

Riverside Fashions

Ken Wilkens arrives early in the morning to his plant, Riverside Fashions, Inc. in Norris, SC. It is a medium sized apparel manufacturer, employing around 500. Ken currently produces garments for six different manufacturers, but earlier this morning he got a distressing call. His largest customer has found an overseas supplier for his shirts. Ken is facing a loss of over 40% of his business. Ken knows he is facing the closing of his plant if he cannot secure more business, and quickly. He feels an obligation to his employees, and to Norris — he must find a way to make his operation profitable and able to compete with overseas competitors.

Ken goes for a stroll around the plant, a plant he has nurtured for more than 25 years. The workers, for the most part, like Ken. Most smile as he walks by; they nod their head; their hands are busy sewing one garment after another. Some of these workers have been in the plant for over 20 years. Almost all are female and nearly all have families.

When Ken gets back to his office there is a message on his machine. It's from Steve Jacobs, apparel manager for Walmart. Ken has gotten these calls before. He expects Steve to offer him an exclusive contract to supply a particular line of apparel for Walmart. However, Ken would probably have to drop all his other customers, and would have to promise Walmart next day delivery on all items. And, of course, the margins would be low, lower than his other customers. In the past he has always turned them down. He doesn't want to rely on a single customer, and above all, he doesn't think he can make money from Walmart. He would have to keep a huge

finished goods inventory in order to guarantee shipment the next day. How can he finance such inventories with the margins Walmart expected? But today things are different. How can he *not* take the offer, when his plant faces closing in a matter of weeks? But if he does take the offer, how would he be able to keep his finished goods inventories small enough to remain profitable?

Ken is right. Steve wants him to produce a new ladies slack for Walmart. Ken has until Monday to decide. His plant has enough capacity, but he would have to drop his other lines.

Over the weekend Ken realizes he has no choice but to take the Walmart contract. This would at least keep some cash flow coming in; the inventories can be financed and paid back over time. On Monday he closes the deal with Steve. Ken knows that for the first month or so he will be producing to get all the stores initially stocked. He will not have to build up his finished goods inventory at first to restock the stores.

Two months later

The plant has completely converted to running the Walmart slack, and has basically reached a steady state. The slack is offered in about 168 different SKUs — roughly 5 different styles, 7 colors and 5 sizes. Each day Walmart electronically sends Ken the sales from the previous day. Ken then fills the order first from his finished goods inventories. If they are missing any items, he expedites them through his plant, so that the next day he can ship the order complete to the Walmart distribution center.

Ken is beginning to get worried; his finished goods inventories are way too large, and his work-in-process inventories are also large. Calculations show that he is losing money on each slack — he has to do something.

Ken picks up the phone to call Mark Cunningham. He met Mark last year at a trade show. Mark is a consultant to the apparel industry. Mark has tried to convince Ken to drastically change the way he does business — to make his operation “lean” or “just-in-time”. Ken frankly is not one

to chase after the latest buzz-words the consultants are selling, but there was something about what Mark told him that made sense. Mark told Ken that he had one important asset that the overseas suppliers did not — his location. That if Ken could turn around orders quickly, then they can be shipped to his customers overnight. That in effect, it was possible for Ken to offer two or maybe one day lead time to his customers without building up excessive inventories. An overseas supplier typically has lead times of a couple of months. But Mark told Ken that in order for him to take advantage of his location he must reorganize his operations.

Mark answers on the first ring. Ken tells Mark a bit about his plant and his current situation, and Mark agrees to visit next week to see what might be done to help his plant.

The plant tour

Mark flies into Charlotte, rents a car and follows Ken's directions to Norris. When Mark gets to Norris he is a half-hour early. He stops at the Hardee's, has some coffee, and an egg sandwich. Then he drives up the hill to Riverside Fashions.

Ken is anxiously waiting. He first gives Mark a brief history of Riverside, tells him about the town, his employees, and finally about the Walmart contract. Mark interrupted, "Ken, I think it would be helpful for me to see your operation. Can we continue our discussion out on the shop floor?"

Ken begins the tour in the cutting department. Here large bolts of fabric are cut into the pieces needed for a particular SKU of the Walmart slack. For most styles this is about 10 different pieces which the cutters group together to form bundles. These bundles batch together all the components needed to sew 50 slacks of the same SKU. The batch size of 50 may vary depending on the SKU, but 50 is typical. The apparel industry traditionally calls their batches "bundles" because they tie them together in a bundle with scrap fabric. These bundles are then gathered up by "runners" who load them into a hopper and wheel them off to the production area.

