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Project Quality Management for Project Managers
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Project Quality Management for Project Managers

By Dr. T D Jainendrakumar

Quality Management: Quality is the degree to which the project fulfills requirements. It includes creating and following policies and procedures in order to ensure that a project meets the defined needs it was intended to meet.

Quality Theorists

- Joseph Juan's theory was based on 80/20 principle; he has told that the top management involvement is a must to maintain quality. Quality is *fitness for use*.

- W. Edwards Deming has put forward 14 steps of total Quality Management; he has described Plan-Do-Check-Act cycle.

- Philip Crosby's theory says Cost of poor quality has to be taken care while producing a product, always prevention is better than cure that is "prevention over inspection" and zero defects. Quality is "*conformance to requirements*" (Just read from other books and have common understanding about other Quality Gurus also)

- Armand. V. Feigenbaum says Quality is a customer determination, not an engineer's determination, not a marketing determination, [nlor a general management determination. It is based upon the customer's actual experience with the product or service, measured against his or her requirements-stated or unstated, conscious or merely sensed, technically operational or entirely subjective-and always representing a moving target in a competitive market.

- Kaoru Ishikawa. Ishikawa makes it clear the proof of high quality is the satisfaction of ever changing consumer expectations. Ishikawa's essential points are: 1. Quality is equivalent to consumer satisfaction. 2. Quality must be defined comprehensively. It is not enough to say the product is of high quality; we must focus attention on the quality of every facet of the organization. 3. Consumers' needs and requirements change. Therefore, the definition of quality is ever changing. 4. The price of a product or service is an important part of its quality. Ishikawa writes that no matter how high the quality, if the product is overpriced, it cannot gain customer satisfaction. In other words, one cannot define quality without considering price

ISO Compatibility

PMPOK's project quality management has some similarities with the ISO's compatibility some of them are as follows:

- Customer Satisfaction (PMBOK & ISO focused in Customer Satisfaction)
- Prevention over inspection (both says prevention is better than cure)

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- Continuous improvement (There are always scope for improvements after improvements)
- Management Responsibility (Quality Consciousness in the management team is must)
- Cost of Quality (COQ) (To maintain quality we have to spend some money)

Plan Quality Management

This is the first process in this knowledge area which comes under planning process group and this is for Identifying quality requirement and or standards for the project and its deliverables, and documenting how the project will demonstrate compliance with the relevant quality requirements.

Plan Quality: Inputs

1. Project Management Plan, includes but not limited to
   a. Scope baseline
   b. Work Breakdown Structure
   c. WBS Dictionary
   d. Schedule baseline
   e. Cost baseline
   f. Other management Plans
2. Stakeholder Register (identified stake holder details)
3. Risk register (details of risk and opportunities and its impact on the project)
4. Requirements Documentation (this contains the details for project team on how quality control will be implemented on the project)
5. Enterprise environmental factor (Rules and regulations of government agencies)
6. Organizational process assets (Organizational policies, procedures, historical information, lessons learned etc.)

Plan Quality: T & T

1. Cost-benefit Analysis

2. Cost of Quality (COQ)

3. Seven Basic Quality Tools

   a) Cause-and-Effect Diagram
   b) Flowcharts
   c) Check-sheet
   d) Pareto Diagram
   e) Histograms
   f) Control Charts
   g) Scatter Diagram
4. Benchmarking

5. Design of Experiments

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6. Statistical Sampling

7. Additional Quality Tools

   a) Brainstorming
   b) Force field analysis (It provides a framework for looking at the factors (*forces*) that influence a situation, It looks at forces that are either driving movement toward a goal (helping forces) or blocking movement toward a goal (hindering forces)
   c) Nominal Group Technique
   d) Quality Management and control tools (There are hundreds of tools, one has to study just in time depending on the need)

8. Meetings

Cost-benefit Analysis

Assessing the Cost incurred towards the revenue generated out of the project and other intangible benefits. Benefit should have prominence over cost. The primary benefit of meeting quality requirements is less rework, i.e., higher productivity, lower costs and increased stakeholder satisfaction and the primary cost of meeting quality requirements is the expenses associated with quality management activities.

