Single Spindle or Multi-Spindle Machines?

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COMPARING THE COST AND ROI of one machine type versus another makes me think of compelling scenes from films such as "Good Will Hunting," "A Beautiful Mind," and "Hidden Figures," in which the main character fills up a chalk board with the divine language of math. When conducting a cost justification study, it's vital to include as many factors as possible to get to the answer, and presently there are several market dynamics that must be figured into the formula. When those are added, the solution might surprise you. For instance, the current market conditions affecting the choice between single-spindle machining centers versus gantry-type multi-spindle machines are equipment build times, the skills gap, and automation.

The upbeat economy, hot demand in aerospace and other markets, and the need for manufacturers to replace legacy equipment have been drivers for a healthy machine tool industry in recent years. As such, machine delivery times are longer, and that's especially true for customized, precision, and complex machines. The category of multi-spindles I'm referring to are in that group.

Some shops simply cannot wait that long and are settling for one or more high-end, single-spindle machines. That being said, some applications are worth the wait, such as high-demand parts like aircraft landing gear forgings and bulkheads for the F-22 Raptor. Most parts over 2.5 m are most sensibly produced on a gantry multi-spindle.

When applications can be produced on either a multi or a single, the choice gets a little fuzzier, especially when considering roughing versus finishing operations. Typically, overall efficiencies on multi-spindle machines are lower because of the downtime between setups. Single-spindles are not as productive as multis during roughing; however, they may make up for it in one-setup machining, and especially if they are in a flexible manufacturing system (FMS). Spindle utilization in an FMS with pallet storage can reach 80 percent because spindles run with minimal downtime.

Another multi-spindle consideration, particularly the five-plus head versions, is the high amount of material and work in process (WIP) inherent with them. Lower WIP provides a fiscal advantage. Instead of having, for example, 30 expensive parts in the shop in any given month processed through multi-spindle machines, there are likely half that amount on the singles.

Factor In the Skills Gap

Because gantry-type multi-spindle machines are complex and fairly rare, it's also rare to find people who know how to set-up and operate them. We have a problem with machining skills in general, and it's even more of an issue with these special machines. In the 1960s and '70s, these types of multi-spindles were more common. In the '80s, it started to change with the introduction of CNC, and today computerization has evolved so that entire factories and machining systems are fully automated, digitized, and connected.

The adoption of automation—specifically the emergence of the FMS—also figures into the equation. Again, the efficiencies of each single-spindle in an FMS is high, plus skills strategies can be applied to these systems that we observe many of our customers employing. With a single-spindle machine, an experienced manufacturing engineer develops the process, which includes probing, coupon "masters," tool wear algorithms, plus other automated quality checks. With the proven plan in place, a less-skilled person loads/unloads parts, maintains the schedule, monitors the workflow, and grows into more complex tasks.

Currently, long lead times for capital equipment, the skills gap, and the rapid adoption of automation are giving single-spindle machines the edge over multi-spindles when the applications can be performed on either sensibly. But let's keep studying. The factors may change. Plus, isn't it just fun to do all that math?