Mark has seen operations like this a hundred times, there is nothing unique about Ken's. Mark does not ask many questions in the cutting department — this is not his main concern.

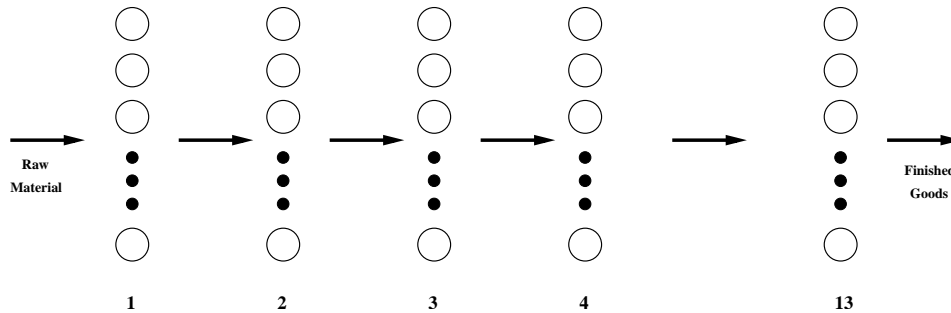


Figure 1: Bundle Production Flow.

Ken then shows Mark his production area. Mark recognizes it as the most standard way apparel is produced — the bundle system. The bundles from the cutting department are queued in hoppers waiting for the first operation to take place. See Figure 1. The first operation is a panel stitch. There are 15 sewing operators, each sitting at their own sewing machine performing this first panel stitch operation. These are industrial type sewing machines, about \$3000 apiece. Each machine is fitted with a special foot to perform this panel stitch operation. A panel stitch operator receives a bundle of 50 garments from a runner. The operator may need to adjust her machine for the new bundle — a thread change for a new color, and perhaps a size or style adjustment on the foot. Then the operator will untie the bundle and begin, one at a time, sewing the panels together for each of the 50 garments.

Mark watches Carol as she sews the panels together. Carol is a good seamstress. Ken notes, “Carol has been here for 2 years. Most of it she has spent on this panel stitch, or something similar. But she has the basic skill

to sew, and so we can move her to any operation in a pinch. She typically hits about 140% of work standard. She makes a good wage.”

Each worker is paid “piece rate”, a rate set depending on the time and difficulty of the particular operation. At the end of the day each worker turns in a card collected from each bundle so that management can calculate their pay. It takes Carol about 45 seconds to sew each garment.

Mark confirms with Ken that he has lost lots of workers who suffer from carpal-tunnel-syndrome over the years. The stress of repeating the same operation over and over again brings on the condition. Indeed, Ken’s insurance costs are on the rise.

After Carol completes the 50 garments she reties the components into a bundle and places them in a hopper. Fortunately, the runner has already placed a new bundle for her at her side. She changes her thread to blue, adjusts the foot for a size 14, and then unties the next bundle.

After the panel stitch the cuffs are sewn. Here 13 operators make the cuffs on specialized machines that facilitate the folding and stitching of the cuff. The cuff operation is slightly faster than the panel stitch.

All in all, Ken and Mark walk past 13 sewing stages needed to produce the Walmart slack. Each stage has from 8 to 20 operators, depending on the time required to perform the task. After the last stage is complete, garments are again bundled together and placed in a hopper. A runner rolls the hopper to the finished goods inventory area in an adjoining warehouse where warehouse personnel take each bundle and stock it in static shelving. The SKUs are arranged along the aisles according to their color, style and size.

By this time it’s past noon. Ken and Mark head off to the Red Barn for lunch.

Problems at the plant

KW: “As you can see Mark, I have a great team of workers here at

Riverside. My piece rates or no more than anyone else pays. My worker utilizations are near 100%. I can't imagine how to get any more efficient than I am now. I have tried to cut my finished goods inventories — don't think I haven't. But every time I do I find myself expediting some small batch through the system. That disrupts everything else.”

MC: “The problems you are having are typical, not just in other apparel plants like yours, but in many different types of production environments. Let me first explain to you exactly what is happening in your operation. First answer me this. What is most critical to you, your machine utilization, your worker utilization or your inventory levels?”

KW: “Well, ... , I think they all are, I mean, ..., I'm not sure I ever thought about it.”

MC: “But these are all related. By the way you have chosen to organize your plant, you are clearly making a statement about how you prioritize these items. Your plant is organized to first maximize your worker utilization, then your machine utilization, and finally you concern yourself with your inventory levels.”

