

**Operations Management  
at Vulcan Materials Company  
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When asked to describe the first thoughts that come to mind when the word “mining” is mentioned, many people picture young, over-worked and under-paid children with coal dust covering their faces or; perhaps, corrupt labor unions and mine explosions. These images, though regrettably a part of the history of mining, do not accurately depict present day businesses such as Vulcan Materials Company (VMC), or give the recognition deserved for being such a vital asset to the American economy. Even less recognized by society is the fact that VMC, which is the leading producer of construction aggregates in the U.S. (Vulcan Materials Company, 2009), has behind it a very meticulous operations management system, giving VMC the competitive advantage to be successful.

Fully appreciating key points of operations management (OM) and the vital role they play in businesses begins first with learning about what VMC does, then understanding what OM is, and finally looking at how OM is best demonstrated in the different areas of Vulcan’s management structure.

#### **An Introduction to Vulcan and the Kennesaw Quarry**

VMC became a publicly held company in 1956. In the Southeast division, (Georgia and South Carolina), VMC currently operates 35 granite and limestone quarries. The company produces crushed stone, sand and gravel, and other construction aggregates. Around 47% of aggregates produced are used to build and maintain highways, bridges, roads, airports, railroads, and water and sewer

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systems. Other aggregates usage includes residential, commercial and industrial building construction (Vulcan Materials Company, 2009).

### A Brief Look at Operations Management

Operations management “is the set of activities that creates value in the form of goods and services by transforming inputs into outputs” (Heizer & Render, 2008, p.4). OM is one of three (marketing and finance/accounting being the other two) important functions for any organization that creates goods or services. According to Heizer & Render (2008), “all good operations managers perform the basic functions of the management process. The management process consists of planning, organizing staffing, leading, and controlling. Operations managers apply this management process to the decisions they make in the OM function” (p.7). Heizer & Render (2008) point to ten main critical decisions of operations managers: (1) design of goods and services; (2) managing quality; (3) process and capacity design, (4) location strategy; (5) layout strategy; (6) human resources and job design; (7) supply chain management (SCM); (8) inventory, material requirements planning, and JIT; (9) intermediate and short-term scheduling; and (10) maintenance. Of these ten, seven will be discussed in this paper.

### A Look at VMC and Influences from OM

Using examples from Vulcan’s business operations, this report will explore how specific OM decision areas currently affect, have affected, or could possibly affect operations. Analysis is done by looking at each of the seven decision areas discussed in this paper separately. In addition, process and capacity design and

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supply chain management will be discussed in greater detail by taking a closer look at how these areas are handled at Vulcan.

### Process and capacity design

In OM, process and capacity design deals with finding the best way to produce a product once it has been decided what is going to be produced; in this particular case, construction aggregates. According to Heizer & Render (2008), “every good or service is made by using some variation of one of four process strategies: (1) process focus, (2) repetitive focus, (3) product focus, and (4) mass customization” (p. 256). VMC is a product focused company.

An example of Vulcan’s process is getting the required permit to work, stripping the soil from the top of the rock supply, drilling and blasting, loading and hauling rocks from the pit to the production area, crushing and re-crushing rocks, separating the size of rocks, storing the rocks on stockpiles, and finally weighing and shipping of the finished product (E. Parivechio, personal communication, January 22, 2010). A product focus, also called continuous process, has very long, continuous product runs. These organizations have an “inherent ability to set standards and maintain quality” (Heizer & Render, 2008, p. 259).

Product focus differs from the other processes for a number of reasons. First, the equipment used is special purpose. Many of the machines used at VMC Kennesaw quarry cost more than \$1 million each and they do a single specialized

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job: move rock from point A to point B. Second, swift movement of units through the facility is typical. Finished goods are usually made to a forecast and stored. For example, stockpiles (discussed later in further detail) represent inventory that is being stored and waiting for customers to come and pick up. Finally, scheduling is relatively simple and concerned with establishing a rate of output sufficient to meet sales forecasts. At the Kennesaw quarry two shifts run continuously. In addition to the process design, managers must also keep capacity design in mind.

