arrangements based on knowledge creation, increasing returns and

innovation in a broad sense. Thus, clusters are made up not only of physical flows of inputs and outputs, but also by intense exchanges of business information, know-how, and technological expertise, both in traded and un-traded forms. Such technological spillovers were actually at the core of Marshall's analysis in the early 20th century, but had been mostly forgotten until Paul Krugman and Michael Porter brought them to center stage in the early 1990s.

The last type of agglomeration relates to knowledge creation and creativity in a region without any sectoral boundaries. While Porter's main concern has been the existence and reproduction of clusters of technologically related firms, there are corresponding attempts to analyze the learning abilities and creativity of regional and urban agglomerations of the general type. Instead of specialization and spatial clustering of related industries, emphasis is placed on the presence of a regional variety of skills and competencies, where the — often unplanned — interaction among different actors leads to new and often unexpected ideas and new creative designs, products, services and business concepts.

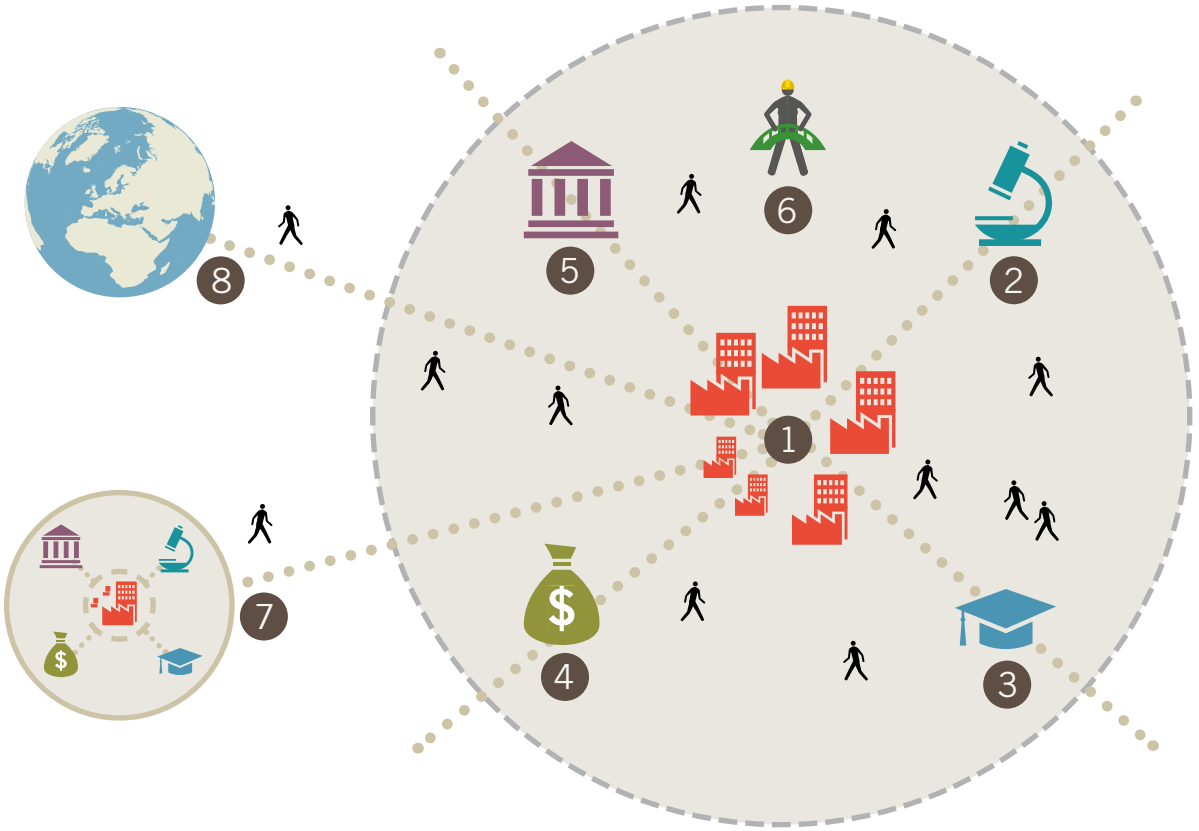
Clusters

Research has shown that clusters play a critical role in innovation processes within regions.[33] To understand why, we should see the cluster as a collection of different types of complementary actors – firms, large and small, domestic and multinational, suppliers and buyers, and many other related organizations that interact in both formal and informal ways. The most important type of actor is the firm. It is firms and individual entrepreneurs (some of which act as role models in the cluster) that plant innovation seeds, take innovations to markets and subject them to the tests of competition and demand. Another type of actor includes research organizations/laboratories, which produce all sorts of innovation seeds. A third type is education organizations, such as schools and polytechnics. Universities are a special case, because they play the double role of being both research and education institutions. A fourth type is the capital providers, such as angel networks, public and private seed funding and commercial banking institutions, who provide the capital (equity/loan) needed for the exploitation of inventions and new business models. And, fifth, government and other public bodies are actors that make and implement policy decisions about public infrastructure investment, regulations, and so on, critical for the innovation climate. The public side includes many levels of government and a wide range of public agencies.

A sixth very important type of actor includes different kinds of networking/bridge-building organizations, or what we often refer to as organizations of collaboration. Such organizations include, among others, science parks, incubators, innovation offices, co-working spaces, chambers of commerce and cluster organizations. In Europe, cluster organizations have become highly prevalent during the last two decades.