KW: “No, I don't think that can be correct. In fact, it's my inventory levels that I worry about the most.”

MC: “That is just my point. Your inventory levels take last priority in your system. Let me explain further. Where do we find inventory in your plant? There is raw material inventory — the bolts of material. There is work-in-process inventory — the WIP in some stage of your bundle system. And there is your finished goods inventory waiting for an order from Walmart. Now, the further along the inventory is in the process the more costly it is.”

KW: “Certainly, it has more value added.”

MC: “Correct. Let's start with the WIP. Now what causes the WIP in your system.”

KW: “Well, ..., I don’t know what you mean. I have orders to fill, so I produce, when I produce there is WIP.”

MC: “But why so much? Between the first two stages of your bundle system I counted, roughly, 60 bundles of garments. That is about 3000 garments. And it was about that much before all stages, so a total of about $13 \times 3000 = 39000$ garments! And don’t forget they are yet to sit in finished goods inventory.”

KW: “OK, but I’ve been to many other plants. Mine is no different.”

MC: “Yes, and of those plants how many are still in business?”

KW: “Well, sure, many are not, but ”

MC: “Ken. Your plant is a good plant, and you are a good manager. That is why you have survived this long, but I want to suggest to you a new way of thinking about how to organize your operations. I know at this point it is unclear what I am driving at, but let’s move on. Let’s think clearly why WIP is so large between each stage of your bundle system.”

KW: “Well, I need it there, so that when a machine and worker become idle they will have something to work on.”

MC: “Yes, that is right! Do you see how you have put the machine and worker utilization before your inventory level.”

KW: “Well sure I have, after all, the worker and machine cost more than a bundle of garments.”

MC: “That is not clear, and it certainly is not a simple matter to answer that definitively. But we should agree that if I could still maintain my utilizations AND reduce my WIP that it would be a good thing. ”

KW: “Of course.”

MC: “But let’s continue along with this discussion, and go a bit deeper. Why do I need WIP to insure there is something for an idle worker to do?

KW: “I’m not following you.”

Mark paused. He grabbed a cigar and lit one up at the table. That was the one good thing he could think of about being in South Carolina.

MC: “Well, why doesn’t an idle worker take a batch *just* as it gets completed from the stage in front of her?”

KW: “What!?! Well that may work in some academic text-book you have been reading, but this is the real world.”

MC: “Ah ha! You must be saying that there are fluctuations in the processing times, that each stage does not sync up perfectly.”

KW: “Of course they don’t. In fact I have two full time managers that do nothing but shuffle machines and workers around trying to maintain some balance between the stages. If one stage gets bogged down with WIP I will move a worker and machine into that stage to try and alleviate it. It’s a pain-in-the-neck I assure you. And this is a system that is basically making the same items. I hate to tell you how bad it got when we had a dozen or so different items flowing through here!”

MC: “OK, good, certainly you experience some fluctuations, and in addition you can never perfectly balance the stages of your production line. Furthermore, you have workers of all different speeds out there. There is no way in this system to eliminate WIP. In fact, the system is set up to create it, more and more of it, with no inherent ability to absorb it. Only by you having your people running around chasing problems can you hope to keep a handle on it.”

KW: “You got it.”

MC: “Now what else contributes to WIP?”

KW: “Well, each bundle has 50 garments. Now I don’t even know if 50 is the right number to tell you the truth. Sometimes I think it should be higher and sometimes smaller.”

MC: “Well what drives it to be higher.”

KW: “Well, each time a worker starts a new batch they lose time. They

may have to rethread, change a foot, etc. This costs me capacity on my machine, it costs me production rate. If I can increase my production rate I lower my WIP, don't I? But if I increase the batch size so that my capacity increases, well,... I've increased my batch size! That seems like I make more WIP! I really don't know what to do."

MC: "Yes, well, this is complicated to some degree. But for now we should agree that these set-ups or change-overs drive you to increase your batch sizes and that is bad. But there is something more important that you don't realize at all. If you watch carefully what your workers are doing you will see that the batch itself causes them to be very inefficient. Much of the time they spend is turning to pick up a new garment from the stack, aligning the material, sewing it, and turning to put it on a finished goods stack. Much of the time they spend is not the actual sewing."

KW: "OK, yes, we know that very well. We understand every movement a worker makes when sewing. Everything is broken down into Time Motion Units. That's how work standards are set. But what am I supposed to do about it — they can't sew a garment without picking it up first!"

