Process Flow Mapping for Improved Flow

By: Greg Hart, President - Hart Innovative Solutions, Inc.

Process flow mapping is used to visualize the process under review. There are many variations of flow mapping, including relationship map, time function map, IDEF, flow charts, activity flow diagrams, PERT Charts and FAST Diagrams. The first two are common and applicable to improving product flow.

A relationship map describes at a high level relationships between functions / organizations. It shows organizations / functions as boxes on the flow map. Product / Information flows are shown as lines connecting these boxes with a text / numeric indication to show what flows / sequence. One variation shows the major inventory locations in between the organizations with major product flows as solid lines, between factory icons. Information flows, the major steps in MRP II, are shown with dashed lines. It is critical to keep detail to a minimum to visualize flow on this process map. This may be used as a starting point to ground a cross-functional team to relationships between functions. It also shows cross flows, disconnects, overloaded / key functions (a lot of in/out flows).

The next process map is more common. There are several variations, under sequential mapping. This map can be done at the macro (major function), mid level (factory flow / routing step), job level (element breakdown - typical of set-up reduction or kaizen process breakdown).

These process maps describe steps in verb-noun format in sequential order. The time-function map shows functions (e.g. planning, manufacturing, and logistics...) along the left-hand margin and aligns steps to those functions. Individual activities have associated work content time (Time to process one unit) and elapsed time (lead time - largely made up of queue, delays). Often a macro timeline is shown at the bottom for groups of tasks. Material and information flows often use symbols to help visualize the flow. Pictures, pictograms, other graphics may help in visualization. There are some standard flow-mapping symbols. One option is to put the map in a software package that allows computation such as project planning software (PERT chart). Another is to tie the process map to simulation. Once you have mapped, the next step of simulation is simplified.

The process map provides the basic step in analyzing a flow. Additional information can be added to the map. Some examples include defect types / quantities - DPU, issues / problem areas, root causes, and costs of quality. It is good to do Ishikawa / fishbone diagram, then link root causes back to flow map. Use this information to plan and later validate flow improvements. It is also good to do an "as-is" and "to-be" version of the flow map. A micro cost-time profile can show the dimension of the flow over cost (work content X charge rate + material cost) vs. time (elapsed time). This can help to visualize delays (long flat spots), high costs and long lead-times.

Use a cross-functional team to describe types of defects observed along the flow path. Take observations on the shop floor through a combination of scrap / rework, process control data and customer escaping defect data. Quantify DPU and show amounts on flow map.

Have the team brainstorm the problems they encounter and root-causes. Show problems where they show up on the flow map, root causes on causing operation. Identify associated cost of quality. Use combined information to identify corrective actions. Assign responsible individuals and track results. Indicate on flow map non-value-added activities, such as inspections, queues, moves, and delays. These can show opportunities to reduce cycle time.

The flow map and Pareto ranked defect data can help with verification. Fishbone diagram with categories of manpower, machinery, methods, measurement, management is a good interim step for root cause, but be sure to attach the root causes to flow map to graphically show major source of defects.

Quality improvements could include mistake proofing / fail-safe methods and statistical process control. Use the flow map to show where these will be added. Cycle time improvements are based on eliminating non-value-added steps. Eliminate inspection when operation has demonstrated process control; eliminate a queue by protecting a bottleneck with a time buffer or increasing its output (break / lunch coverage, etc.); Reduce lot sizes and corresponding queues by first reducing set-ups; reduce machine downtime delays through preventive maintenance, etc. These form the basis of action plan.
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Greg Hart, President - Hart Innovative Solutions, Inc.

Greg Hart is a management and industrial engineering consultant specializing in material flow, business process and quality improvement. He earned a MBA in Operations Management, Finance and Accounting from the University of Rochester Simon School in 1998 with honors and a BS degree in Industrial Engineering from Rochester Institute of Technology in 1985 with honors. Greg has over 30 years of experience in engineering and operations management. He was an Industrial Engineer for Kodak for twelve years and a retail distribution center manager for The Denver stores for seven. He has visited or worked with many other firms - small to Fortune 500.