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| ***Basic* Category** | **Knowledge Base, Method, Tool, or Skill** | **Description of Knowledge Base, Skill, Method, Tool** |
| **Foundational** | System of Profound Knowledge | A concept developed by W. E. Deming by which to organize the special knowledge base for improvement. The system of profound knowledge has four parts that interact to form the science of improvement: Appreciation of a System, Understanding Variation, Theory of Knowledge, and Psychology. |
| Deming Chain Reaction | The theory that relates improvement of quality to the financial and business aspects. Different chain reactions exist for the three strategies or improving quality by reducing errors, reducing cost while maintaining technical quality and expanding customer expectations to increase demand.  |
| **Model for Improvement** | Charter  | A tool to initiate a project by beginning to answer the first three questions of the Model for Improvement. The charter communicates the purpose of a team or individual involved in an improvement effort. The charter directly answers the fundamental improvement question, "What are we trying to accomplish and begins to answer the 2nd and 3rd questions (measures and changes). |
| Driver Diagram  | A diagram that organizes the theory of improvement for a project and thus provides a learning structure for the project.The structure connects Aim, measures and creates a theory-based organization of the changes |
| PDSA Cycle | A structure for learning and improvement. One of the components of the Model for Improvement. The four steps in the cycle are: Plan, Do, Study, Act. It is also known as the Deming cycle, Shewhart cycle, and the PDCA cycle. |
| Use of Data (including basic statistics) | Use of data for learning, e.g. identifying information in the patterns of variation in data and using this to guide actions for improvement. Includes understanding the value of plotting data over time, the pitfalls of viewing before/after data and an understanding of common sources of bias. Also understanding the differences between purpose of data used for improvement, accountability and research  |
| Developing Changes | Aiding others to develop more powerful changes than those previously tried. Includes diving deeply into an understanding of process and systems, using creative thinking techniques (e.g. change concepts, concept triangle, provocations) and making use of new or existing technology.  |
| 70 Change Concepts | 70 general approaches to change (organized by API) that have been found to be useful in developing specific ideas for improvement. Change concepts are general, abstract notions and require further thinking to develop into actionable ideas to take forward to testing.  |
| Reliability Change Concepts | Change concepts used specifically to incorporate high levels of process performance. Based on human factors theory and mistake-proofing concepts.  |
| Lean (or TPS) Change Concepts | A lean approach, adapted from the Toyota Production System (TPS), focuses on continuously reducing waste in operations and in product and services, improving flow of the system, and continuously enhancing the value proposition to customers. |
| Testing Changes | Putting a change into effect on a temporary basis using the PDSA cycle. Trying change, typically on a small scale first, then using multiple PDSA cycles increasing size, scope, and conditions under which change is tested to improve confidence, staff readiness and reduce cost of failure prior to implementation. Principles of experimental design are incorporated into test designs |
| Implementing Changes | Using the PDSA cycle to make the change a permanent part of the way things are done. Implementation involves engaging the infrastructure of the organization such as staff training, documentation, compensation, supply or equipment requirements, hiring, policy, procedures, measurement, etc.  |
| Spread and Scale up of Changes  | Spread and Scale-up refer to the processes of taking a successful improvement effort in one area of the organization and disseminating the changes throughout the organization. There are several challenges in spreading good ideas, including the characteristics of the changes; the willingness or ability of those making the adoption to try the new ideas; and the social system connecting the organization. |
| Other Roadmaps for Improvement Projects | The Model for Improvement provides a roadmap for accomplishing an improvement project. There are other such roadmaps that some organizations use: Juran’s Universal Sequence for Quality Improvement, Six-sigma DMAIC and DFSS, Seven-step problem solving model, FOCUS-PDCA, The 8-D Model, and Japanese Quality Story  |
| **Teamwork**  | Conducting Meetings | Includes understanding how to structure team meetings so they are more effective and efficient. Includes knowledge related to clarifying roles and responsibilities of team members, team leader, facilitator, technical consultant and management sponsor, clarifying agenda items, timeframes, expected outcomes, decision making methods, meeting documentation and physical environment for the meeting. |
| Group Dynamics | Improving team functioning through understanding of how individuals behave when in a group. Includes understanding of the need for clarity of purpose (charter), clarity of behavioral expectations (norms), typical stages of group development, use of discussion and of dialogue, avoidance of “group think” and methods for evaluating, monitoring and improving group interaction in meetings.  |
| **Viewing Systems**  | Flow Diagram | A graphic representation of a series of activities that define a process. The diagram shows the stages of a process as inputs are being transformed into outcomes. There are different types of flow diagrams including top-down, complexity, ideal flow, and group-matrix.  |
| Linkage of Processes | A method to develop a view of a system composed of processes linked together to accomplish the purpose of the system. |
