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The Easy Way To See If You Have A "Hidden Factory" Inside Your Operation

Abstract: This is an example of the value of identifying the variability in your business processes and removing them before spending money on new capital works. A simple production rate distribution bar chart shows you whether you have a "hidden factory" and how big it is.

Keywords: frequency distribution, production rate chart, throughput performance curve

When a process is run, it produces a range of outputs that are its characteristic signature—you get what the process does. Your process variability produces a frequency distribution of results. The repetitiveness of outcomes form a distribution. When you make a distribution curve of production rate data and you see a long tail on the poor performance side, like the left-hand side of the production rate frequency bar chart in Figure 1, you've got a "hidden factory" in your operation.

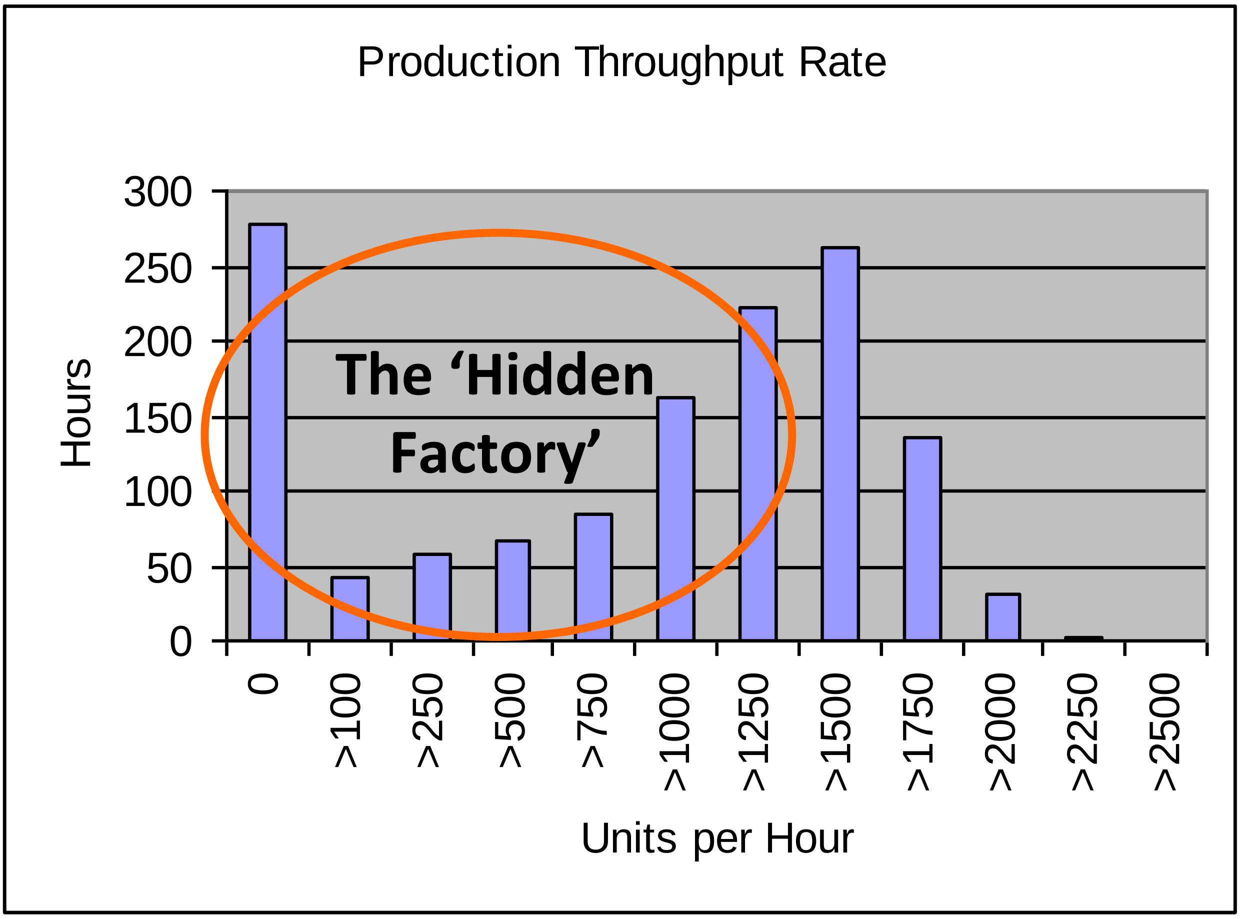

Figure 1 The Low Production Rates In the Bar Chart Tells You A Hidden Factory Exists

The simple bar graph shows production rate trended from an ore-processing plant feed conveyor. It is the hourly production rates in a milling operation running 24 hours a day, seven days a week during eight consecutive weeks. It contains a lot of valuable information about the operation's capacity as well as a clear indication that the business is suffering from wild fluctuations in its production throughput. Examination of the graph provides insight into the facility's dilemmas.

The eight weeks of production shown on the graph represent 1,344 production hours. For 275 hours, there was no production, so for 20% of possible production time, the plant was standing still. The plant design capacity is 1,500 units per hour. For 615 of the remaining hours, 57% of the time it was running, it delivered substantially less than the designed production rate. The actual average throughput for the eight weeks was 1,000 units per hour, which is two-thirds of design duty. This facility is suffering from severe production problems and needs to investigate why it is not producing consistently at design capacity.

There are obvious questions to ask of a plant with this extent of variability in performance. What is causing the stoppages and below-design throughput so often? If the plant can produce at higher rates by accidents of circumstance, then what could be consistently produced if those circumstances were deliberate? It would be sensible to identify the causes of the disastrous production losses and solve them while making the fortuitous events of the past intentional. The total "lost" throughput represented by the work stoppage and slow running, plus the higher production rates available from reengineered capacity, means that this operation has plenty of opportunity to deliver a large production increase without significant capital investment.

There is additional information in the graph. It is clear that for a significant number of hours, the plant ran above its design rate. There are two possibilities here. One is that in trying to make up for lost production, the plant was overloaded, which then led to even more equipment failures and added downtime. The second is that the plant could be run at more than its design duty. Confirming each possibility requires an engineering design investigation. There is a good chance that with minimal engineering changes, the plant could be run consistently at 2,000 units per hour, which is one-third greater than the current design capacity and twice the current average production. The overstressing of parts would be a major concern at the increased production rate and would need to be addressed by a full design review. An operating risk analysis would be conducted and problems designed out as part of the decision to increase production to a higher rate than the original design.

This company's decision to spend $250 million on a major capital upgrade to boost production 50% may not have been necessary. By recovering the downtimes and low production rates and reengineering bottlenecks for higher throughput, the extra capacity was probably achievable with the old plant. It was only necessary to conduct root cause investigations on why the production losses were occurring and how to solve them. The financial return on such an investment would be unbelievable. All of these options become clear simply by measuring production variability.

Constructing a graph like that in Figure 1 requires collecting the hourly production figures for a sufficiently long time to observe the full range of variability affecting the process. The figures show a range of performance around a mode value (the quantity in a data set that occurs most often). The extent of the spread below the mode indicates whether there are production problems hampering throughput. The range of spread above the mode indicates whether there is over capacity available. If the spread is tight about the modal production rate, then the throughput is stable, though not necessarily optimal. But if the spread below the mode is wide, as in Figure 1, then the plant has "hidden" efficiency opportunities to improve its production performance.

When production throughput graphs have a wide spread of production rates, there is potential to increase plant capacity by removing the causes of operating losses with minor engineering upgrades or removing the variability by adopting improved procedures and useful training. Before you invest more capital to expand plant capacity, investigate the variability of current production, as there may already be a "free" hidden factory within your plant.

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