In addition to the six types of actors within a cluster, one should also take note of outside actors, particularly firms and organizations in other fields of technology (represented by the cluster to the left of the focal cluster in Figure 2) and global markets and value chains (represented by the globe to the left in Figure 2).

Dynamic clusters are characterized by dense inside networks (so-called strong ties), but also numerous weak ties to global markets and value chains and other areas of technology. Isolated clusters, and clusters with extensive gaps between actors, will not lead to innovation (see Recipe VI). Now, let us take a quick look at clusters through a series of four lenses.



1 Firms
2 Research
3 Education
4 Capital
5 Public
6 Bridge Builders

7 Other clusters
8 Global markets

Figure 2. Six Actors inside the Cluster Field and Two Outside Fields

Your own notes:

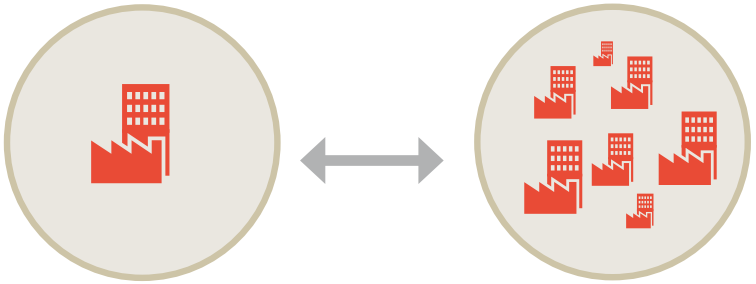


Figure 3. Degree of agglomeration

Figure 4. Clusters Facilitate Fast Reshuffling of Resources

Lens One: Degree of Agglomeration

Looking out over the economic landscape, we find firms and organizations being located in, or relocated to, places characterized by everything from large agglomerations, such as Silicon Valley, to almost total isolation. Some clusters are part of larger urban agglomerations, whereas others are more rural. A firm to the left of the scale in Figure 3 is isolated in a cluster sense, lacking close rivals or firms in technologically related industries, including suppliers and buyers in the vicinity. But the firm can still be located in an urban location, surrounded by other diverse actors.

The left side is in line with the Soviet-style planning model built on highly fragmented value chains, or the old model of one-company towns (in Swedish, "bruket") in traditional industries such as paper and steel. These firms were often large and efficient in terms of economies of scale at the plant level. On the other hand, they were not surrounded by a multitude of related firms and industries, and entrepreneurship and new firm formation were unknown phenomena in these towns.

Lens Two: Cluster Dynamics

The second dimension of clusters involves the level of dynamism and amount and quality of linkages between cluster actors, as well as external linkages to international markets. Some agglomerations are more on the static side, i.e., the "Silicon Glens" as opposed to the "Silicon Valleys". Characteristics such as level of networking, factor mobility, and general dynamism differ enormously across clusters. Also, the level of sophistication differs, where some clusters are more production-oriented in terms of low-cost goods (e.g., the automotive cluster in Dogu Marmara, Turkey), while others offer highly differentiated products (e.g., the automotive clusters in southern Germany), including R&D, design, branding and other strategic functions. If the quality of resources differs across regions, so does the flexibility

with which the pieces can be assembled and reassembled. As with a Chinese puzzle, the shape of each piece plays a role, but how the pieces fit together, and how they are constantly rearranged to improve the productivity of available resources, is critical to innovation and economic growth.

