Industrialization and Economic Structure

The political and economic consequences of the Renaissance had helped to spread European domination worldwide. ... The forces of industrialization helped to complete that process of world domination by dividing the world between the advanced industrialized nations (originally Europe and North America) and the underdeveloped, non-industrialized nations.

—Richard T. LeGates and Frederic Stout, eds. The City Reader, 2000

Essential Question: How did the diffusion of industrialism affect people around the world?

The Growth and Diffusion of Industrialization

The Industrial Revolution was a set of changes in technology that dramatically increased manufacturing productivity. It reshaped how people worked and behaved, where they lived, and how they related to each other spatially.

Diffusion of the Industrial Revolution

The start of the Industrial Revolution in the mid-1700s was like tossing a rock in a pond. It caused a large initial splash in England and then the ripples spread outwards. On a large scale, the first continents and countries affected were near England: France and the Netherlands. By the mid-1800s, industrialization had spread east to Germany and west to the United States. By the early 1900s, it had reached all of Europe, Japan, and parts of China and South America. Today, most of the world is industrialized.

On a smaller scale, within countries, the first factories were usually built near sources of power, such as rivers or coal deposits, and near transportation routes. With the development of electrical power and the construction of new roads, canals, and harbors, later factories were added in more diverse locations.

As the Industrial Revolution progressed, improvements in farm machinery and farming techniques, along with the enclosure movement, increased agricultural productivity. Machine power replaced human and animal power. Hence, many people in rural areas were no longer needed for their labor.
These displaced farm workers moved to towns and cities, causing an explosion in urban populations everywhere industrialization occurred. As urban residents, they promoted the growth of industries in two crucial ways:

- As workers, they toiled in factories, running the machines that made textiles, steel, and other products.
- As consumers, they provided a market for the expanding quantities of food and manufactured goods.

**Growth of Population and Cities**

As the number of industries in factory cities increased and rural-urban migration continued, cities grew rapidly. London grew from one million people in 1800 to six million in 1900. Old systems for handling human waste, burying the dead, and cleaning up horse manure were overwhelmed. Since people burned wood and coal to heat their homes and run factories, air pollution increased to harmful, even deadly, levels. In some weeks, smog got so bad that it doubled the normal rate of death. Over time, people supported stronger government action to build sewers, regulate cemeteries, and so on, to protect public health.

Public health measures became increasingly important as cities became even more dense by expanding vertically. The development of elevators, stronger and more affordable steel, and techniques to construct stronger foundations combined to allow for taller buildings.

Cities also expanded horizontally. Improvements in intra-urban transportation, such as trains, cars, and trucks, allowed cities to spread out farther from the downtown core. People could live farther from their workplace and still commute to work easily. And food could be transported from the countryside into cities to feed a growing population.

**Colonialism, Imperialism, and the Industrial Revolution**

The Industrial Revolution built on the earlier rise of imperialism, a policy of extending a country's political and economic power. As countries such as Great Britain and France industrialized, they recognized the value of controlling trading posts and colonies around the world. Colonies provided several resources and other contributions to the economy:

- raw materials such as sugar, cotton, foodstuffs, lumber, and minerals for use in mills and factories
- labor to extract raw materials
- markets where manufacturers could sell finished products
- ports where trading ships could stop to get resupplied
- profits to use for investing in new factories, canals, and railroads

By the early 1900s, several other European countries and the United States also had far-flung possessions. The development of imperialism made wealthy
countries even wealthier, leading to a great divide between the advanced, industrialized states and the underdeveloped, nonindustrialized states.

**Fordism and Post-Fordism**

In the 19th century, production increased with the shift from a system of cottage industry, in which people would weave cloth and make products in their homes, to a system of large factories with machines powered by water or coal. But each product was often made individually. Early in the 20th century, Henry Ford took another big step in advancing productivity by developing the assembly line, in which an item moved from worker to worker, with each worker performing the same task repeatedly. The use of assembly lines allowed companies to produce more standardized products more rapidly and with less-skilled workers than ever before.

