



## Value-Added Analysis

*Tuesday, April 13 7:00 a.m.*

All nine members of the management team were waiting in the conference room. "Cecil introduced me to you last week," Maria said to the group, "and you met Tom yesterday during his plant tour. To my right is Roger Dominick, the gentleman we told you about when Tom and I organized this meeting. I must also tell you that Tom and I dismissed the manufacturing manager yesterday. Tom will tell you why."

Tom stood. "You know we've been losing money for over a year. What you don't know is that four days ago West-Mart decided to stop buying clocks from us because our costs were too high, our quality didn't meet their standards, and our shipments were consistently late. They represented 47 percent of our revenues across all of our product lines."

"We lost West-Mart?" asked Kim Nguyen, production control manager. "We're dead."

"Not yet," said Roger. "We can still recover, but we must act quickly."

"We can't afford any false steps," said Maria, "and that is why I invited Roger to meet with us today. Tom and I discussed hiring him as president, making him a part owner, and putting him in charge of the effort to turn this company around. Before we make a final decision, we want him to spend this morning with us to describe his improvement strategy and give you a chance to grill him. We'll ask for your feedback, then make a final decision by the end of the day. Any questions?"

They all shook their heads.

"Roger, you're on."

\* \* \*

"There are three areas we need to improve in this plant," Roger said. "Do you know what they are?"

"One area is quality," said Paul Shivers, head of quality control.

"Another is cost," said Maria.

"The third is delivery," said Kim.

"Right, right, and right," said Roger. "Those three key measures determine the profitability of any business. I remember them by using the acronym QCD."

"Fine," said Tom impatiently, "so what's your strategy?"

"Simple," said Roger dramatically. "Eliminate non-value-added process steps. By doing that we will improve quality, cost, and delivery. In a typical manufacturing company, value is being added to a product less than five percent of the time it is in the plant, and from what I've seen, your plant is no different\*."

"So you're saying we're wasting time 95 percent of every day," said Roy Esterhaus, chief engineer.

"Yes," agreed Roger. "Not only 95 percent of your time, but 95 percent of the money you spend on the shop floor. And unfortunately, 95 percent is probably optimistic."

"But...," started Roy defensively.

"Hold on, Roy," Kim interrupted. "What do you mean by 'value-added,' Roger?"

"A process step is value-added if it causes a change in the physical state of the material, in accordance with customer specifications," said Roger.

"That's all we do," Roy said.

"We'll see," said Roger. "First we'll make a list of your process steps. Then we'll compare each step to our definition of value-added to see what kind of improvement potential exists here at Accurate Clock Company. That is called 'value-added analysis.'"

"Where do we start?" asked Evanson Lontubu, manager of marketing and sales.

"Start from the moment the vendor drops off the material," said Roger.

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\* Value-added (VA) process steps are more visible than non-value-added (NVA) process steps, therefore traditional managers and engineers spend most of their time making the value-added steps more efficient. Given that the VA steps account for only 5 percent of the time, and the NVA steps account for 95 percent of the time, this behavior makes little sense.

“Estimate the amount of time spent on each step. Do as much as you can in an hour, then we’ll look at the results.”

The management team spent the next hour making a list of process steps and putting them in order. In an hour they agreed on the first 38 steps (see chart on next page).

“Good job,” Roger said as he reviewed the list. “These are normal process steps for a manufacturing company. Let’s start at the top. Is moving the material off the truck value-added?”

“Of course,” said Lois Duke, the HR manager. “We wouldn’t pay someone to do it if it wasn’t.”

