

Start Reading Your Production Outcome Distributions

Abstract

Start Reading Your Production Outcome Distributions: W. Edwards Deming, the late quality guru credited with launching Japanese industry on its global quality dominance of the late 20th Century, complained bitterly that Western managers looked at the wrong KPIs (Key Performance Indicators). The important business KPIs were not financial, because they were historic indicators. The important business indicators were the distributions of process performance, because they indicated process behaviour and warned of what was to come. A distribution curve of process performance contains truly insightful information on the cause of the performance. With that information you know what to do to improve your company.

Keywords: business process management, process distribution,

What does the distribution curve below tell you? There are great stories in it. Stories and messages that every manager, supervisor and engineer needs to be able to read and understand.

The distribution is the throughput rate variance over a eight week period of an iron ore conveyor. It draws from a stockpile and feeds to a crusher at the front end of an ore crushing circuit. The design rate is 1500 metric ton per hour and the plant operates 24/7.

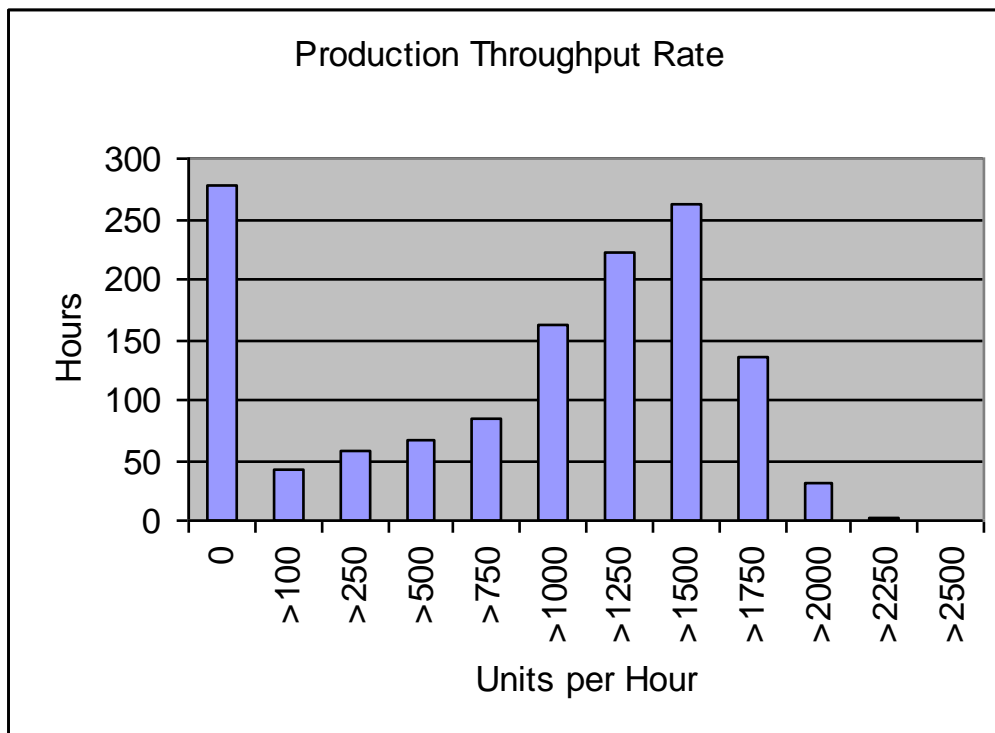


Figure 1 Conveyor Feed Distribution Curve

The first piece of important information that is in the distribution is the size of the ‘hidden factory’. The ‘hidden factory’ is seen in Figure 2. It is all the lost time and slow production rate in the distribution plot below the design rate. For 900 hours out of 1344 hours production was stopped or below designed capacity.