This system of mass production, known as **Fordism**, soon became standard practice across industries. Capitalists copied his methods—as did communists. Ford became a cult hero in Russia because it was through economic efficiency that Russian workers realized they might become productive enough to achieve the goals of communism. As consumers, people appreciated that the cost of goods plummeted. However, as workers, people resented how dull and repetitive the assembly line made work.

Fordism quickly changed manufacturing. One issue was the lack of variety. Every product was identical to every other product. Since not every consumer wanted a black car identical to their neighbor’s black car, companies gradually modified the assembly line process to produce more varied products. These changes added time and cost to the process.

In recent years, with the use of computers and increased automation, every product coming off the assembly line can be different. In modern factories, the substitution principle, in which businesses seek to maximize profit by substituting one factor of production for another, has been applied to a significant percentage of the labor force. Through mechanization, also known as automation, companies have replaced workers with machines. For example, U.S. industrial output doubled between 1984 and 2015—but industrial employment declined by one-third.

Although expensive to install, the machines often save a company money over the long term. They can work 24 hours a day without breaks or vacations, and they produce consistent, high-quality work. The workers who don’t lose their jobs are often trained to do more than one job, so they can rotate among a few different workstations during a day. These changes in the production process constitute the basis of the post-Fordism system.

**Economic Sectors**

Some economists analyze a country’s workforce by dividing it into three sectors according to how closely people work with natural resources. The following chart shows these three sectors for United States history.
THE THREE ECONOMIC SECTORS IN THE UNITED STATES

<table>
<thead>
<tr>
<th>Sector</th>
<th>Task</th>
<th>Examples</th>
<th>Economic Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Extracting natural resources</td>
<td>• Farming</td>
<td>Dominated the economy until the Civil War</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mining</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fishing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Forestry</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>Processing natural resources</td>
<td>• Manufacturing</td>
<td>Significant labor growth 1840s to 1960s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Building</td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>Providing services rather than working</td>
<td>• Marketing</td>
<td>Most people in the U.S. labor force today</td>
</tr>
<tr>
<td></td>
<td>with natural resources</td>
<td>• Banking</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Design</td>
<td></td>
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</tbody>
</table>

The composition of a country’s economy changes over time. When the United States was formed, nearly everyone farmed or did other work in the **primary sector**. Today, in the United States and other developed countries, the primary sector usually employs less than 5 percent of the labor force. In a least-developed country, the figure is over 70 percent.

**LABOR FORCE BY SECTOR IN TWO COUNTRIES**

The **tertiary sector** is also known as the service sector because it consists of providing services to people and businesses. It includes people involved in retail sales, automotive repair, plumbing, the restaurant industries, and accounting. In developed countries, where manufacturing is on the decline, the tertiary sector is expanding and dominating the labor force.

**Refining the Tertiary Sector**

In recent decades, the tertiary sector has gotten so large that economists have begun to divide it into smaller segments:
• The *quaternary sector* is the knowledge-based sector that includes research and development, business consulting, financial services, education, public administration, and software development.

• The *quinary sector* consists of the highest levels of decision-making and includes the top officials in various levels of government and business. A decision made by a country’s president or senior advisors or by corporate executives can affect millions of people.

**Changing Employment Sectors and Economic Development**

As countries industrialized, the primary sector shrank and the secondary sector grew. As part of this shift, countries became wealthier because wages in the secondary sector were higher than those in the primary sector.

In addition to higher wages, the secondary sector jobs also had a greater *multiplier effect*, a term for the potential of a job to produce additional jobs. For example, when a tire manufacturer expanded a plant and created 100 new jobs in a community, the new workers would have more money to spend on food, clothes, movies, and other items from nearby businesses. These businesses would prosper and sometimes add more staff.