Dynamic clusters create the foundation for sophisticated strategies, and act as a driving force behind upgrading and innovation among incumbent firms. In summary:

- Firms in dynamic clusters develop strategies and new capabilities in a process of high-stakes backyard rivalry
- Firms in clusters tend to share many activities through cooperation or swapping products. Clusters facilitate both horizontal and vertical (buyer-supplier) cooperation within a setting of a "common language", trust, low transaction costs and high social capital.
- Firms in rich clusters can operate more efficiently, drawing on specialized assets, suppliers and buyers with short lead times. Critical resources and capabilities are often not within the firm but are accessible through networks inside the cluster.
- Firms in clusters can achieve higher levels of knowledge creation and innovation. Knowledge spillovers and close day-to-day interaction between buyers, suppliers and organizations leads to incremental improvements, which are the foundation of innovation, both technical (product and process improvements) and non-technical (business model improvements). Innovations diffuse rapidly within clusters.
- Clusters offer an environment in which different resources (individuals, technologies, capital, etc.) can quickly be reshuffled and restructured (spin-offs, labor mobility transferring skills across organizations, etc.), allowing for new and better economic combinations of skills, capital and technology. The need for changing the strategy or "recipe" of the firm can quickly be accommodated within the cluster (see Figure 3).
- New business formation tends to be higher in dynamic clusters. Start-ups are reliant on close interaction with suppliers and buyers. The cost of failure is typically lower within a cluster, where many alternative opportunities exist.
- Clusters in many cases offer lead markets where sophisticated buyers help pull technology development and innovation in close interaction with suppliers.

The outcomes of firms, as manifested in the output of goods and services, will vary from cluster to cluster. Certainly, cars from Japan will compete in the global marketplace with cars from Germany or the U.S., and increasingly, Japanese-built cars in the U.S. compete with U.S. cars built in Mexico. But global markets are one thing and local clusters another. Cars from one cluster will "taste" and "smell" differently from cars from another. They will cater to different consumer tastes; they will exhibit differences in cost levels, quality, features, and energy efficiency and so on.

Clusters tend to oscillate on the scale in Figure 5. So let us now turn to the ups and downs of clusters.