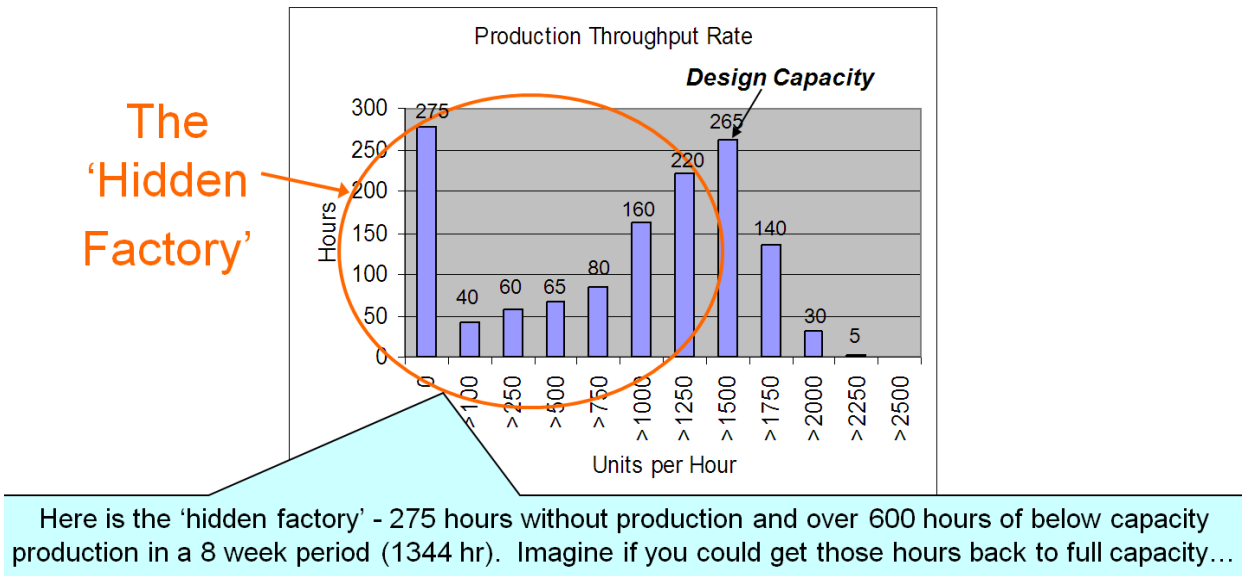


Figure 2 The 'Hidden Factory'

At the other side of the distribution is the 'broken factory' of Figure 3. This is the hours that the plant ran above design duty during which Production induced endless future failures into their plant and equipment. You cannot run your plant at 125% of rated duty without consequences. You can make your plant and equipment work harder, but there will be serious failures and breakdowns to come because of those decisions. At overload duty the working parts are so heavily stressed and fatigued that later they fail even when you run at below rated loading.

You can imagine the poor Production Manager during those eight weeks looking everywhere to get more tonnage out. With so much throughput being lost in the 'hidden factory' they would be very worried as to how they were ever going to meet the delivery schedule. How tempting it must have been to them to run the plant hard and make up for lost tons. What a great mistake!

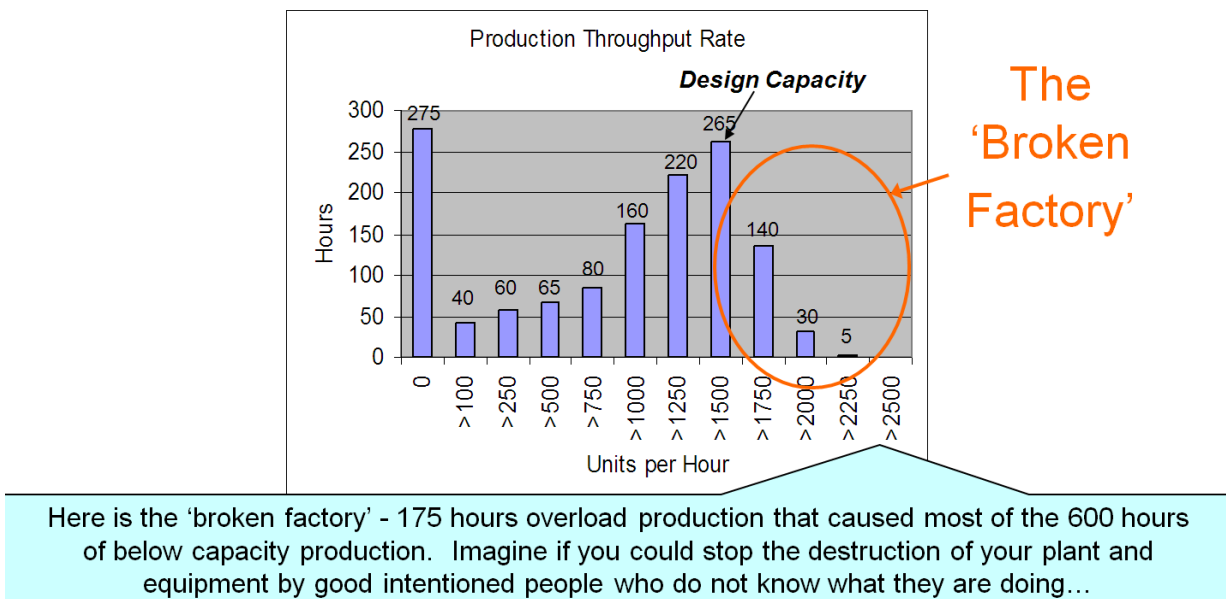


Figure 3 The 'Broken Factory'

A financial analysis of the lost opportunities across the distribution curve is shown in Table 1.