However, the multiplier effect also works in reverse. In recent decades, the shrinkage of the secondary sector workforce in the United States and other developed countries has caused many other businesses to suffer as well. In addition, the opening of a new store can have a negative effect on other stores in the region. A large retail store opening in a community might employ hundreds of people—but smaller stores nearby might close or lay off employees.

Governments in developed countries often attempt to replace manufacturing jobs lost because of deindustrialization and automation with new quaternary jobs. Both types of jobs pay higher-than-average wages and both can generate additional jobs. Cities such as Denver, Pittsburgh, and Austin are using quaternary jobs to drive their rapidly growing economies. With research and high-tech jobs flowing into the cities, other sectors of the economy are benefiting, especially entertainment, tourism, and education. This quaternary sector growth also boosts the secondary sector because it requires construction and improved infrastructure. One challenge of shifting from manufacturing to quaternary jobs is that many of the displaced workers do not possess the skills required for the new jobs.

**Theories on Industrial Location**

Geographers have developed many models explaining the geographic distribution of economic activities. By focusing on the key factors in a process, a model is useful for making predictions about how a change in one factor affects the entire process. In 1909, the German economist Alfred Weber developed an influential theory, known as the *least cost theory*, to explain the key decisions made by businesses about where to locate factories.

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Least cost theory attempts to predict the location of a manufacturing site relative to the location of the resources needed to produce the product and where the final product will be sold (market). Weber’s theory focused on three key variables: transportation, labor, and agglomeration.

**The Importance of Weight**

One major factor in the cost of obtaining raw materials and shipping finished products is weight. The heavier an item, the higher the cost of transporting it. Copper ore is very heavy, but most of the ore is waste that is discarded in the refining process. Hence, transporting copper ore is expensive, but transporting refined copper is not. This is known as a **bulk-reducing industry**, a **weight-losing industry**, a **raw material-oriented industry**, or a **raw material-dependent industry**. In bulk-reducing industries, companies try to locate processing plants near the source of raw materials.

Products that are heaviest when finished are in a **bulk-gaining industry** or **weight-gaining industry**, a **market-oriented industry**, or a **market-dependent industry**. Consider soft drinks. The heaviest component of the product is water. Since water is widely available, companies try to add it as close to the market as possible, rather than pay to ship the weight of the water. For example, soft drinks are often sold to restaurants as thick syrup, and then water is added at the restaurant. In bulk-gaining industries, companies try to locate factories near the market.

**The Importance of Energy**

The history of manufacturing demonstrates the importance of a source of power. The type of power influenced where factories were established:

- Water power was not mobile, so early mills and factories were located on streams and rivers.

- Coal could be transported, so companies had wider options about where to locate factories. However, coal is bulky and expensive to transport. It was so important to early manufacturing that industrial plants, even iron mills that relied on a bulky raw material such as iron ore, were still located near coalfields.

- With the development of electricity in the late 19th century, power became even more mobile. It could move through wires. Hence the location of energy sources became less important.

The aluminum industry is one type of industry that is still an **energy-oriented** or **energy-dependent industry**. Even though the aluminum industry requires raw materials such as minerals, the energy demands are so high that factories are built in close proximity to major sources of abundant, cheap power. China and Canada are major producers of aluminum, but Iceland’s production is on the rise because it has abundant and cheap geothermal energy.
Weber's Least Cost Model

Rather than simply studying each industry to see how companies located factories, Weber developed a general theory. He argued that factory owners balance three factors in deciding where to open a factory: transport costs (getting raw materials to a factory and getting finished products to the market), labor costs (the wages and salaries of employees), and agglomeration economics (the spatial grouping of businesses in order to share costs, as when several factories share the cost of building an access road to connect with a public highway). According to Weber's model, companies should minimize transport and labor cost and maximize agglomeration economies.

The Locational Triangle One way to show Weber's model is to use a locational triangle. In this situation, the market for a good is at one location and the resources needed to make the good are obtained at two other locations. These three points make up the points of a triangle.