Cost of Quality

There are two type of cost of quality are Cost of conformance and the Cost of Non Conformance. Cost of Conformance has again divided to two that are prevention cost and appraisal cost. Prevention cost is the expenditure made for building a quality product such as training, documentation processes, and equipments for testing etc. Appraisal Cost is the cost incurred for assessing the quality such as Testing, Inspection, losses incurred in destructive testing etc...
And the cost of Nonconformance also has two parts first one is internal failure cost and the second is External Failure Cost. Internal failure found by quality control department results in rework or scrapping the product similarly failure can be detected by the customers also in the scope validation process that is external failure, this costs heavily, it can damage the reputation of the company and lost business, liabilities like arbitration, litigation , warranty replacements or re-work etc.,

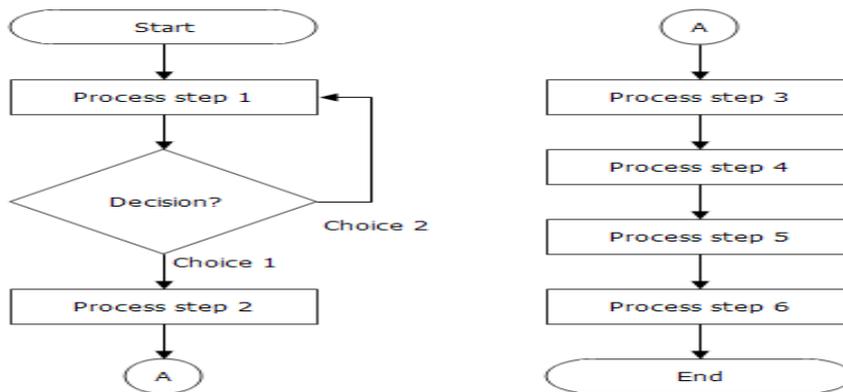**Cause and Effect Diagram**: To trace the problem's source back to its "actionable root cause"
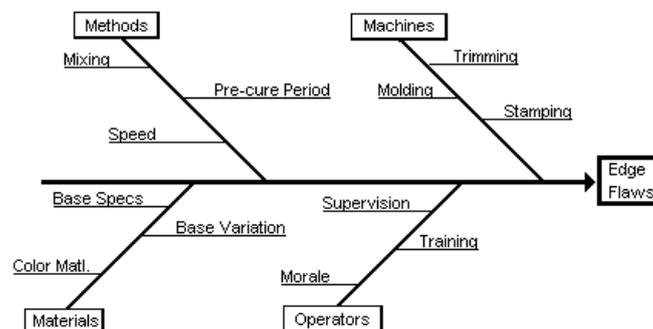
Cause and Effect Diagram for Edge Flaws

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Effect on the head and causes are on the bones, each individual "bone" or section, can then be broken down further into another "fishbone" of individual items for analysis and suitable action can be initiated. In the above diagram the effect edge flaws in production can be due to operators fault, machine fault, fault in the materials used, methods or process fault, and each main bourn is further divided to reach in to the exact problems for corrective action.

Flowcharting: A graphical representation of a process showing the logical relationships among process steps to find out flaws in processes for example process related to supplier input to the processes, output delivered to the customer etc. can be monitored.
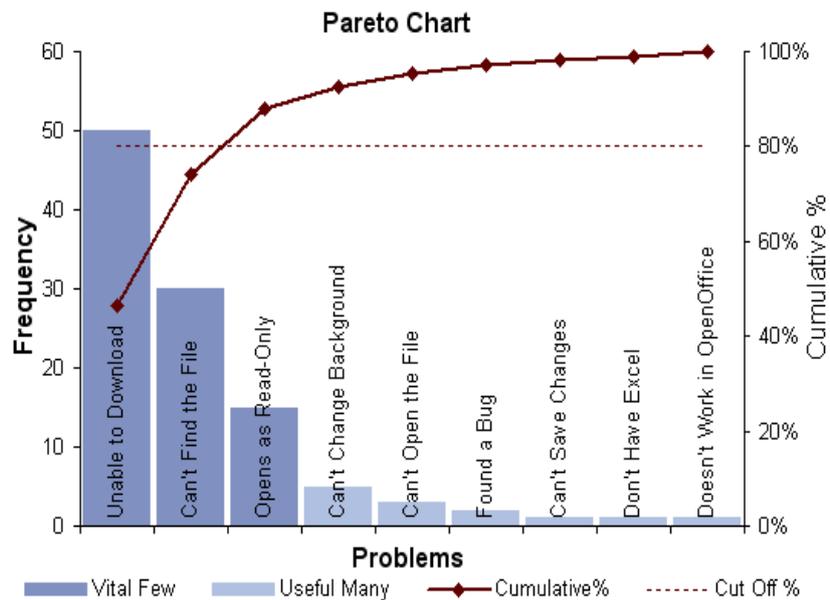
Basic Flowchart

Tally Sheets

In the above tally sheet, errors are observed and marked the defects in a tally sheet as shown above and can do a research on the problems identified and appropriate measures can be taken to reduce the defects.