Design capacity is the theoretical maximum output of a system in a given period under ideal conditions (Heizer & Render, 2008). For VMC, capacity design has to be thought out decades in advance. To illustrate this point, consider that it takes approximately ten years from the time a rock supply is found and the land is purchased to the time when the first load of rock is sold and shipped. There has to be a lot of detailed planning before a plant ever goes up.

Diving deeper into the topic of process and capacity design, there is a pressing matter affecting all businesses worldwide: sustainability. As in any business, the idea of sustaining one's business for the longest amount of time possible is the ultimate goal. The challenges of sustainability stem from the fact that it not only deals with a business continuing to make profits but also has come to have more environment friendly associations as well. In the Harvard Business Review article *Why Sustainability is now the Key Driver of Innovation* (2009, September), the authors discuss how "becoming environment-friendly lowers costs because companies end up reducing the inputs they use...and that smart companies

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now treat sustainability as innovation's new frontier" (p. 58). At VMC, the idea of sustainability can be seen firsthand. The Kennesaw quarry uses sustainable practices every day. Possibly the most notable practice is their ability to recycle all the water that is used from washing impurities off the rocks and then filtering the dirty water through a waterfall back into the retention pond to be used again.

Recycling water is not the only sustainable practice at VMC. Another excellent example of how the company plans for the future is, once all the rock from the quarry has been extracted, the pumps from the retention pond are pulled out and the pond is allowed to fill back up, making the area suitable to grow back naturally, almost as if the quarry had never been there in the first place. In addition, many of VMC's quarries have acreage set aside as wildlife habitats that are certified by the Wildlife Habitat Council, making the plants much more eco-friendly (Vulcan Materials Company, 2009).

### Managing quality

As mentioned previously, VMC's product focus gives them an inherent ability to maintain quality. VMC has a very high standard of quality. In fact, their own requirements for quality exceed those of the government. There are two quality control groups on premise at all times monitoring the size, shape, and overall quality of all shipments.

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VMC has such a high standard of quality that once rock has been sold and taken off property, it cannot be returned and resold to another customer. The returned product is recycled in other ways since VMC cannot assure its quality. VMC's consistent quality initiatives have resulted in the recognition of numerous awards such as being named to *Fortune* magazine's list of America's Most Admired Companies from 1999 through 2004, 2006 and 2007.

When defining quality, there are several categories to use such as user based, manufacturing based, and product based. Vulcan's definition of quality is product based because of the precise and measurable values that are associated with Vulcan's standard of quality. Besides being a critical element in operations, quality has other implications. Company reputation, product liability, and global implications are all other reasons why quality is important (Heizer & Render, 2008).

### Supply chain management

SCM is the "management of activities that procure materials and services, transforming them into intermediate goods and final products, and delivering the products through a distribution system" (Heizer & Render, 2008, p.434). A company's supply chain, according to Dittmann, Mentzer, & Slone (2007, September), "can deliver significant, tangible benefits in the form of reduced working-capital investment, faster inventory turns, lower fixed costs, and greater return on assets" (p. 117). A supply chain managers' job requires more than just

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overseeing the physical process of goods being made, SCM also includes suppliers, customers, distributors, forecasting, accounting, and a number of other functions.

Vulcan's supply chain encompasses more than 250 vendors and over 150 customers (E. Parivechio, personal communication, January 22, 2010). To reduce liability and cost, VMC subcontracts portions of the supply chain out. For example, at the Kennesaw quarry, Vulcan enlists the expertise of Austin Powder Co. to do all of the blasting that is required on premise. Vulcan also subcontracts companies such as Mine Safety Training, Inc. located in Jasper, GA for annual refresher training. This approach of having many suppliers is incredibly cost effective by holding the supplier responsible for maintaining necessary technology, expertise, and forecasting abilities, as well as cost, quality, and delivery competencies (Heizer & Render, 2008). Once rock is crushed down to the correct size and meets customer specifications, the finished product is held on site in a type of pass-through facility. Once again, the actual shipping of the product is not done by Vulcan. This job is contracted out for distribution by truck, railroad, airfreight, or waterway. By subcontracting work out to various specialized companies, Vulcan succeeds in lowering costs in the company's supply chain.