As Weber realized, transportation costs are important to manufacturers. So whether a raw material loses weight during processing influences where a factory should be. If neither raw material used in production loses weight during processing, then the company gets no advantage from locating the factory near either location. The manufacturing could take place at the location of the market.

If only one raw material loses weight when processed, then the company can save money by moving production close to the location for that raw material. It does not need to pay the cost of shipping the full weight of the material when only part of it is needed.

In most cases, both raw materials lose weight as they are processed. When this happens, then the manufacturing site (D) will be somewhere between the locations of the two raw materials (A and B). The intermediate location will be closer to the one that loses the greater percentage of its weight. The finished product would then be shipped directly from the processing facility (D) to the market (M).
Sometimes the cost savings from either cheaper labor or from agglomeration economies could be greater than the savings derived from locating at the cheapest spot relative to transport costs. In these cases, Weber recognized that business owners should choose to locate where the cheaper labor or benefits from the agglomeration economies existed.

**Applying Weber’s Theory** Models are simplified versions of a complex process. But they are very useful for making predictions, understanding how changes in one factor affect changes in other decisions. Applying a model usefully requires recognizing how it differs from reality.

<table>
<thead>
<tr>
<th>COMPARING WEBER’S THEORY AND REALITY</th>
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<tbody>
<tr>
<td><strong>Issue</strong></td>
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<tr>
<td>Uniformity of Area</td>
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<td>Labor</td>
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<td>Raw Materials</td>
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<tr>
<td>Number of Products and Markets</td>
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<tr>
<td>Transportation Costs</td>
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<tr>
<td>Influences on Location</td>
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<tr>
<td>Significance of Costs</td>
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</table>

**Additional Models** Other geographers have used different assumptions than Weber did. For example, Weber emphasized minimizing costs while August
Losch argued that higher expenses for transportation, labor, or raw materials were justifiable if they resulted in higher profits.

Another model is Harold Hotelling's linear city model which explains the behavior of two competing shops. The classic example is that if two food vendors want to locate their carts on a beach, they should locate next to each other in order to split the market and maximize revenue and market share.

**Other Considerations and Factors** One refinement to Weber's theory, and to most theories, is that not all industries make decisions the same way. For example, the cost of raw materials is more influential for a steel plant than it is for a factory making high-end clothing. It is useful to think of a hierarchy of locational factors as shown in the chart below—the most important factors used to pick a general region or state and secondary factors used to narrow down the location to a particular county. Finally, another group of factors may be used to determine the exact site of the factory.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Example</th>
<th>Factors</th>
</tr>
</thead>
</table>
| Large   | Region or state, such as northeastern United States | • Closeness to the market  
           |                                                               | • Closeness to raw materials  
           |                                                               | • Availability of adequate labor supply  
           |                                                               | • Quality of transportation network  
           |                                                               | • Adequate supply of power |
| Medium  | City or neighborhood                         | • Level of taxes and subsidies  
           |                                                               | • Location of highways and on/off ramps  
           |                                                               | • Location of railway lines  
           |                                                               | • Availability of a skilled work force  
           |                                                               | • Quality of municipal police, fire, and other services  
           |                                                               | • Quality of education and recreational facilities for employees and their children |
| Small   | Specific property                             | • Large and flat piece of land  
           |                                                               | • Adequate municipal water and sewer lines  
           |                                                               | • Highways and public transit routes |

Weber's model discussed labor but in a very simple way. It did not differentiate among different types of labor. But some industries require people with very specific skills. High-tech companies want people trained in the computer or engineering fields. Consequently, they often locate close to major...
training institutions, such as colleges or universities. These industries are known as labor-oriented industries or labor-dependent industries.

While geographers debate how to refine models such as Weber's and recognize the value of different assumptions, they recognize the value of models. They provide the most useful way to recognize patterns in making decisions. Most importantly, they help people make predictions. Weber's model and other models inspired by it remain valuable tools for understanding the spatial distribution of factories, offices, and all types of business that employ workers.