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Pareto Diagram

The left vertical axis (border) shows the frequency of problems for each problem category, and the right vertical axis shows the cumulative percentage of each problem of the total problems. The horizontal axis (bottom) lists the defective items starting with the most frequent one on the left (unable to download), progressing over to the least frequent occurrence on the right side (doesn't work in open office). Here the reason for failure in a file transaction is analyzed. The cumulative points are marked as dots and a line is drawn through those dots as shown in the figure, then there is a curve and a dotted line is drawn from the middle of the curve shows that 80% of the problems are due to the 49% of causes like unable to down load, can't find file, opens as read-only etc., Therefore, the Pareto diagram visually indicates which problem should be solved first as listed above. With this bar graph, it is easier to see which problems are most important of the entire problem that exists. If we solve all of this 49% of problems other problems will be automatically dissolve or easy to solve.

Histogram

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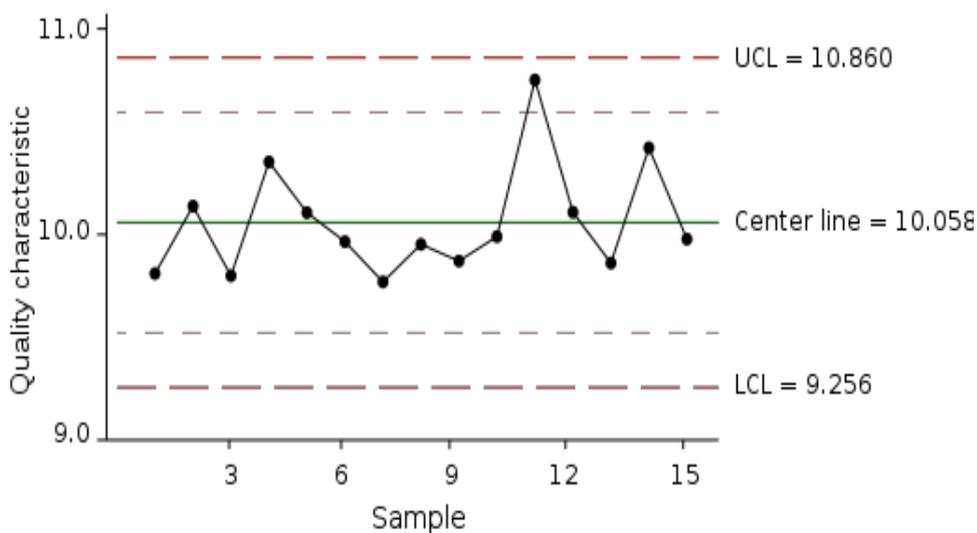T. D. Jainendrakumar
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Histogram is the bar chart which shows the distribution of data. The above histogram It is useful in understanding the number of customers willing to wait against the number of minutes on hold in a call centre. From the above histogram we can decide why the customers has to wait more than 3 minutes to 7 minutes and take appropriate action to reduce waiting time to less than 3 minutes.
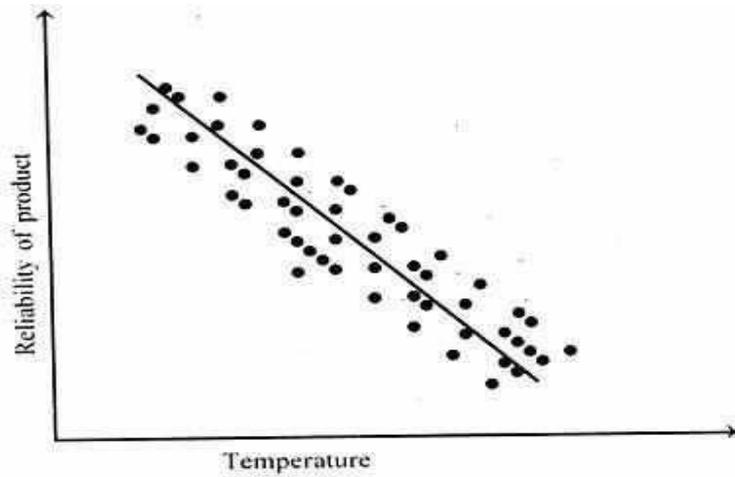
Histograms are generated by some of the project management software like primavera while allocating resource's times to the project activities, and when the resources are over allocated and over loaded, the bar chart in the histogram shows red from that point. If we level the resource automatically the software will do it by increasing the project duration.

Control Charts

- Graphic displays of the results, over time, of a process and it is used to assess whether the process is "in control".

- Upper control limit (UCL) value is given by the customer and lower control limit is set internally by the project team.

