Tools and Knowledge: Your Management Survival Kit

Using Spaghetti Diagrams to Improve Process Flow
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Does your work environment have enough space? Feeling hungry for process flow improvement? You just might need some spaghetti.

A spaghetti diagram is a common Lean Six Sigma tool used to illustrate the physical flow of a patient, employee, or product as it moves through multiple steps in a process. The most efficient path is for each step to pass directly into the next in a continuous manner. The spaghetti diagram helps an organization visualize optimal workflow and determine solutions for overcoming space-related impediments to achieving it.

While spaghetti diagrams originated in manufacturing, they have great value in healthcare. The name refers to how processes often look as people or materials move from one location to another—like a plate of spaghetti. All of the starts and stops in a process, along with the long distances traveled, can be very surprising. One chemistry technologist in a large tertiary care hospital who wears a pedometer to monitor her movement reports she walks between 1.8 and 3.4 miles each day!

By following the steps outlined below, you can begin to serve up a healthy portion of spaghetti diagrams:

**Step 1: Gather the tools** needed, which are simply:
- Colored pencils or pens.
- Paper.
- Self-stick notes (optional).

**Step 2: Draw the basic workstations or work areas** of the process being studied; this can be accomplished in a variety of ways:
- Copy an available floor plan. (The Emergency Evacuation Map is a possible source.)
- Draw the layout on either plain white paper or, if you want more accurate measurements, graph paper in which each box equals a square foot. Caution! This is meant to be a simple, visual analysis—take care not to become bogged down by too many details. *(Tip: Using a pencil for this step will allow for easy adjustments. Utilize photocopies of the original floor plan, allowing for multiple analyses to be conducted.)*
- Utilize self-stick notes to lay out the floor plan on a large sheet of plain paper. This is helpful to provide the needed visual for large groups.

**Step 3: Diagram the workflow** by marking an “S” where the process starts, then draw an arrow from there to where the second step happens, etc. Continue until you have mapped all process steps, indicating
the final step location with an “E” for the end point. Use a different color line for multiple patients, employees, or products that move through the process. Make note of any trip to a remote location and the reason why.

Step 4: **Analyze the spaghetti diagram** by asking the following questions:

1. Is there a continuous workflow, or do the lines look like a tangled pile of noodles? Could the work space be rearranged to avoid excessive movement?
2. Do the lines repeatedly come back to one location? If so, do multiple steps in the process need this function, and could the location be more centrally positioned? Common examples include a copy machine, specimen handling counter, or supply cabinet.
3. Are the equipment, people, and materials built around the point of entry for high volume? Assess how many times each intake area (such as the specimen processing area) is utilized, and explore options for the most efficient location.

Step 5: **Design and test an improved workflow** by drawing a new floor plan based on your findings. Test it out by repeating Steps 3 and 4 as you hypothetically move a patient, employee, or product through the new layout, asking again the basic analysis questions.

Step 6: **Communicate and pilot the changes** within the work area, being careful to assure everyone fully understands the who, what, why, and when of the improvement efforts prior to making any changes.

Step 7: **Evaluate effectiveness**, modify if needed, implement final improvements, and then celebrate success!

Figure 1 shows an example of how one laboratory applied spaghetti diagrams to evaluate its day shift workflow.

**Figure 1: Spaghetti Diagram Analysis of Day Shift Workflow**

Findings: Heavy traffic and bottleneck in specimen processing area. Technical workbenches spaced far apart when techs need to cover multiple areas, which results in overall excessive movement by staff.
By analyzing its workflow, the laboratory realized that there was a major bottleneck in the specimen processing area. Although the staff had tried several times to address issues with specimen flow, the spaghetti diagram helped to identify the real source of the problem. It was decided that the best option for improvement would be to remove one panel from each of the main workbenches to change the movement of people within the laboratory. Figure 2 shows how the movement of specimens and people within the workspace has been redistributed.

**Figure 2: Increasing Workflow Efficiency with Minimal Change**

As illustrated in the example above, a spaghetti diagram is a valuable Lean Six Sigma flowcharting tool that uses a continuous line to trace the path of a patient, employee, or product through all steps in a process. It helps identifies workflow inefficiencies, such as long distances traveled between steps, which can then be addressed to improve the process. When combining spaghetti diagrams with process mapping, it is possible to identify 80 to 90 percent of all problems associated with delays and wasted activity in a process.

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