Other Locational Issues

Weber's theory also addressed other issues. Because cars are considered a "bulk-gaining product," car assembly plants have traditionally been located close to where the greatest numbers of customers live. This remains true in the United States; most car assembly plants are located in the eastern third of the country. Older plants are centered in northern states—Michigan and Ohio. Newer plants, often owned by foreign car companies, are located farther south. These states are attractive to companies because they offer lower costs because of weaker labor unions, generous state incentives, and a growing population of consumers.

Significance of Other Factories In some cases, the location decision for a factory is dependent upon the location of other factories, a condition referred to as locational interdependence. Being near similar factories allows the businesses to make use of the same services, such as transportation firms or accounting firms that might specialize in servicing their industry. It also allows firms to keep an eye on their competition and to occasionally hire away talented young employees trained by someone else.

In addition, the finished product from one factory could be an input at another factory. In this case, it is somewhat of a market-dependent situation. For example, an auto assembly plant is the market for the output from an auto parts factory. Consequently, the location of the parts factory is very dependent upon the location of the assembly plants.

Auto assembly plants make use of just-in-time delivery, a system in which the inputs needed in the assembly process arrive at the assembly plant very close to when they are needed. Using this system reduces expensive storage costs and avoids tying up money in inventory—but at the risk of running short. It works only if a factory has confidence in its suppliers, its communications and transportation systems, and its ability to predict its need accurately. Suppliers also need to consider transportation costs and the time it takes to get their parts to the assembly plant.

Significance of Government Government policies can often influence location decisions. Many governments offer a variety of incentives to get companies to locate their factories in specific areas:
- At the international level, trade agreements such as NAFTA or the European Union can change the rules of how business is conducted and thereby change locational factors.

- At the national or regional level, governments hope to attract industries to encourage economic growth. Many businesses prefer to do business in the United States rather than in Russia because U.S. procedures are more predictable and transparent.

- At the local scale, communities commonly provide incentives such as tax breaks and low-interest loans to attract companies.

**Tertiary and Quaternary Considerations**

For face-to-face retail businesses or services, such as a grocery store or a physical therapy center, being conveniently located close to a large customer base or market is crucial. However, if the retail business is virtual, then proximity to the customers is not especially important as long as there is an efficient and affordable delivery system available. Bookstores were once mostly small, intimate, neighborhood businesses. Most of these went out of business as they were replaced by outlets of large bookstore chains. Then many of these chain stores went out of business, replaced by online sellers.

**Flexible Locations** If the service is an informational type of service, such as a call center, there is far greater flexibility in locational requirements. An office can be set up anywhere with good communication systems. All the business needs to be successful is a group of trained people who can speak the language of their customers, computers, and good phone and Internet links.

Over the past two decades, hundreds of call centers serving U.S. customers have set up in rural areas of the United States, Canada, India, and the Philippines to take advantage of high unemployment and low wages. Towns and cities trying to generate economic development opportunities often recruit these types of businesses, since the locational demands are minimal. However, because of these minimal demands, these businesses are footloose, meaning they can pack up and leave for a new location quickly and easily.

**Prestige and Location** Sometimes companies have different locational needs for different parts of the business. A corporation might want its main office for its top executives to have a high profile to signal its power. So the company might choose a location on the upper floors of a large building in the downtown of a city. Such a location also allows the executives to easily interact with executives from other nearby business institutions. These types of spaces, known as front offices, are very expensive, and therefore businesses do not want to occupy more space than necessary.

A corporation might decide that the rest of its employees do not need to be in high-profile locations. They could be located in much cheaper office spaces,
known as back offices. Since the back office workers are able to communicate with their customers and the head office through the computer and phone systems, they can be located anywhere these technologies are available.

Some companies move their back offices to other countries, a process known as offshoring. Companies will locate services in other countries if the costs of doing business are lower and worth the risk of moving some operations overseas. Many software and manufacturing companies in the United States and Europe locate facilities in India and China to take advantage of the highly skilled but lower-cost labor.