- RUN - When several plotted points line up consecutively on one side of a Central Line (CL), whether it is located above or below the CL, it is called a "run". Rule of Seven, if there are 7 points in a row on one side of the CL, there is an abnormality in the process and it requires an adjustment.
- TREND - If there is a continued rise or fall in a series of points (like an upward or downward slant), it is considered a "trend" and usually indicates a process is drifting out of control.
- Assignable causes – Variations may be caused by differences in machines, workers overtime, etc. Identify the root cause and stream line the process.

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Scatter Diagram

In the above example, you can see that the dots, which are actually data points, have various relationships. The Negative and linear correlation indicates that there is a close relationship between the reliability of the product and the temperature settings, as temperature increases reliability of the product decreases.
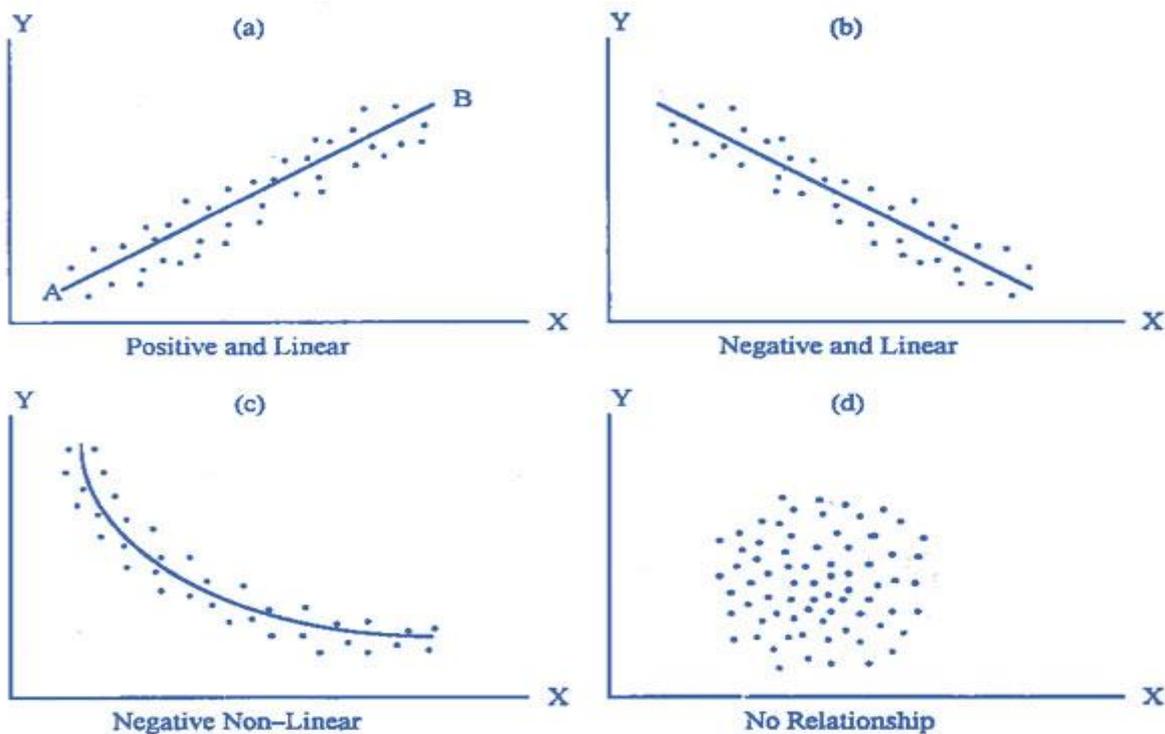
If the dot pattern indicating is in the opposite direction as shown in fig (a) implies that, as the temperature increases reliability of the product is also increasing this is a Positive and linear Correlation

If the dots are as in fig (c) it shows negative non-linear relationships.

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In some cases dots will be scattered as in fig (d) means there is no correlation, or no relationship at all between the temperature and reliability of the product.

Benchmarking

Benchmarking involves comparing actual or planned project practices to those of other projects in order to generate ideas for improvement and to provide a standard by which to measure performance. These other projects may be within the performing organization or outside of it, and may be within the same or in another application area.

Design of Experiment

Design of experiments is a statistical method that helps identify which factors might influence specific variables. It also plays a role in the optimization of products or processes. E.g. A floor designer might want to determine which combination of materials and equipment will produce reliable tiles at a reasonable cost. Appropriately designed experiments will compute various combinations to select, and select the most appropriate combination of materials to produce the tile.

Statistical Sampling

Statistical sampling involves choosing part of a population of interest for inspection (e.g., selecting 10 samples of 75 electronic components). Appropriate sampling can often reduce the cost of quality control. There is a substantial body of knowledge on statistical sampling; in some application areas, it is necessary for the project management team to be familiar with a variety of sampling techniques.