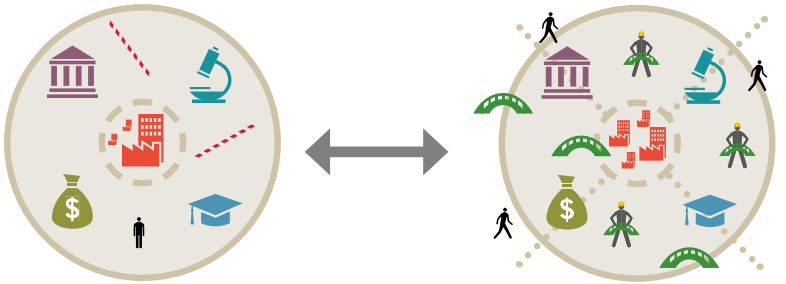


Figure 5. Degree of Cluster Dynamism

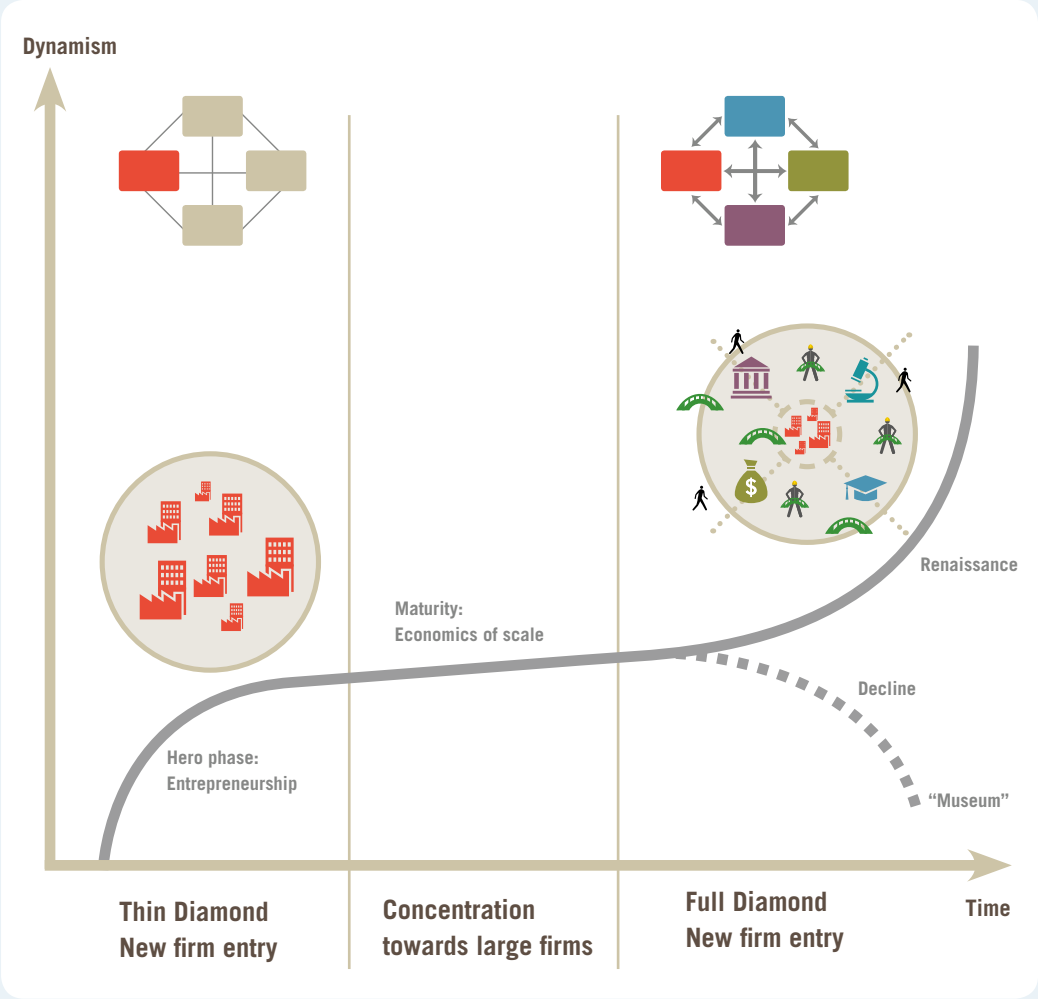


Figure 6. The Cluster Life Cycle and the Inverted S

Your own notes:

Lens Three: Cluster Life Cycles and the Inverted S-Curve

The third dimension of clusters involves the maturity of the cluster. Clusters follow life cycles. Typical seeds of clusters include natural advantages (ore deposits, transportation routes, climate, etc.), entrepreneurship or some particular demand or skill within the region. Hollywood achieved success based on its abundance of sunny beaches perfect for shooting silent movies; the wine industry in Bordeaux, France is based on a particular terroir; the silk industry in western Japan relies on a consistent and moist climate; and the Swedish paper industry in Värmland is based on access to timber, energy and efficient transportation on rivers (in the old days). Another typical cluster seed is an entrepreneur who starts a particular industrial activity in a particular location.[34] If the new venture is successful, and local resources support the business idea, new businesses are likely to be formed and a cluster can emerge over time.[35]

Some emerging clusters will ultimately take off and grow, whereas others will remain small or disappear. Growing clusters will enter into a process of international competition in both factor markets (attractiveness of new companies, people and capital) and final goods markets. The more successful clusters are built on a combination of superior internal dynamics, including rivalry and intensive new-firm formation, and superior attraction of external resources. Over time, the cluster will go through different phases. The early period is often identified with one or a small handful of people – the "heroes" acting as role models. If the entrepreneur is successful, others will follow suite and enter the business, and with a growing business, there is room for the entry of upstream and downstream industries. A cluster is emerging. In the mature phases, certain strategies will tend to dominate, and economies of scale will play an increasingly important role. Concentration of a few dominating firms is common. Ultimately, some clusters go into decline, finally reaching the "museum" stage, or they jump into a new cycle, a renaissance, based on new technologies and new firms (see Figure 6).