### Inventory management

As mentioned earlier, Vulcan keeps inventory in the form of stockpiles. These stockpiles are literally piles of rock that have been sorted into different sizes and stored outside for customers to pick up and haul away. Inventory is managed in two

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ways. First, the county's tax assessors go up in airplanes and take aerial views of the stockpiles. Using special formulas based on the measurements of the stockpiles in the pictures taken, the assessors are able to estimate the amount of rock on the site. These calculations are not always the most accurate, so, Vulcan also keeps track of their inventory. Using cycle counting, based on what conveyors are running and for how long, Vulcan can get a precise calculation of inventory on hand.

There are several different types of inventory. Raw materials inventory, WIP, and finished-goods inventory all represent inventory used by VMC. Examples of each type can be viewed in terms of where the rock is in the supply chain. At the very beginning of the process, the rock has not been blasted out of the ground yet. This represents the raw material inventory. Once the rock has been blasted and extraction has begun, it becomes work-in-progress inventory. This is the rock that is moved by truck from the extraction point to the gyratory crusher, (which is a very powerful machine that crushes the rock to a specific size). Once the rock goes through the crusher and is the correct size and quality, it is transported one last time onto conveyors that sort the finished good into different stockpiles based on size.

### Human resources and job design

The objective of a human resource strategy is to manage labor and design jobs so people are effectively and efficiently utilized (Heizer & Render, 2008). VMC values their employees very highly. In the company's mission statement Vulcan says

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*they recognize that success in all of our activities is related directly to the talents, dedication, and performance of our employees throughout the company.* This level of recognition instills mutual commitment and mutual trust between both management and employee.

Constraints on Vulcan's human resource strategy have changed over the years largely due to the advance in technology. There are other constraints such as labor planning (which will be discussed), job design, and labor standards. In today's economy, employment stability is becoming a major focus. The Kennesaw quarry currently maintains approximately 60 employees throughout the year. This number is down from 87 employees just a year ago. Despite the economic downturn, the Kennesaw quarry has not laid off any employees. Instead, the company will do whatever can be done to either transfer an employee to a different quarry or work with employees on scheduling (E. Parivechio, personal communication, January 22, 2010).

## Maintenance

Maintenance at VMC is a necessity. This area of OM accounts for a large portion of the costs incurred by the company. At Vulcan, preventative maintenance and increasing repair capabilities must occur on a daily basis. An event as seemingly minuscule to another company, such as a flat tire, is an enormous catastrophe if it occurs at the Vulcan plant. In a personal communication with Edith Parivechio, community relations coordinator for the southeast division, she approximated that

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a set of tires (four tires) for one of Vulcan's hauling machines would cost \$35,000.

To prevent issues with any of the machinery, Vulcan uses fully automated systems that are able to track scheduled maintenance and anticipate any problems that may arise.

### Layout strategy

According to Heizer & Render (2008), layout is one of the key decisions that determine the long-run efficiency of operations. The strategic importance of layout design is based on a company's needs in terms of facilitating the flow of materials, people, and information within and between different areas.

The repetitive nature of moving rock from the pit to the conveyors makes Vulcan best suited for a product-oriented layout. A good layout design requires many considerations such as material handling equipment, capacity and space requirements, environment and aesthetics, flows of information, and cost of moving between various work areas.

Not all layout decisions are always made with all the information needed, leading to the possibility of making costly errors that can affect future profits. For example, when the Kennesaw quarry built their brand new \$28 million plant, the fact that it was built right on top of a large granite formation was overlooked. This could possibly prove to be a very costly error ten years from now.

### Summary

After reading this paper, a new image should come to mind when thinking about the mining industry. Instead of the previous images of over-worked and under-paid children, a picture of skilled workers, specialized equipment, intricate process design, and construction aggregates of superior quality should be a few of the images that appear. This paper has shown that, despite the ability to seem exceptionally broad, OM does in fact have several key applications in business management today in companies such as Vulcan. Using decision areas such as process and capacity design; managing quality; supply chain management; inventory management; human resources and job design; maintenance; and layout strategy, managers at VMC are able to achieve competitive advantage over other companies that do not utilize these tools as efficiently.

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