Plan Quality Management: Outputs

1. Quality Management Plan (specifies the application of a quality policy of an organization to a specific project)

2. Process Improvement Plan. There are always scope for improvement in:

   - Process Boundaries(the purpose of the process, duration, process owner and stakeholders)

   - Process Configuration (Process under operations and their interaction levels)

   - Process Metrics (Analyzes the efficiency of the matrix)

   - Targets for Improved Performance

3. Quality Metrics (Product quality parameters are generated in a matrix form and "what gets measured gets done)

4. Quality Checklist (Quality Check List(To Do List) to verify at the time of Quality Control Checking)

5. Project Documents Updates (Responsibility assignment matrix, WBS, WBS dictionary and Stakeholder register are updated)

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Perform Quality Assurance

This is the second process in the project Quality management knowledge area which comes under execution process group for auditing the quality requirements and the results from quality control measurement to ensure that appropriate quality standards and operational definitions are used. The key benefit of this process is that it facilitates the improvement of quality processes.

Perform Quality Assurance: Input

1. Quality Management Plan (It specifies the quality management approach and process improvement for the project)

2. Process Improvement Plan (the quality assurance activities and quality management plan should be in aligned with the organizations process improvement plans0

3. Quality Metrics (These quality metrics parameters should be measured at regular intervals to assure quality)

4. Quality Control Measurements (The output of quality control process is used as an input for quality assurance)

5. Project Documents include process improvements procedures and formats.

Perform Quality Assurance: T & T

1. Quality Management and Control Tools

    - Affinity Diagrams

    - Process Decision Program Charts

    - Interrelationship Digraphs

    - Tree Diagrams

    - Prioritization Matrices

    - Activity Network Diagram

    - Matrix Diagrams

2. Quality Audits are conducted to see that the standards are maintained in using the materials, best practices are followed, whether any nonconformities are existing etc.,

3. Process Analysis (Whether the processes are in order and to determine any flows in the process or to suggest further improvements etc.,)
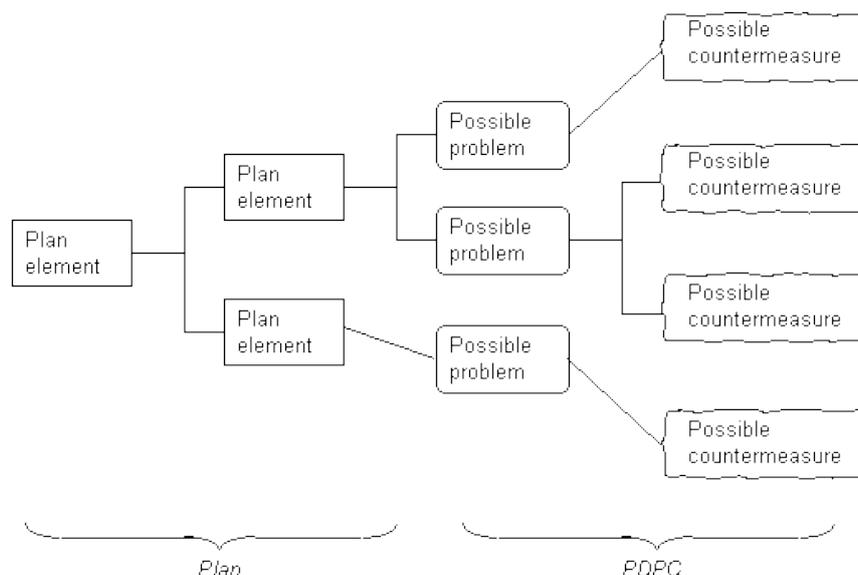
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Affinity diagram

Affinity diagrams are a special kind of brainstorming tool that organize large amounts of disorganized data and information into groupings based on natural relationships. Affinity diagram can be in any form like tree structure of the WBS etc., in this you can also diagrammatically record the affinity of the customer towards certain requirements at the time of requirement gathering, and for quality management and risk management etc., and you can show this diagram to the customer at the time of scope validation to make a positive impression about you and your company to build trust and brand.
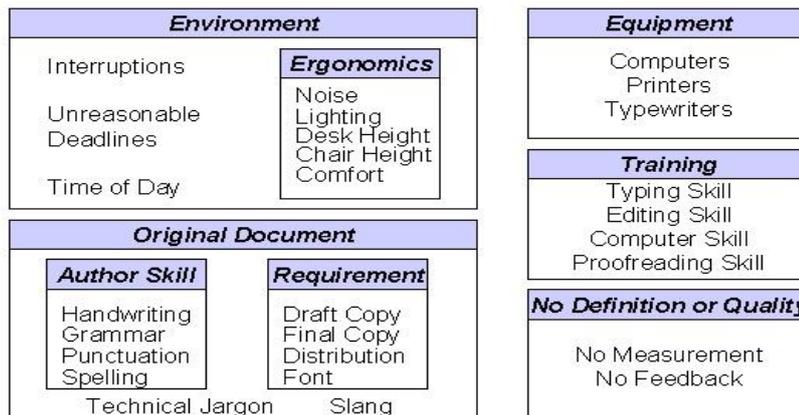
Process Decision Program Charts

