

Chapter 14

Productivity

What is productivity? Productivity is a ratio of the outputs from the operations management transformation process to the inputs to the transformation process as shown in Equation 14.1.

$$Productivity = \left(\frac{outputs}{inputs} \right)$$

Equation 14.1: Basic Productivity Formula

Haven't we already discussed this once when we talked about measures of competitiveness? Yes, we discussed this briefing in Chapter 1 when we introduced the concept of Operations Management. However, we need to discuss it in greater detail to look at the uses of productivity calculations and how the calculations are made.

The Association for Supply Chain Management defines productivity as: “An overall measure of the ability to produce a good or a service. It is the actual output of production compared to the actual input of resources. Productivity is a relative measure across time or against common entities (labor, capital, etc.). In the production literature, attempts have been made to define total productivity where the effects of labor and capital are combined and divided into the output.”⁸¹

Productivity is impacted by many factors. Consider the impacts to productivity from the March Madness every year when employees are more concerned about busted brackets than

⁸¹ ASCM dictionary app, “productivity.”

customer support. Or the impacts to productivity every time Louisiana has to button down for impending hurricanes rather than process customer orders. Think about the impacts in 2020 to productivity as employees were forced to work from home. How many did not have reliable internet connectivity or the same resources available in the office and who was checking on the employees to make sure that they were actually working?

Why Should I Care About Productivity?

As was mentioned in Chapter 1, productivity is a commonly used measure of competitiveness between companies, individuals, and plants within a company. Productivity can also be used a measure of efficiency for a company. It also ties to quality – if we have to rework products, then we are not being productive. It is also tied to profitability. The more productive a company is, the more profitable it will be. It may also be used as measure of the engineering efficiency of a process or transformation activity.

Productivity is usually expressed in units of output per unit of inputs. For example, it may be displayed or expressed as labor productivity and shown as dollars or units produced for every labor hour or labor dollar invested.

Productivity is simply the ability to produce goods or services compared to the resources to produce them. So, obviously the higher the costs to produce a product or service, the lower the productivity rate will be. It is incumbent on all managers at every level to control these rates of investment while trying to maximize the outputs. This does not mean working at levels that burn out the employees or wear out the machines just to hit productivity targets. Decisions on productivity need to be long term decisions and not short term/short sighted decisions.

Productivity and Specialization

Does specialization increase or decrease productivity? I think the answer to this question is, “it depends.” Too much specialization leads to idle time for employees in some specializations thus decreases overall productivity. But the flip side to this argument is that if an employee is a specialist in a particular area, they should be very productive at what they do with little to no rework of their production.

The other argument is that specialization may lead to boredom. If an employee only does one thing all the time, they may in fact get bored and start making boredom mistakes or taking short cuts in the production cycle or they may develop repetitive motion injuries which may lead to decreased productivity. Harley-Davidson tries to prevent the repetitive motion injuries and boredom by assigning workers to a team that frequently changes activities in the assembly plant. The collateral benefit of this type of job rotation is that the workers get to see the impacts of different functions on the overall product quality.

Productivity and Technology

What about technology? Does it always increase productivity? Personally, I don't think so. It should, after all that is the goal of technology. However, how productive are you when your internet connectivity goes down? How productive are you when you are constantly bombarded with e-mails?

While technology should increase productivity, some workers are intimidated by technology advances or abuse the technology available. How much time in any given workday is devoted to surfing the web or sending personal e-mails? Or how much productivity is lost when someone sends you a document with corrections that need to be made and you realize that the time it took to write the e-mail and make the annotations on the document took longer than it did

to actually change the document and simply ask for comments? How much time is lost trying to make PowerPoint slides perfect with animations and graphics flying in and flying out? This is why a previous Chief of Staff for the Army dictated that slides would be plain, to the point and no graphics or animation.

Factors that may Affect Productivity

Technology innovations may impact productivity. In the short run, these innovations have to be mastered and may decrease productivity. Once mastered, these innovations should increase productivity.

Economies of scale can impact productivity. The more items that a company produces from the operations management transformation process, the more productive they should be.