#	Process Step	Duration
1	Move off truck	15 min
2	Wait in receiving	18 hours
3	Compare to purchase order	20 min
4	Wait in receiving	1 day
5	Move to quality control	15 min
6	Wait in quality control	2 days
7	Inspect	30 min
8	Wait in quality control	1 day
9	Move to raw material storage	15 min
10	Wait in raw material storage	28 days
11	Print work order	5 min
12	Attach work order	10 min
13	Move to marshalling area	15 min
14	Wait in marshalling area	2.5 days
15	Move to press #1	5 min
16	Wait at press #1	18 hours
17	Set up press #1	3 hrs
18	Load press	30 min
19	Stamp material	1 sec
20	Wait at stamping	1 day
21	Move to stores	10 min
22	Wait in stores	7 days
23	Print work order	5 min
24	Attach work order	10 min
25	Move to press #2	15 min
26	Wait at stamp #2	18 hours
27	Set up press #2	4 hrs
28	Stamp material	1 sec
29	Wait at stamp #2	18 hours
30	Move to stores	15 min
31	Wait in stores	7 days
32	Print work order	15 min
33	Attach work order	10 min
34	Move to deburr	15 min
35	Wait at deburr	18 hours
36	Deburr material	10 min
37	Wait at deburr	18 hours
38	Move to stores	15 min

"Is that how we determine if a process step is value-added?" asked Roger.

"Well, no," she admitted. "You had a different definition. I've got it in my notes. 'A process step is value-added if it causes a change in the physical state of the material, in accordance with customer specifications.'"

"Right," agreed Roger. "So is moving the material off the truck value-added?"

"Not according to your definition," she said.

"Why?"

"It doesn't cause a change in the physical state of the material," she said.

"Exactly," said Roger. "My definition of value-added is tough, but it will force us to look critically at our process and uncover improvement opportunities. The

next process step is 'wait in receiving'. Is that value-added?"

"Not according to your definition," said Sam Mordecai, purchasing manager, "but you can't expect my receiving people to drop everything they're doing every time a shipment comes in."

"Does that mean having the material sit there is value-added?" asked Roger.

"No," admitted Sam, "but you make it sound like we're letting things sit for no reason."

"That's the way your current process works," said Roger. "Could your process be changed so that the material doesn't have to wait?"

"I don't see how," said Sam.

"We'll get to that," said Roger, "but for now do you agree that having material sitting around is non-value-added?"

"Yes," said Sam.

"Okay, how about comparing the incoming material to the purchase order?" Roger asked.

"If we don't check it against the P.O., we might mistakenly accept the wrong material," said Evanson.

"Does that make this step value-added?" asked Roger.

"No," said Evanson, "because we aren't causing a change in the physical state of the material."

"Right," said Roger. "Then the material waits in receiving again."

"Non-value-added," said Sam quickly.

"Then we move it to quality control," said Roger. "Value-added?"

"If we don't move it," said Roy, "how on earth is it going to get there?"

"Just because we have to move it in our current process doesn't make it value-added," said Kim. "Besides, maybe we could move quality and receiving next to each other, right Roger?"

Roger smiled. "You're getting it now. Next, the material waits in quality control..."

"Non-value-added!" they all said at once.

"Very good," said Roger. "How about 'inspect'?"

"Well, we've got to inspect the material," said Paul. "We don't want bad material from the vendor going into our products."

"That doesn't make it value-added," said Kim. "Inspection doesn't change the physical state of the material. Besides, our vendors should make sure it's right before they send it to us. What does everyone else think?"

They all nodded in agreement.

"Steps 8, 9, and 10 are wait, move, and wait," said Roger. "Non-value-added?" Everyone nodded. "What about printing the work order?"

"That causes a change in the physical state of the material," said Roy. "The ink goes on the paper, and it's stuck on there for good."

"But it doesn't physically change the product," said Sam.

"That's right," said Roger. "A process step is not value-added unless it changes the physical state of the material going into the product itself."

"So the next step is non-value-added also," Evanson said. "Attaching the work order doesn't change the material."

"Right," agreed Roger. "Steps 13, 14, 15, and 16 are move, wait, move, and wait, so we know they're non-value-added. How about number 17, setting up press number one?"

"If we don't set up the machine, we can't stamp the metal," said Roy.

"So setting up the press is value-added?" asked Roger.

"I know what you're going to say," said Roy. "You are going to tell us that setting up the press doesn't change the material, so it's not value-added. You've been telling us that everything we do is a waste of time, like we're a bunch of idiots. So far we've done 17 steps, and you say that not one of them adds any value."

"You noticed," said Roger.