A useful way of planning is to break down tasks into a hierarchy, using a tree diagram. The PDPC extends the tree diagram a couple of levels to identify risks and countermeasures for the bottom level tasks. Different shaped boxes are used to highlight risks and identify possible countermeasures (often shown as 'clouds' to indicate their uncertain nature). The PDPC is similar to the Failure Modes and Effects Analysis (FMEA) in that both identify risks, consequences of failure, and contingency actions; the FMEA also rates relative risk levels for each potential failure point.
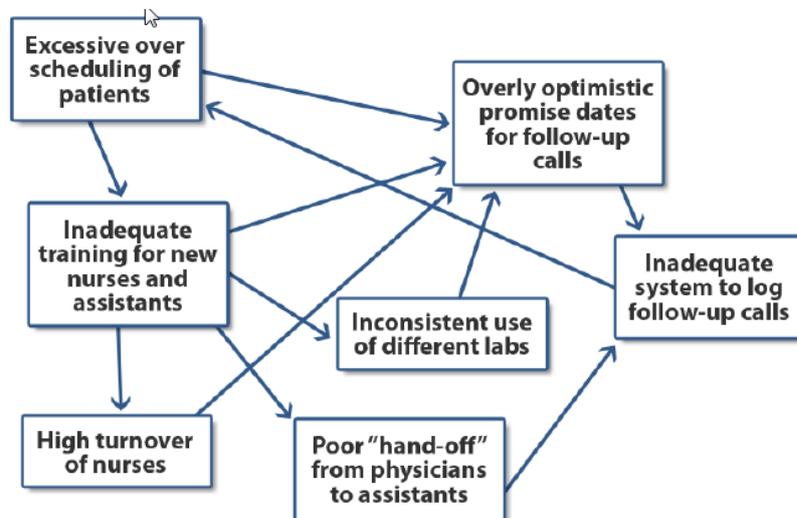
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Interrelationship Digraphs

Process interrelation ship diagram can be drawn as given above to understand the relationships of activities within a complex process. This tool displays all the interrelated cause-and-effect relationships and factors involved in a complex problem and describe desired outcomes. The process of creating an interrelationship digraph helps a group analyze the natural links between different aspects of a complex situation.

Example: A local physicians' group is experiencing a relatively high number of patient complaints regarding the lack of returned phone calls following a patient visit where some kind of test was ordered. In particular, the patients are frustrated that the promised call notifying them of the test results is either delayed or must be initiated by the patient. The office manager of the group conducts a brainstorming session to generate potential reasons for the lack of effective and timely follow-up calls. The group then takes the brainstormed list and organizes the potential reasons using an interrelationship diagram.

The basic idea is to count the number of "in" and "out" arrows to and from a particular issue and to use these counts to assist you in prioritizing the issues. In the interrelationship diagram above, "Overly optimistic promise dates for follow-up calls" is a key issue and, of course, would cause patients to expect a phone call faster than the group believes it can deliver it. However, do not summarily ignore or devalue the importance of issues with few "in" and "out" arrows until you have verified empirically the influence of these issues.

