Design for Manufacturability – What It *Really* Means

Case Study by James La Trobe-Bateman

Are you a "**Right First Time**" person? With the idea that if you are disciplined and professional enough at your jobs, the result of your efforts will come out right and need no further tinkering to make it better. Sometimes you *must* think this way: if you are putting a man on the moon, for example.

Or is your attitude more "**Let's Get Started**, because we can always fix it later"? Having something to experiment with, find out what really happens and then improve it, will get results faster than trying to foresee everything and then still being off the mark at the end of it. It would probably be best to think this way, if you are blazing a trail with something really novel. You probably won't know what the market really wants until it sees it.

In general, neither approach is realistic. What you really need to know are which things have to be "Right First Time" and which can be "Fixed Later". You need your A-team on the vital few, but first you want to narrow them down and then be sure that you are not missing something else important. This is vital, because you will make decisions on these key issues that will set the way you conduct business for the lifetime of the product. Making these kinds of changes later will be uneconomic, because they will be tantamount to creating a new business to compete with your old. You've got competitors who are doing that already!

Let's investigate what this would mean by looking at a real life example.

The case study looks at how the 2 products for the same market, designed by 2 different design teams resulted in one that was much more "manufacturable" than the other. With the foresight that this approach could have provided at the design stage, the less manufacturable one could have been as good as the other (or even better!).

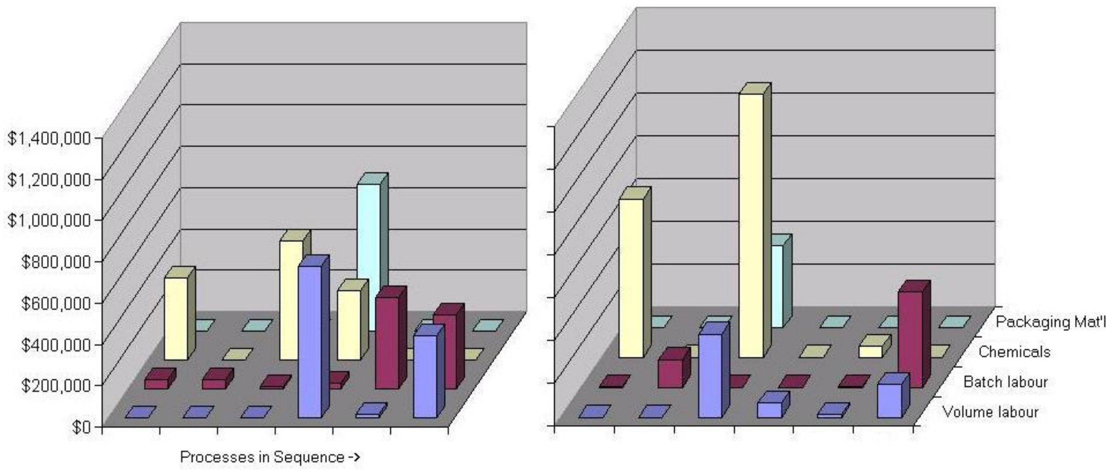
Our assertion is that if you see how manufacture of the product you are designing now will look, then you will improve it before you create it. You avoid having to say that "we can fix it after we start making it". In practice, that is often very hard to do and will be limited in scope.

We will compare two product lines made in different places, designed by different groups of people, but with the same purpose. Each product line is sold in volume to the healthcare industry and includes a range of similar product variants.

We look first at "Manhattan Diagrams™"[*] of the breakdown of variable costs for each. Visualize the process flow from left to right. At each process step, direct labor is used processing the material (blue), labor is needed to changeover between batches (maroon), material is added in the form of chemicals (yellow) or added in the form of packaging (green). . Despite differences in the detail, you can see that manufacture of each product spends approximately the same amount on labor and material.

[*] A 3-D histogram chart that looks like a grid map of Manhattan

VARIABLE COST COMPARISON



Product Line A   Product Line B

So far, so good. Let's now take a look at cost a little differently. If you analyse the costs on an Activity Basis, things are different. The expense driven solely by volume is the same for both at $0.30 per unit. However, each time there is an additional batch of Product A, you need to spend $13,000 on top of the processing cost. For Product B, the cost is only $1,600. That's not all: the extra overhead that each product variant creates is twice as much for Product A as for B. This means that there is twice as much effort going in to product technical support, special material purchasing, planning, quality assurance and a range of other activities driven by having an extra product in the range

Product Line	*Volume related $ per unit*	*$ per Batch*	*$ per Yr per Product*
A	0.30	13,000	90,000
B	0.30	1,600	48,500

So why, doesn't this manifest itself in the Manhattan Diagrams above?