Employee training/motivation/engagement can impact productivity. If employees feel that they are appreciated they will work better and be more productive. When employees feel unappreciated, their productivity usually decreases, or they leave the company. Employee retention or turnover rates can severely impact productivity. There was a facility in West Memphis, Arkansas a few years back that was experiencing a 95% turnover rate in employees. They were constantly hiring and training workers and could not reach respectable productivity rates with the constant inflow of new employees. One company that I worked with in Southern California experienced a 50% turnover rate for their employees. The result was a continual hiring action and training of new employees and the necessary certification of the employees only to lose them after the certification. The reason most of the employees left was that there was a distribution center less than a half mile away that was paying almost double for a certified/licensed forklift operator. The reason they could afford this was because the other company was paying for the training and certification but not recognizing the new skills of their

employees with a pay raise. They could not afford the pay raise because they were constantly spending their money on training of new employees.

Calculating and Using Productivity to Assist in Decision Making

Productivity calculations allow managers to compare how their company is doing in relation to the competition, how their company is doing in the international markets, compare different processes within the company, or compare different plants/facilities within the company. For example, a company may want to see how its West Coast facility is doing compared to its East Coast facility. Then the company can delve into why the facilities are not at the same productivity levels. This could be tied to management, facility constraints, labor issues or different machines. It also allows countries to compare their productivity to other countries.

Partial Productivity

Partial productivity is usually relatively easy to calculate because it is based on one particular aspect of inputs. The problem with partial productivity is that it may give a false picture of the true productivity. Since companies are tempted to use that statistic or metric that makes them look better, they may use a partial productivity measure that is better than the overall productivity. Partial productivity is calculated using only one factor as shown in Equation 14.2 and Example 14.1.

$$\textit{Partial productivity} = \textit{outputs/single factor inputs}$$

Equation 14.2: partial productivity

$$\textit{Outputs} = 500 \textit{ items per hour}$$

$$\textit{Inputs} = 40 \textit{ labor hours}$$

$$\textit{Partial Productivity} = 500/40 = 12.5 \textit{ items per labor hour}$$

Example 14.1 Partial Productivity

Multi-factor Productivity

This calculation uses more than one factor for the productivity calculation. If we add in labor costs and material costs to Example 14.1, we will see the multifactor productivity calculation as shown in Example 14.2

$$\text{Outputs} = 500 \text{ items per hour}$$

$$\text{Inputs} = 40 \text{ labor hours}$$

$$\text{Labor costs} = \$25/\text{hour}$$

$$\text{Material Costs} = \$1500/\text{hour of operations}$$

$$\text{Multi-factor Productivity} = 500 \text{ items}/((40\text{hours})(\$25/\text{hour})+(\$1500/\text{hour}))$$

$$500 \text{ items}/(\$1000+\$1500)$$

$$= .2 \text{ items/dollar invested}$$

Example 14.1 Partial Productivity

Total Productivity

Total productivity takes into account every input into the transformation process. Total productivity is a better metric for managing productivity and profitability than single factor or partial productivity.

Changes in Productivity

Hopefully, we are measuring productivity growth, but it may be productivity decline as well. The change in productivity calculation is shown in Equation 14.3 and Example 14.3. This calculation is usually shown in a percentage of growth or decline.

$$\text{Change in Productivity} = (\text{Current Productivity} - \text{Baseline Productivity}) / \text{Baseline Productivity}$$

Equation 14.3 Change in Productivity Calculation/Equation

Base year productivity = 16,000 produced per hour

Current year productivity = 22,000 produced per hour

Change = (22,000-16,000)/16,000 = 37.5% increase in productivity

Example 14.3 Change in Productivity

Productivity Assumptions

There are at least two assumptions that I believe should be factored into every productivity calculation. The first is that the outputs are quality outputs – if not, then we are not being productive, I don't care how many we are making. The second assumption is that someone is buying what we are making. If everything we make or any of what we make goes on the shelf and no one buys it, then we are not being productive because we are adding value.

Summary

Productivity is critical to success in business and operations. It is important to know what it is, how it is calculated, how it is used, and the two basic assumptions built into every productivity calculation.