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Tree Diagrams

This tool is used to break down broad categories into finer and finer levels of detail e.g. WBS.
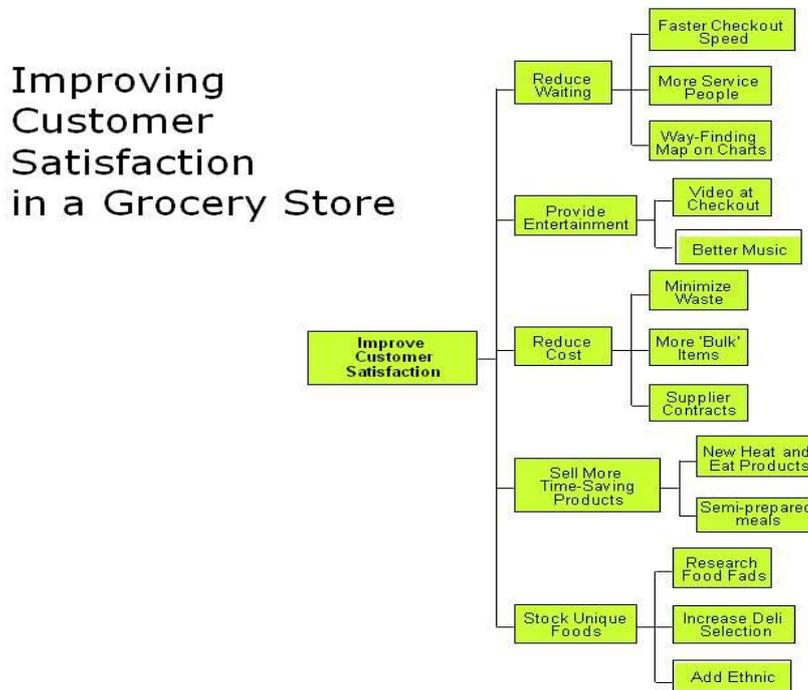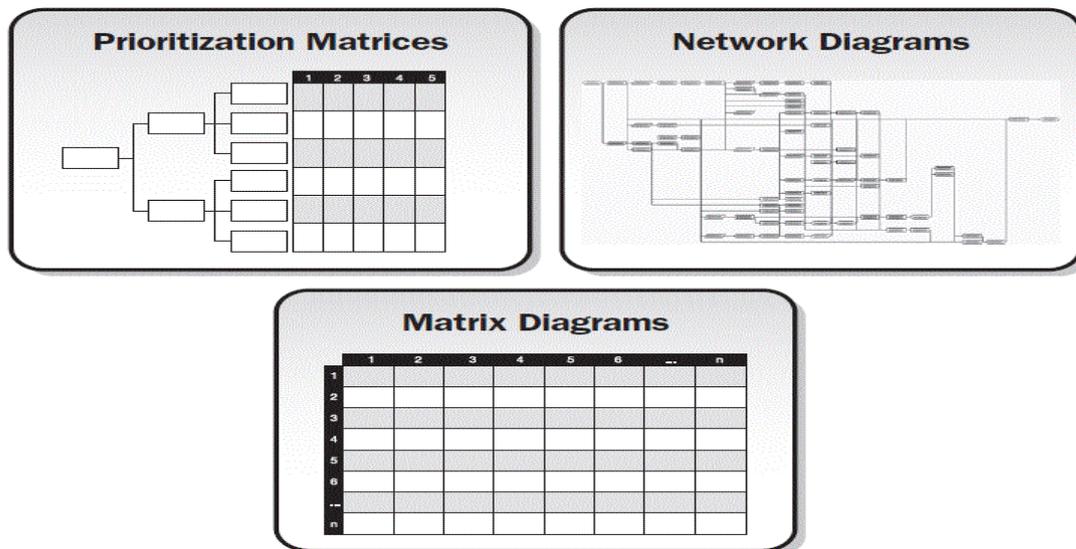

Prioritization Matrices

Prioritization matrix is used to prioritize items and describe them in terms of weighted criteria. It uses a combination of tree and matrix diagramming techniques to do a pair-wise evaluation of items and to narrow down options to the most desired or most effective. Popular applications for the Prioritization Matrix include return on investment (ROI) or Cost–benefit analysis (investment vs. return), time management matrix (urgency vs. importance), and Risk management etc.

Activity Network Diagram

This tool is used to plan the appropriate sequence or schedule for a set of tasks and related subtasks. It is used when subtasks must occur in parallel. The diagram helps in determining the critical path (longest sequence of tasks)

Matrix Diagrams

This tool shows the relationship between items. At each intersection a relationship is either absent or present. It then gives information about the relationship, such as its strength, the roles played by various individuals or measurements. Six differently shaped matrices are possible: L, T, Y, X, C, R and roof-shaped, depending on how many groups must be compared.

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Prioritization Matrices

Network Diagrams

Matrix Diagrams

Perform Quality Assurance: Output

1. Change Requests (if there is any variations in the quality management plan change request has to be raised and this changes has to be approved or rejected through perform integrated change control process and approved changes has to be given to the perform quality assurance)

2. Project Management Plan Updates (Quality management plan, scope, schedule management plan and cost management plan will get updated

3. Project Documents Updates (Audit reports are prone to changes, training plans etc. may require an updation)

4. Organizational Process Assets (Quality documents and standards get updated)

Control Quality

This is the third and final process in this knowledge area which comes under monitoring and control process groups for Performing Quality Control. It is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes. The key benefits of this process include

- Identifying the causes of poor quality

- Validating that project deliverables and work meet the requirements

Important Quality terms

- Prevention (Keeping errors out of the process) vs. Inspection (Keeping errors out of the hands of the customer). The methods used are sampling. In Attribute sampling products are checked and see whether it meets the conformance to requirement or not. But in Variables sampling checks the degree of conformity in terms of the specification and functionalities of the product.