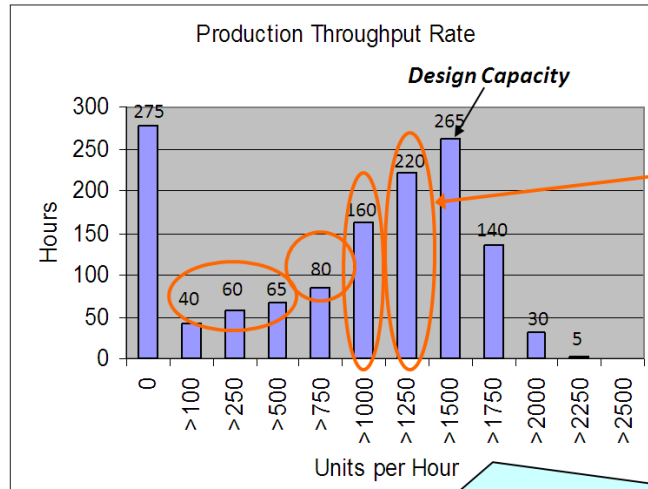
Financial Analysis of Hidden Factory Impact							
Rated Duty	Operated Duty	Lost Duty	Hours at Lost Duty	Lost Production in 8 Wks	Cost per Tonne	Sale Price per Tonne	Profit Lost in 8 Wks
Tonne/ Hr	Tonne/ Hr	Tonne /Hr	Hr	Tonne	\$	\$	\$
1500	0	-1500	275	-412500	\$30	\$130	-\$41,250,000
1500	100	-1400	40	-56000	\$30	\$130	-\$5,600,000
1500	250	-1250	60	-75000	\$30	\$130	-\$7,500,000
1500	500	-1000	65	-65000	\$30	\$130	-\$6,500,000
1500	750	-750	80	-60000	\$30	\$130	-\$6,000,000
1500	1000	-500	160	-80000	\$30	\$130	-\$8,000,000
1500	1250	-250	220	-55000	\$30	\$130	-\$5,500,000
1500	1500	0	265	0	\$30	\$130	\$0
1500	1750	250	140	35000	\$30	\$130	\$3,500,000
1500	2000	500	30	15000	\$30	\$130	\$1,500,000
1500	2250	750	5	3750	\$30	\$130	\$375,000
							-\$74,975,000
Rated Duty	Operated Duty		Hours at Operated Duty	Tonnes Produced in 8 Wks	Cost per Tonne	Sale Price per Tonne	Profit Made in 8 Wks
Tonne/ Hr	Tonne/ Hr			Tonne/ Hr	\$	\$	\$
1500	0		275	0	\$30	\$130	\$0
1500	100		40	4000	\$30	\$130	\$400,000
1500	250		60	15000	\$30	\$130	\$1,500,000
1500	500		65	32500	\$30	\$130	\$3,250,000
1500	750		80	60000	\$30	\$130	\$6,000,000
1500	1000		160	160000	\$30	\$130	\$16,000,000
1500	1250		220	275000	\$30	\$130	\$27,500,000
1500	1500		265	397500	\$30	\$130	\$39,750,000
1500	1750		140	245000	\$30	\$130	\$24,500,000
1500	2000		30	60000	\$30	\$130	\$6,000,000
1500	2250		5	11250	\$30	\$130	\$1,125,000
							\$126,025,000

Table 1 Financials for Distribution Curve

Such horrendous profit losses. Not even the gains from overloading come close to making up for the waste! Running overloaded made \$5,375,000, but it cost a big portion the missing \$41,250,000 lost to complete stoppage. At this mine they do a two day shutdown every six weeks to replace worn items. For 48 hours every six weeks there is a planned outage. Even if there were two shutdowns in the eight week period of production, it would only amount to 96 hours from the 275 hour of total stoppage time. The remaining 179 hours of no production would be either no feed to the plant or plant breakdowns. If you were the Production Manager or Maintenance Manager at this mine site you would want to urgently investigate the reasons behind those stoppage hours and the ‘hidden factory’ slowdowns—there must be some amazing stories to hear that explain how you lose \$75,000,00 profit over eight weeks.

The broadness of the distribution tells us that this plant is suffering a range of production problems. In Figure 4 there are four regions of the distribution that are different to each other. The throughputs in each zone vary so greatly that they are incomparable. Each zone of the ‘hidden factory’ is likely caused by different reasons. The hours lost at very slow production and the hours of lost production at rates slightly less than design cannot be due to the same causes.

In all cases the plant is running, but at very low throughput little product is getting through the plant, while at near design rate the product is flowing through the operation but it cannot hit design capacity. The two ends of the ‘hidden factory’ are not the same problem. Logically the region between the two ends is also due to a different type of cause.



At least 4 types of problems in the ‘Disrupted Factory’

This is a ‘disrupted factory’ with at range of causes producing production problems. What causes the major slowdowns and what cause the slight slowdowns are very different problems. Imagine if you could control your processes so well you stopped the production disruptions to your plant...

Figure 4 The ‘Disrupted Factory’

Your production equipment distribution curves are telling about your production practices and management decision making. Because an output distribution is the end result of how your company works and operates its equipment, it is a true representation of your organisation’s management and operational behaviours. Within every output distribution curve are the summary effects of company-wide choices and historic practices. A decision to run machines at overload rates will later show up as more breakdown time loss. A wide distribution tells us that you are living with many problems; the worst of them you should have solved long ago. When your production rate distribution fully sits within the 95% to 100% zone of the design duty you have got things pretty well right.

My best regards to you,

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