"I'd like to see you go down on the shop floor and tell our guys to their faces that setting up a machine is non-value-added," Roy said. "See what they tell you. They spend more time setting up machines than running parts."

"Every step you do on the shop floor is necessary given your current process," Roger said. "That doesn't mean the steps add value. I bet the guys on the shop floor are more frustrated than anyone in this room because they spend so much time setting up the machines."

"That's true," admitted Roy.

"Human beings get a whole lot more satisfaction out of transforming material into a product than they do out of generating paperwork, moving parts, and inspecting material that should have been made right in the first place," said Roger. "Not only is non-value-added bad for business, it's bad for morale. The waste is all around us, but we can't see it anymore. We've learned to live with it. Looking at our processes using our new definition of value-added will wake up our minds and show us where to improve."

Roger looked around the table. The management team was quiet.

"Makes sense," said Maria.

"The next step is loading the material onto the press," said Roger.

"Non-value-added," said Lois, "but necessary in our current process."

"Right," said Roger. "How about stamping the material?"

They all looked at each other.

"Value-added?" said Sam.

"Maybe," said Roger, smiling.

Roy looked confused.

"It causes a change in the physical state of the material," said Kim, "but the other part of the definition of value-added requires it to be 'in accordance with customer specifications.'"

"Okay," said Roy, looking relieved, "as long as we do it right, it's value-added."

"Right," said Roger.

"We finally added some value," said Roy.

"Hooray!" they all yelled.

"You can analyze the rest of the process steps without my help," said Roger. "Do the math and tell me what percentage of time spent in the first 38 steps is value-added. Then tell me what the biggest source of non-value-added time is."

The management team huddled together over the table for a few minutes.

"We've got it," said Maria. "The total elapsed time is 54.5 days. The total value-added time is 10 minutes 3 seconds. The percentage of time we are adding value is .01 percent. That's much lower than the 5 percent you said in the beginning."

"That's not unusual," said Roger. "What is the biggest source of non-value-added time?"

"Fourteen out of 38 steps are waiting," reported Maria. "Waiting time accounts for 54 days, or 98 percent of the non-value-added time."

"Well, great," said Roy. "What a wonderful discovery. Too bad we can't get rid of it. Our MRP\* system makes us order parts in advance, so we'll always have them

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\* MRP stands for Materials Requirements Planning. It is software that uses demand forecasts, bills of material and lead time estimates to determine when to order parts from suppliers, release parts to the floor, and build subassemblies in order to deliver products on time. MRP does not work very well for shop floor management because it assumes a predictable environment. It has been said that no battle plan survives contact with the enemy. The enemy of MRP is reality, and that is why traditional manufacturers do so much expediting. Traditional manufacturers use MRP to deal with problems by ordering extra parts and lengthening the estimated lead times. This gives them "more room for error". Lean manufacturing (as we shall see) actually allows less room for error, forcing you to deal with the underlying causes of problems immediately so that they are solved permanently. Later versions of MRP are MRP II (Manufacturing Resources Planning), and ERP (Enterprise Resources Planning).

when we need them."

"Do you?" asked Roger.

"Do I what?" said Roy.

"Always have the parts when you need them?" asked Roger.

"Well, no," responded Roy. "We're always missing a few parts, which is why we never ship on time."

"Who told the MRP system how far in advance to make the parts?" asked Roger.

"I did," said Kim.

"So you told it what to do, and now it tells you what to do?" asked Roger.

"That's the way our system works," said Roy. "What do you want us to do, wait until the last minute to make the parts we need?"

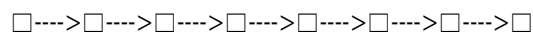
"Yes," said Roger.

"What?" said the entire management team simultaneously.

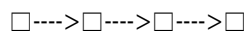
"You heard me," said Roger, chuckling. "But we'll get to that later. Let's keep talking about eliminating non-value-added process steps for now."

"So we've got a lot of steps to eliminate," said Maria. "I have another question. Earlier you said that by eliminating process steps we will improve quality, cost and delivery. Explain that."