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- Tolerance means range of acceptable results and control limits means threshold which may indicate out of control.

- There is a tradeoff between Quality and Grade, quality is conformance to requirement, let us take a base model of Honda Car even though this car has lower in grade than Mercedes Benz (S class) , if it meets the functionalities offered to its customers it has quality. Benz S class is higher in grade than base model of Honda, if it doesn't fulfill the functionalities offered to the customer, then this car is lacking quality. This is the difference between grade and quality.

Control Quality: Input

1. Project Management Plan

2. Quality Metrics (describes the attributes of product or project and how it is measured)

3. Quality checklists (Checklist of list of requirements)

4. Work Performance Data (Actual work performance details)

5. Approved Change Requests (output of perform integrated change control process)

6. Deliverables (will be checked for correctness in this process)

7. Project Documents (Agreements, Quality audit reports, change log, training plan etc.)

8. Organizational Process Assets (Organizational procedures for quality standards, work guidelines, issues and defect reporting procedures etc.)

Control Quality: T & T

1. Seven Basic Quality Tools (described above0
2. Statistical Sampling (Samples are tested for acceptance or rejection of a lot)
3. Inspection (confirmation of deliverables to exact requirements, for keeping errors out of the hands of customer)
4. Approved Change Request Reviews (all the change requests that are approved will be reviewed in this process and see that the changes are implemented)

Control Quality: Output

1. Quality Control Measurements are the outcome of the quality control process.

2. Validated Changes (see that change requests are implemented)

3. Verified Deliverables (confirmation of deliverables to exact requirements)

4. Work Performance Information (Comparing actual work done with the planned work and decision making information are generated)

5. Change Requests (if the changes are not implemented properly, change requests are raised.)

6. Project Management Plan Updates (Changes will result in the updation of Quality management plan and process improvement plans)

7. Project Document Updates (quality related documents and process improvement documents are updated)

8. Organizational Process Assets Updates (Completed checklists, lessons learned documentation, etc.)

Follow above processes as and when needed to ensure that a project meets the defined needs it was intended to meet and thus the project managers can ensure the quality.

_____

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About the Author

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Dr. T D Jainendrakumar, PhD, MCA, PMP is an international PMP trainer, EX-Scientist/Principal Scientist/Joint Director, N.I.C, Ministry of Information and Communication Technology, Government of India, Madhyapradesh. He has over 25 years' of extensive experience in the areas of IT Project management in e-governance at Ernakulam District Collectorate, District Courts of Kerala, Central Administrative Tribunal Ernakulam, Rajeev Gandhi National Drinking Water Mission (400 crore project), New Delhi and Principal Systems Analyst in National Informatics Centre, Madhya Pradesh State Centre especially in the following areas of specialization: IT practice management (Project Management Methodologies, Tools and techniques, Standards & Knowledge);IT Infrastructure Management (Project Governance, Assessment, Organisational Instructions & Facilities and Equipments); IT-Resource Integration Management (Resource Management, Training & Education, Career Development & Team Development);IT-Technical Support (Project Mentoring, Project Planning, Project Auditing and Project Recovery); and Business Alignment Management (Project Portfolio management, Customer Relationship Management, Vendor Management & Business performance management).

Teaching Project Management & ICT Subjects for professionals and post graduates. Master of Computer Applications (MCA), a 3 year post graduate course dealing with software Engineering and Project Management from a premier institute Anna University Campus. He is a PMP of PMI USA since 2008. Resource person of PMI, you can see his name in the PMBOK 4th edition and 5th edition published by PMI, USA under the list of contributors for project management. Scored 4.11 out of 5 in the project management (2005) examination conducted by brainbench.com, secured a Masters Certificate in Project Management, and is one among the top scorers (First in India and 3rd position in the world in the experienced category).

Published many international journal papers in PM World Today having cumulative index factors more than 2 in the areas of specialization of Project Management & Information Technology.

Holding a Hon' Doctorate from Cosmopolitan University, USA in Project Management & Information Technology. Presently working as an independent project management consultant and an International Project Management (PMP) trainer. Provided PMP training to the senior officials of big MNCs like M/S. Earnest & Young and He is a visiting professor and sharing his knowledge and experience and to handle classes in Management Information Systems, Quality Management, Project Management and Software Engineering to some of the big universities. He can be contacted at jainendrakumartd@ymail.com.