Outsourcing In order to lower costs or just focus on their core business, many companies outsource a variety of business functions. Outsourcing is contracting work out to noncompany employees or other companies. The contracting company might be less expensive because it specializes in the work and does it more efficiently or because it hires workers for lower wages or benefits. Companies often outsource work on their taxes and payroll.

Sometimes companies will both offshore and outsource. An excellent example is how Boeing developed and built a new airplane, the 787 Dreamliner. The planes were designed by Boeing in Seattle, the nose section was outsourced to a company in Kansas, wing tips were made in South Korea by Korean Air, wings were assembled by Boeing in Canada, and final assembly was done by Boeing outside of Seattle. The final product demonstrated outsourcing, offshoring, globalization, and the international division of labor.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Change in Number of U.S.-Based Employees, 1999 to 2008</th>
<th>Change in Foreign-Based Employees of U.S.-Based Corporations, 1999 to 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>-1,938,000</td>
<td>+243,000</td>
</tr>
<tr>
<td>Nonmanufacturing</td>
<td>+35,000</td>
<td>+2,115,000</td>
</tr>
<tr>
<td>All Industries</td>
<td>-1,903,000</td>
<td>+2,358,000</td>
</tr>
</tbody>
</table>

Source: Adapted from David Aikig, “Is Offshoring Behind U.S. Employment’s Current Problems?” Data from Bureau of Economic Analysis.

GEOGRAPHIC PERSPECTIVES: NEIGHBORHOODS FOR NEW CLASSES

Prior to the Industrial Revolution that began in the mid-18th century, most people in European societies were poor farmers who lived in rural communities. A few were wealthy nobles who lived on estates or in the centers of cities. With industrialization, the number of people who belonged to neither of these classes expanded dramatically.
Middle Class
Many of the jobs that expanded, such as factory managers, business owners, and professionals, made people wealthier than farmers but not as wealthy as nobles. Hence the people in these expanding categories became known as the middle class. They lived and worked mostly in urban areas, but in widely scattered locations. Some could afford to live in the center of the city. Others lived in new areas built on the outskirts of an urban area. And some lived above their shops, wherever they were located. The spatial distribution of the middle class made building a sense of unity in the new class difficult.

Working Class
The other type of job that greatly expanded in numbers was working in factories. People doing these jobs became known as the working class. They found housing in urban neighborhoods outside the central business districts. The spatial dimensions of their lives—toiling together in large groups in factories and living near each other in distinctive neighborhoods—created strong social bonds among them. These bonds led them to form labor unions, which gave them power to push for higher wages and better working conditions.

KEY TERMS

<table>
<thead>
<tr>
<th>Industrial Revolution</th>
<th>agglomeration economies</th>
<th>energy-oriented or energy-dependent industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>imperialism</td>
<td>isotropic plain</td>
<td>labor-oriented or labor-dependent industries</td>
</tr>
<tr>
<td>assembly line</td>
<td>least cost theory</td>
<td>locational interdependence</td>
</tr>
<tr>
<td>Fordism</td>
<td>locational triangle</td>
<td>just-in-time delivery</td>
</tr>
<tr>
<td>substitution principle</td>
<td>bulk-reducing industry or weight-losing industry</td>
<td>footloose</td>
</tr>
<tr>
<td>post-Fordism</td>
<td>or raw material-oriented or raw material-dependent industry</td>
<td>front offices</td>
</tr>
<tr>
<td>primary sector</td>
<td>bulk-gaining industry or weight-gaining industry or market-oriented or market-dependent industry</td>
<td>back offices</td>
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<tr>
<td>secondary sector</td>
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<td>offshoring</td>
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<td>tertiary sector</td>
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<td>quaternary sector</td>
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<td>quinary sector</td>
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<td>multiplier effect</td>
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