| **Gathering Information** | Operational Definition | A definition that gives communicable meaning to a concept by specifying how the concept is applied within a particular set of circumstances.  |
| Form for Collecting Data | A form for collection of data that provides an organized method to record required data and additional observations to be used in analysis. Often a part of a PDSA Cycle. |
| Surveys | A method of collecting information directly from people about their feelings, motivations, plans, beliefs, experiences and backgrounds.  |
| Benchmarking | The process of measuring products, services, and practices against the best performers or those companies recognized as industry leaders. |
| Sampling Methods | Selection of units for study. Different sampling methods include judgment sampling, simple random sampling, proportionate random sampling, systematic sampling, and stratified sampling. |
| Creativity Methods | A collection of techniques for tapping into the unconscious mind for new ideas that lead to different ways of attacking a problem or accomplishing a task. Also called lateral thinking methods. Methods include six thinking hats, provocations, random word, and concept triangle.  |
| **Organizing Information** | Affinity Diagram  | A method to summarize qualitative data into groups with a common theme |
| Cause and Effect Diagram | A tool for organizing a group’s current knowledge regarding a problem or issue. Useful for recording ideas in a brainstorming session (also called a fishbone diagram or an Ishikawa diagram). |
| Matrix Diagrams | Method used to arrange data to help the user understand important relationships. Displays the relationship between two groupings (e.g. criteria for a supply and vendors under consideration, or steps in a process and the departments involved).  |
|  | Tree Diagrams | Used to visualize the structure of a problem, plan or any other opportunity of interest. Helps in thinking systematically about each aspect of the problem or plan. It has also been called a “systematic diagram”. The tree diagram allows the graphical view of different level of details about a problem or plan  |
| **Understand-ing Variation** | Run Chart | A graphical record of a measure plotted over time. May include median line and/or a goal line. |
| Shewhart Control Chart  | A method used to distinguish between variation in a process due to common causes and variation due to special causes. It is constructed by obtaining measurements of some characteristic of a process, summarizing with an appropriate statistic, and grouping the data by time period, location, or other process descriptive variables. There are many different types of control charts, depending on the statistic analyzed on the chart. |
| Pareto Chart | A tool for helping focus our efforts by identifying how frequently categories of events occur |
| Frequency Plot | A tool to display data which presents to the user basic information about the location, shape, and spread of a set of data. (also called histogram or dot plot) |
| Process Capability  | A prediction of the individual outputs of a characteristic from a process. If a process is found to be stable, the process capability can be determined. The prediction from a capability calculation can be compared to specifications to determine whether the process can produce outcomes that meet the specs |
| **Relationships** | Scatter Plots | A tool for showing relationships between two quantitative or continuous variables. Pairs of data are plotted together on scales set at right angles to each other. |
| Two-Way Tables | A tabular representation of the relationship between pairs of qualitative variables. (Similar to a scatter plot for qualitative data) |
| Designing Tests of Change | Designing studies (before-and-after, simultaneous comparisons, planned grouping) to determine the effect of a specific change to a process. Use the principles for testing a change to understand the effect of the change. |

**Knowledge, Skills, Methods, or Tools for Improvement**

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|  ***Advanced* Category** **Category** | **Specific Method, Tool, or Skill** | **Description of Knowledge Base, Skill, Method, Tool** |
| **Organizing Information** | Systems Thinking/Analysis | A view of the organization as being dynamic, adaptive to the needs of the customer, and comprised of interdependent processes and products. |
| Failure Mode & Effects Analysis (FMEA) | A systematic, proactive method for evaluating a process to identify where and how it might fail, and to assess the relative impact of different failures in order to identify the parts of the process that are most in need of change. Teams use the FMEA Tool to evaluate processes for possible failures and to prevent them by correcting the processes proactively rather than reacting after failures have occurred. The FMEA Tool is particularly useful in evaluating a new process prior to implementation and in assessing the impact of a proposed change to an existing process  |
| **Understand-ing Variation-**  | Advanced SPC | Use of the control chart method beyond the basic charts: separating measurement variation, rational subgrouping, stratification, non-standard control charts (Cusum, EWMA, Time Between), variance components, autocorrelations, multivariate charts |
| Enumerative and Analytic Statistical Studies | Knowledge of enumerative (a study in which action will be taken on a universe) and analytic studies (one in which action will be taken on a cause system to improve performance of a product, process, or system in the future). Includes understanding when each is most appropriate and the differences in statistical approaches.  |
| Statistical Methods  | Use of more advanced statistical methods: correlation analysis, regression analysis, confidence intervals, analysis of variance, statistical tests, power analysis.  |
| Evaluation of Measurement Processes  | Methods for evaluating the degree of variation in individual measurements of the same item. Deals with evaluating the measurement process to address accuracy, precision, bias, repeatability, reproducibility, and stability.  |