The answer lies in the huge difference in actual batch size used.

Product Line	***Batch Size***
A	130,000
B	24,000

The cost effect of the larger "per batch" cost of Product Line A is mitigated by making bigger batches less frequently.

So what?

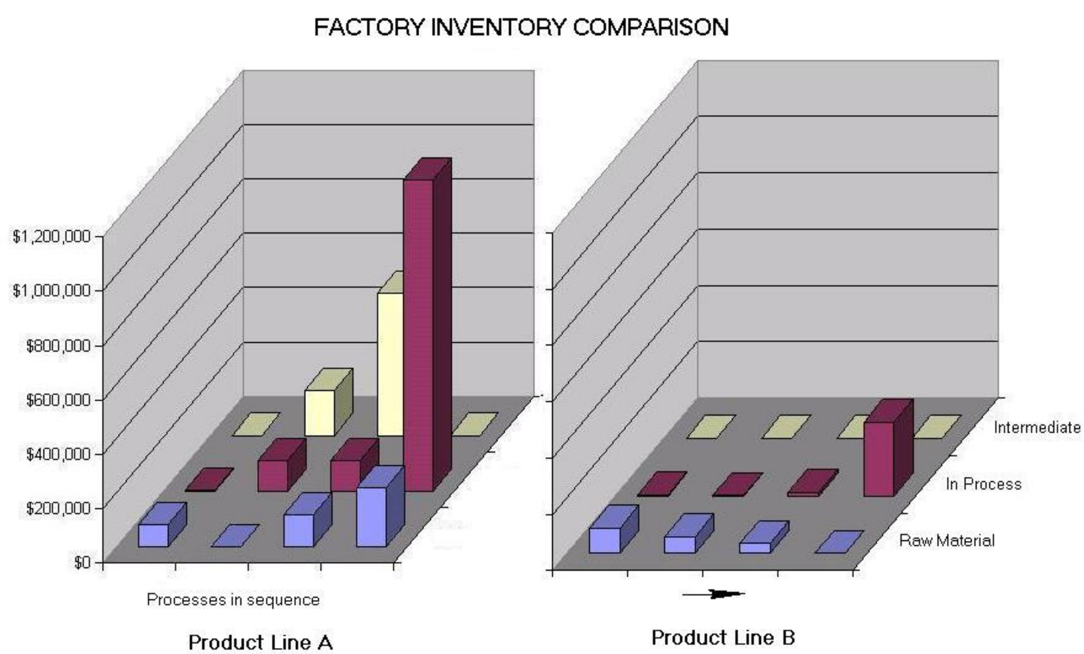
Cost is only one of the key measures that matters when you make things. On a day to day basis, you are more concerned about maintaining a reliable supply. One measure of this is Responsiveness†. If you are more responsive, then you are more likely to maintain supply when demand changes. In order to be more responsive, you have the following options:

- Increase stock levels at a point close to the customer
- Decrease Lead Time
- Decrease Batch Size (which reduces the time between batches)

The down sides of these 3 are:

- Inventory (i.e. capital employed) goes up
- Extra Capacity is needed, costing more
- Cost goes up

None of these are desirable! However, the product line designed to be more responsive will not need the extra inventory and will contain its costs. We have established above that the costs are comparable. Let's take a look at the Inventory associated with each Product Line:



It is immediately obvious that much less inventory is needed to maintain supply with Product B, even though in both cases there is a regulatory requirement to hold material for a period of time to assure quality before allowing its sale.

† See separate article on why response time is important.

The manufacturing Response Time comparison shows a similar large discrepancy:

Product Line	***Response Time***
A	69 days
B	22 days

So you can bet that delivery performance is better for B.

Product Line B achieves this because it was **designed** that way.

To get Product Line A to achieve this, would require an enormous, probably unjustifiable, effort to re-engineer its processes.

The evidence of Product B proves that if Product A had been designed differently, it would have been intrinsically easier to make. What you don't have is the view above of the process **before** you start to guide you with your product and process design decisions. It was to meet this need that reMODEL developed its "Operations Models".

These show you how to…

- Save expense
- Save inventory
- Improve delivery reliability

…before you have an Operation at all.

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