Roger turned to the board behind him and drew this diagram:



"Pretend this is a map of the process we use to produce our product," Roger said. "The boxes are the process steps, and the arrows show the order in which they are performed. This process has eight steps. Let's pretend we found a way to eliminate half of the process steps. Then the process would look like this:"



"What happened to the quality of our product?" asked Roger.

"You want us to say it gets better," said Roy, "but I don't know how it could."

"I know," said Sam. "Every process step is an opportunity to make a mistake. The more steps, the more mistakes."

"What about the non-value-added steps?" asked Roger. "Is it possible to create a defect even when you are not adding value?"

"Sure," Sam said. "You could copy a number wrong, and the next thing you

know, the wrong shipment could be delivered to the wrong customer. Or you could crash the forklift while moving parts around."

"You've got it – so much for quality," said Roger. "So what happened to the cost of manufacturing our product when we eliminated half the process steps?"

"It would obviously be less," said Maria.

"Why?" asked Roger.

"Because every step costs something," said Maria. "We have to pay someone or use chemicals or heat or something for every process step."

"Even the non-value-added steps?" asked Roger.

"Sure," said Evanson. "When we move material we pay labor, use electricity, and add mileage to the forklifts."

"What about the waiting steps?" asked Lois. "How do they cost us money?"

"Easy," said Maria. "Material sitting around is inventory. First, it takes up space we could use for something else or rent out. Second, there is money tied up in the material we could invest. Finally, we run the risk of the material getting damaged or becoming obsolete. I bet one-third of this building is taken up by motionless inventory."

"So every step we remove saves us money," said Roger. "Even the non-value-added steps. What happened to our delivery time when we removed half the steps?"

"It obviously would decrease because fewer steps take less time," said Lois.

"Right," said Roger. "Now you know that our manufacturing process contains many non-value-added steps, and that by eliminating them, we will improve our quality, cost and delivery."

"Makes sense to me," said Tom.

"One more point while we're on this subject," said Roger. "We are not going to forget about quality or cost, but delivery improvement, or lead time, will be our first priority, and the goal we stress to our people."

"Why shouldn't we have quality or cost be our most visible measure?" asked Tom.

"If you tell traditional manufacturing people that you want to improve quality by 50 percent, what would they want to do?" asked Roger.

"Add more inspections," said Paul, "which is what I've been saying for the past six months."

"That wouldn't work," said Sam. "That's more non-value-added work. Inspections take time, cost money, and believe it or not, you can create a defect during inspection."

"Good. What if you told a group of traditional manufacturing people that you want to cut costs by 50 percent?" asked Roger.

"They'd lay off a bunch of people and stop making any investments in the future," said Lois.

"That's right," said Roger, "but let me ask you something. What happens if we ask our people to help us improve lead time by 50 percent?"

"We can't do it by working faster," said Tom.

"The only way you can do it is by eliminating process steps," said Roger. "There is no other way to do it. And when we eliminate steps, we improve what?"

"Quality, cost, and delivery!" yelled Kim, Sam and Lois together.

"Right," said Roger, grinning ear to ear. "Any questions?"

"Yes," said Kim. "This will work great if we can figure out how to eliminate those non-value-added steps. Do you have any tools to do that?"

"As a matter of fact, I do," said Roger. "Let's take a break and then we'll talk about them."

# CHAPTER SUMMARY

## Three measures:

1. Quality (defects, rework, returns)
2. Cost (materials, productivity, overhead)
3. Delivery (lead time)

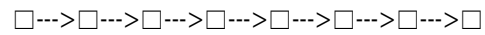
## Strategy to improve QCD:

Eliminate non-value-added process steps.

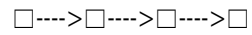
## Value-Added definition:

- *A process step is value-added if it causes a change in the physical state of the material, in accordance with customer specifications.*
- This tough definition forces people to look at their processes critically and uncover improvement opportunities.
- In a typical company, value is being added to a product for less than 5 percent of the time the material is in the plant.

## Process map



## If you eliminate process steps



## You get...

### **Better quality**

Every step is an opportunity for a mistake

### **Better cost**

Every step costs money

### **Better delivery**

Every step takes time