| Statistical Graphics | Understanding advantages to graphical display of data versus display of table of numbers or summary statistic; principles of graphical display of data based largely on Edward Tufte’s work. Includes principles such as showing all the data, focusing user on learning (rather than on graph itself), separating different sources of variation, making it possible to learn from a large amount of data, emphasizing comparisons and relationships, minimizing text, colors, markings that are not directly related to the data, data integrity (sampling, scale), clarity of labeling, simplicity. |
| Reliability  | The measurable capability of a process, procedure or health service to perform its intended function in the required time under existing conditions. Designing reliable systems of care includes prevention, early identification and mitigation of failure. High reliability involves the design of integrated systems and a high reliability organization. Reliability in health care is often discussed in terms of levels of reliability (10-1, 10-2, 10-3).  |
| Multivariate Analysis | Statistical methods where multiple measures are analyzed at the same time, e.g. multivariate control charts and multiple analysis of variance. Correlations between the variables are a basic part of the analysis. |
| **Relationships with measures and variables** | Time Series Analysis | Time order charts that account for autocorrelations, seasonal effects, and other complex patterns in data. |
| Planning Experiments – Developing response variables, factors, and background variables  | Enumerating and deciding the role that all of the variables in a process will play in a study. The variables will be response variables (outcomes), factors (primary focus of the study), background variables (other variables that can affect response variables), or nuisance variables (unknown causes of common and special causes of variation). |
| Planning Experiments – Use of experimental pattern, planned grouping, replication, and randomization | Defining experimental units and using tools for developing a planned study: Experimental pattern – arrangement of factor levels and experimental units Planned grouping – blocking of experimental units Randomization – objective assignment of factor levels to experimental units Replication – repetition of experiments, units, measurements, or other aspects of study |
| Analysis of Designed Experiments using Graphical Methods. | Use of graphical methods (using run charts, dot plots, geometric displays, response plots and paired comparison graphs) to separate the contributions of all of the variables in an experiment, determine the important sources of variation, and present the results of the study. |
| Factorial Design and Analysis | Studies designed to evaluate more than factor (change) at a time. Designed to determine both the individual and combined effect of each of the factors of interest.  |
| Fractional Factorial Design and Analysis | Studies with a large number of factors (four to 20) designed to learn as much as possible about each factor while minimizing the required size (experimental units or time) of the study. |
| **Leadership of Improvement** | Quality as a Business Strategy | An approach to make the concepts and methods of quality integral to the function of the organization. The aim of this strategy is to enable the organization to produce products and services that will be in demand and to provide a place where people can enjoy and take pride in their work. The foundation for this strategy is ongoing matching of products and services to a need and viewing the organization as a system. |
| Establishing & Communicating Purpose of the Organization | Includes aiding leadership in development of useful purpose statement (mission, vision and values or tenets). Includes communicating the purpose throughout the organization and using the purpose statement in operations of the organization.  |
| Viewing the Organization as a System  | Assisting leadership in developing views of the organization that include a Systems Map and a Linkage of Processes to develop much deeper understanding of system interdependencies. Also includes aiding leadership in developing a measurement set to determine the performance of the system. This data in this measurement set, or family of measures, is displayed over time on the appropriate type of Shewhart control charts.  |
| Gathering Strategic Information | Designing a system to gather information for strategic, operational and immediate problem solving. This system is designed to gather information from current and potential customers, suppliers, employees, technology, and key government and business forces. The system includes determining what will be gathered, who will get it, where it will be stored, how it will be used on an immediate, operational and strategic basis and how it will be summarized and used by senior leadership for organizational planning.  |
| Planning for Improvement | Incorporating improvement into the strategic and business planning processes in an organization. Learning from inputs to develop strategic objectives, and then mapping the strategic objectives to the processes and services in the organization. Identifying high-leverage processes for improvement and allocating improvement resources to these processes |
| Managing Improvement | Aiding leadership to deploy and manage the necessary resources to accomplish the plan for improvement and the selected improvement projects. Improvement advisor aids leadership in: knowing how long to stay personally involved in a project, encouraging tests of change on a small scale, making sure that improvement focuses on second-order changes, addressing the redirecting and redeploying resources after an improvement is made, studying changes to learn about fundamental causes of problems in the system, and evaluating and publicizing the status of improvement efforts in the organization  |