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Complexity and Supply Chain Management

Truism: Progressive companies know that reduction in complexity is a priority for success – and in some cases, survival.

By Robert Martichenko

"I have seen the enemy, and it is us " Pogo

Bedtime

As a father of two young children it never ceases to amaze me how supply chain management principles apply to our everyday life. Although my family is growing tired of my constant analogies and supply chain parallels, I feel it is my duty as a supply chain professional to continue to educate my two ever curious daughters and unconditionally supportive partner and wife regarding the challenges of supply chain management.

The lessons of supply chain complexity surround my home life to a point where everyday routines offer the opportunity to gather the family together for high quality learning sessions. For example, just the other night I was helping my two daughters complete the bedtime routine of brushing their teeth. As I went to get the toothbrush for my six year old, I was amazed to find out there were easily ten toothbrushes to choose from! Yet, each one I choose resulted in my daughter shaking her head in disapproval and challenging me to find the right toothbrush. This allowed me to have some quality one on one discussion with both daughters. "You see girls" I said, "it is a fact that the more inventory you have, the less likely you will have what you need! And further more," I continued "look at the counter space and size of glass we are using to store all the toothbrushes. Could this space and glass not be used for more productive uses for our family?" I continued to explain to my two wide eyed angels that businesses suffer from the same issue of inventory complexity, inefficient use of space and ultimately they are paying significant prices to carry inventory that will never be used under any circumstances.

My oldest gave me a look of understanding and then reached to pull the correct toothbrush from the toothbrush glass, or should I say toothbrush "warehouse". She handed me the toothbrush and I went into the vanity drawer to pull out the toothpaste. To my surprise, there were four tubes of toothpaste in the drawer, all open and at various levels of usage. I grabbed the closet tube and started to apply it to the toothbrush. Within seconds, Emilee yelled that this was not her toothpaste. "Do I not know anything?" she said, "Abbey uses Care Bear and I use Winnie the Pooh," she told me with patience and frustration. I turned to Abbey and asked if she would use this toothpaste and she shook her head in disgust at the notion that she would use her sister's toothbrush or used toothpaste. I rinsed the obsolete toothpaste down the drain and seized the opportunity to continue my lesson.

"Girls" I said, a famous quote often attributed to Henry Ford and the production of his Model T is, 'You can paint it any color, so long as it's black.' Although this quote is generally used to produce a smile, Henry Ford knew that building cars in a variety of colors was no laughing matter: he recognized that a variety of colors meant product complexity that would have a significant ripple effect through the entire manufacturing process. As an engineer committed to the elimination of waste, Mr. Ford could not understand why a company would add this burden of complexity, cost, and inventory to the process.

"You see girls having four types of toothpaste means that we have four times the required inventory of toothpaste at any given time, not to mention the fact that our probability of running out of a particular brand increases 100% with each new flavor of toothpaste!" They both looked at me with bewilderment and yelled for their mom to come to complete the bedtime routine. Therefore, I took the opportunity to sneak away and get some of my thoughts down on paper.

Complexity of Products

Products can represent any stock keeping unit (SKU) ranging from finished goods, subassemblies, to raw materials. Products can also include fixed assets, packaging materials, or repair items. For example, let's look inside the junk drawer that contains our store of household batteries. Not only are there different sizes (D cell, C cell, AA, AAA, etc.) but there are multiple packages available as well. You can get 2-packs, 4-packs, 8-packs, 16-packs, bonus packs, and the list goes on. At times, the packaging can be so complex that it takes a frugal consumer many minutes to figure out which package is the most economical. Although marketing folks will staunchly argue the necessity of all the different packaging types, significant cost is created by the complexity.

Complexity of products and packaging configurations increases the number of finished goods and raw material stock keeping units. With the addition of each SKU, the manufacturer is forced to forecast sales at the SKU level. Each forecast introduces a margin of error, because demand and forecast will never be exact. The variability

between demand and forecast increases inventories and these inventories cost the organization real dollars. For example, safety stock levels grow geometrically as each new SKU is introduced. By reducing SKU complexity and reducing stocking locations, we can in fact significantly reduce safety stock levels and corresponding inventory carrying cost. (For more on this, look into the "Square Root of N Rule "). Not only is there a real cost to SKU proliferation complexity; it also creates an environment where continuous improvement disciplines are difficult to initiate and sustain. This is due to the fact that complexity creates a culture of chaos which in turn results in an environment where a formal continuous improvement program is difficult to sustain. It is the old saying "when you are up to your eyes in alligators, it is hard to remember your goal was to drain the swamp". However, if we can manage to drain the swamp (complexity), there will be no place for the alligators!

Logistics management is about managing material and information flow and the elimination of waste through the reduction of inventories. As logisticians, we also attempt to reduce process defects by understanding, eliminating, and controlling variation. Consequently, product and SKU proliferation goes against all disciplines within what we are trying to achieve as professionals. This is precisely the reason why successful manufacturers manage product complexity very consciously and deliberately, rigorously scrutinizing attempts at SKU proliferation and ensuring that the increased complexity is absolutely necessary.

Process Complexity

Complexity also has significant impact on processes. The implications of this are waste of energy, resources, and increased opportunities for errors that may result in defects. Process complexity results from the number of steps and inputs that it takes for processes to be completed properly. This is especially important in logistics as not only do logistics processes have multiple steps, but often they will also have many elements of paperwork requirements as well. Each process step and paperwork requirement creates complexity, which in turn creates an opportunity for defect. This is based on the mathematical principle of cumulative probabilities.

Cumulative probabilities show us that overall performance of a process is equal to the multiplied performance of each process step. In other words, overall performance is at the mercy of each step in the process. This relates to the concept of throughput yield, which is used in many manufacturing settings.

Consider a logistics process such as shipping a pallet to a customer. This process may have 20 steps and 5 pieces of paper involved with the entire process. These steps may include building the pallet, staging the pallet for shipping, loading the carrier, completing a packing slip, completing a bill of lading, and other steps associated with shipping a pallet. Consequently, the overall performance of the process is a function of the success of each step. For instance, if each step has a performance level of 99.5%, then a process with 20 steps would have an overall performance of 90%. This describes the power of the multiplying effect of process performance. The key is to eliminate process steps and paperwork work requirements in order to reduce the number of opportunities for defects.

Process complexity is becoming even more critical as we globalize our supply chains. Importing and exporting of material requires multiple process steps and a large amount of paperwork. In addition to all this process complexity, logistics security issues create another dynamic that adds to complexity. Consequently, it is imperative that we complete value stream maps to visualize our processes in order to isolate process and paperwork requirements in order to measure each leg of the process. After we clearly understand the opportunities for defects because of process complexity, the challenge is to highlight and correct process errors prior to them becoming defects.

The Never Ending Story

The girls are safely in bed, and I retire to the porch to enjoy adult conversation with my wife. I can tell she has something on her mind so I pry a little to get the conversation going. "Honey," she says quietly, "We know how you are with your views of supply chain management, but I have something I would like to do."

"What's that?" I ask, clearly nervous about the answer.

"Well" she says, "lately I have been finding that the freezer is overflowing and I have no room for new groceries. So, I am thinking we should buy a big freezer for the basement and then go to a big box store to fill it up with food so we will not need to make as many trips to the grocery store"

I smile at my loved one and realize I still have much work ahead of me.