MC: "Right, at least it seems that way, ..., we will get to that later."

KW: "OK, let's head back to the plant, I need to make sure we get an order shipped out by 3:00."

Ken was feeling a bit depressed. Everything Mark had been saying made sense, but so what. He knew he had WIP, he knew he had batches, but so does everyone else. What was he supposed to do about it?

Back at the plant Ken meets up with one of his floor supervisors, Jack McGregor. After the usual introductions:

KW: "Hi Jack, how is the order going today?"

JM: "Well, there are a couple of SKUs they need that we don't have in inventory."

KW: "Damn, well what's the status."

JM: "One SKU is in the queue at zippers. "

KW: “Which one?”

JM: “It’s that Ruby number, Size 12. We started the batch early last week.”

KW: “Geez, it should have been out by now.”

MC: “Excuse me, weren’t zippers at Stage 5 or 6.”

JM: “Yep, Stage 6. But I can tell you exactly what happens. An operator gets done, with say a Navy bundle, or Brown, something standard. What do they do next? We don’t pay ’em for set-ups. And the runners are instructed to minimize change-overs. The Rubys, the Yellows, the Light Greens, will just stay in the queue until we push ’em through. And that is exactly what I’m doing now with the Ruby-12s.”

KW: “Thanks Jack, I’ll let ya go. Keep me posted.”

Ken and Mark walk to Ken’s office. On the way they grab a Dr. Pepper.

MC: “Ken, let’s review what we know so far before we get any further along. There are a number of fundamental causes for your WIP. First, it’s difficult to keep each stage in balance. At any one time one stage will be either faster or slower than its neighboring stage. This is because the products differ, set-ups differ, the worker speeds differ, etc. Second, even if you could balance the stages on average, there are random fluctuations. A thread breaks, material quality problems, etc. Third, everything is in large batches of 50 or so garments.”

KW: “OK, that all seems clear.”

MC: “Now Ken, let’s talk about your finished goods inventory. Why is it so large?”

KW: “Well, that is obvious, I have to ship Walmart the next day, and so I need the stuff in inventory!”

MC: “Yes, OK, that is clear. But it’s deeper and more fundamental than that. Why does anyone need finished goods inventory?”

KW: “Mark, I am really not sure what this is about. Are you going to tell me how to fix this place or not? I don’t care about anyone’s inventory but my own.”

MC: “I understand, but we have just a bit more to go. Then we can understand together the only way to save your plant. I think one reason you have finished goods inventory is because goods are produced in batch quantities.”

KW: “OK, sure, that sounds right. I mean the inventory level shoots up every time a new batch arrives, but what..”

MC: “Hold on. I didn’t say it was wrong or right. I’m just trying to understand what causes finished goods inventory, so that we can try to reduce it. Now what else drives finished goods inventory up?”

KW: “Well, it takes a week or more to get the items from production. I better have enough inventory around to help absorb that kind of lead time.”

MC: “Well, yes, I see your point. But let’s be more clear. Suppose I told you that each time you placed a replenishment order for finished goods inventory to production it would get through production and be delivered in exactly 2 weeks. Would you still need a finished goods inventory of that SKU?”

KW: “Well, yes, like I told you, a batch will arrive and that will increase my finished goods inventory.”

MC: “OK, OK, yes, but suppose I could make my batches very small, forget how, but this small batch can be ordered and it will get through production and back to my inventory stocks in exactly 2 weeks.”

KW: “Well, let me see. Of course, I’m certainly not psychic! I don’t know what Walmart will order tomorrow. Some days they need this SKU, and some days another. Sometimes the order is large and sometimes small. I need some inventory to cover that uncertainty while I wait the two weeks for my order.”

MC: “Yes, that’s right! You need some *safety stock* because there is uncertainty to what Walmart might order. What if I now tell you that the lead time of two weeks only averages two weeks, sometimes it’s shorter and sometimes it’s longer.”

KW: “Well, that only makes my life worse. Since it can sometimes be longer I must plan for it. More safety stock as you said. And if it comes in early it’s likely to sit there costing me money.”

MC: “Yes! So let’s review. Your finished goods inventory is there for a number of reasons. First, there is uncertainty in the demand you face from Walmart. Second, there is some significant lead time through your production area. Third, this lead time has variance. And fourth, you have a large batch size of 50 garments.

KW: “Yes, yes, but what can I do about it?”

It was then past 7:00PM, and Mark had an early flight back in the morning. They agreed to continue their conversation later in the week.