IDOV Quick Reference

Phase	Activities
Identify	✓ **Define and scope the Project; Commission Team** ➢ Strategic planning, benchmarking ➢ *TOOL*: Project/study charter (review with sponsor and coach) ✓ **Develop project plan, schedule, etc.** ✓ **Identify customers/stakeholders and gather their requirements** ➢ Interviews, surveys, focus groups, etc. ✓ **Determine importance ratings for the customer requirements** ➢ Use a 1-5 scale to rate the importance of the customer requirements, where 5 indicates the most critical requirements ➢ *TOOL:* Pairwise comparison, Nominal Group Technique, Multi Voting, or DOE ✓ **Translate customer requirements into CTCs and Prioritize CTCs** ➢ *TOOL:* House of Quality #1 (QXL Stat Tools > QFD > HOQ) ✓ **Start Performance Scorecard** ➢ List the CTCs as items in the performance scorecard ➢ *TOOL:* Scorecard (QXL Monte Carlo > Scorecard > New Scorecard)
Design	✓ **Determine specs for CTCs** ➢ From customer, contractual or regulatory requirements, goals, etc. ✓ **Develop alternate design concepts** ➢ Come up with ideas or potential solutions (brainstorming, ideation, morphological mapping, function modeling, TRIZ, etc.) ✓ **Select Best Design** ➢ Use a structured decision analysis to help identify the best design concept, or to reduce the number of potential concepts ➢ Decision criteria should include CTCs plus any other business decision criteria such as risk, development time, cost, manufacturability, etc. (FMEA can be used, as desired, to help understand risk) ➢ *TOOL:* Pugh concept selection, FMEA (QXL Stat Tools > Pugh, FMEA) ✓ **Translate CTCs into Product Design Characteristics for the selected design concept** ➢ *TOOL:* House of Quality #2 (QXL Stat Tools > QFD > HOQ) ✓ **Obtain transfer function for CTCs** ➢ Relate inputs (product design parameters) to outputs; May be exact (known) equations or obtained using DOE ➢ *TOOL:* Design of Experiments (DOE) ➢ Reminder: If the data for the DOE comes from physical experiments (as opposed to computer simulation), remember to evaluate the capability of your measurement system using MSA ✓ **Update Scorecards** ➢ Create part and process scorecards, and begin to gather data ➢ *TOOL:* DFSS Scorecard

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Reference: Design for Six Sigma: The Tool Guide for Practitioners

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Optimize	✓ **Perform EVA to determine output distribution and dpm** ➢ Simulate the output using the transfer function for the CTCs ➢ Create a design sheet in Quantum XL or use free-form modeling ➢ If using *QXL DOE*, transfer functions can be imported using the "Import Model from Quantum XL" feature (this creates the design sheet). If using *DOE PRO*, transfer functions can be imported using the "Import Model from DOE Pro" feature. If using other software, type in the transfer function (model) as appropriate. ➢ Specify input distributions and parameters for inputs affecting the performance scorecard CTCs; add <u>noise</u> as desired; put in specs for the outputs ➢ For input distributions, use histograms of historical data, industry standard data, representative parts or processes, estimates of sigma using specs, etc. ➢ *TOOL:* Expected Value Analysis (QXL Monte Carlo > Run) ➢ Place results into performance scorecard for each CTC ✓ **Perform parameter (robust) design analysis to determine if there is a better combination of input mean settings to minimize dpm** ➢ *TOOL:* Parameter Design (QXL Monte Carlo > Optimize) ✓ **Perform tolerance allocation analysis to determine the impact of the input variables standard deviation on the output dpm** ➢ Consider reducing the standard deviation for inputs which we are sensitive to; consider increasing the standard deviation for inputs which we are robust to as way to offset costs ➢ *TOOL:* Tolerance Allocation (QXL Monte Carlo > Contribution Tools > Tolerance Allocation) ✓ **Apply Design for "X" (manufacturability, testability, reliability, etc.)** ➢ Throughout the entire IDOV process, look for opportunities to simplify the design, make it easier to manufacture, easier to maintain, etc. ✓ **Estimate product capability by updating scorecards** ➢ Update the part, process, and performance scorecards as new information is obtained ➢ Review the pareto of DPUs to identify opportunities for improvement ➢ *TOOL:* DFSS Scorecard
Validate	✓ **Perform sensitivity analysis** ➢ Quantify the impact of shifts in the mean or standard deviation of the inputs ➢ *TOOL:* Sensitivity analysis (QXL Monte Carlo > Contribution Tools > Sensitivity Analysis) ✓ **Perform validation tests (develop prototypes, tests cases, conduct pilots, etc.)** ✓ **Compare predicted capability with actual** ➢ Compare the predicted capability from the scorecard with actual capability from prototypes, small scale production, etc. ➢ Do a gap analysis if results deviate substantially from predictions ✓ **Update scorecards, drawings, control plans, etc. / pass knowledge to manufacturing** ➢ *TOOL:* Control Plan, Scorecards, Sensitivity Analysis

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