Some clusters continue as rather static agglomerations for very long periods of time (the flat part of the inverted S-curve). Internal constraints (see Railway Model) include:

- Investments in plants, equipment and specialized labor and infrastructure that reduces flexibility
- Limitations on information received by decision-makers and increased ethnocentrism (and the NIH syndrome), leading to a dead end
- History and culture, leading to political constraints
- The evolution of rigid institutions (legal barriers and self-restraint based on norms) hindering a change in technology or strategy
- Legitimacy considerations, reducing room for action and unconventional strategies
- An over-concentration around a dominant firm

External constraints typically emerge from technological shifts emanating outside the cluster, or from actions of war or other exogenous shocks.

Linking the cluster life cycle to the Diamond Model, one can think about a limited but dynamic diamond in the early "hero" phase, shifting into a static diamond environment (surviving large firms with market power, economies of scale, lack of rivalry, etc.), and then back to a dynamic diamond in the renaissance phase (or alternatively, if static forces take the upper hand, in the museum stage).

Lens Four: Natural vs. Planned Clusters

The fourth dimension of clusters involves the level of planning and policy involvement (see also the Funnel Model). Many world-leading clusters were not "planned" in the way we typically think of the word. In other cases, there has been more of a clear game plan created by national or regional governments. In Dubai, Saudi Arabia,

Korea, China, and other parts of the Middle East and Asia, we see very visible government influence shaping cluster construction, whereas in the Western world, it is less visible and often more or less absent, at least as a direct "cluster policy". Europe has turned to more development of cluster programs and initiatives forming a natural part of regional (including smart specialization), industrial and innovation policies. And even in the U.S., cluster programs are emerging as part of the economic development landscape.

As Professor Porter's cluster model was "adopted" by policymakers and public officials all around the world, it typically shifted from a focus on competition to one of cooperation. It also shifted from a model describing how market forces lead to clusters, to one of constructing clusters via visible government intervention. Clusters are to some extent always a result of "construction", even if there is not one central "manager" or dedicated organization guiding the process. A range of policies impact firms and regions in many different ways. Industrial policy, innovation policy, science policy, regional policy, and now even cluster policy are crucial parts of the business environment of firms all around the world. Some policies help in fostering a more innovation-driven business environment, while other policies and regulations clearly hinder innovation and upgrading. Policies do play important roles, but not necessarily always constructive ones. The 7 Cluster Gap Model (Recipe VI) will take a closer look at these issues.

In connection with discussions around cluster construction, probably the most common questions we get are these: how is it that Silicon Valley, which has evolved into the world's most impressive cluster, did this without any public initiative? And based on this example, why should anyone, whether a public or private actor, take on collective action to enhance cluster dynamics?

First, we would argue that the evolution of dynamic clusters typically combines a mix of invisible and visible hands, and that this also applies to Silicon Valley. The most critical and visible hand to build a bridge between the world of science and the world of business was initiated by the Provost of Stanford University in the early 1950s[36]. No one outside the region really took notice, but two or three decades later, this bridge began to allow for intense traffic, which in turn nurtured emerging star firms in IT hardware and software, and later, around Internet-based business models[37]. Second, and this is often forgotten, public money (research grants, etc.) actually has played a critical role when attracting talent and investment to the Valley, and also in financing a number of high-risk technologies, including ARPA, support to SMEs through the SBIR program, and through other means.[38]

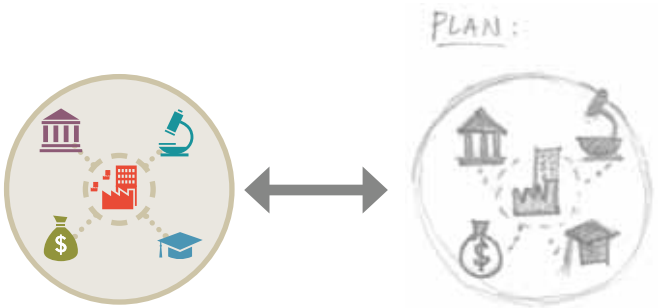


Figure 7. Evolutionary vs. Constructed Clusters