

Implementation of QR code for Operation & Maintenance (O&M) manuals for machines at project sites

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Abstract

Operation & Maintenance Manuals have generally covered Technical Literatures about the Machine and either are stored in Hard Copies in Customer office / site archives or stored in Computers in soft forms. After a long period generally, the accessibility of these documents becomes difficult due to change of site persons/change of office/hard disk crash, etc. which increase the difficulty of retrieval of these documents & increase the machine idle time & customer dissatisfaction. The subject article covers aspects of the Implementation of Latest Digitalization effort of converting the Operation & Maintenance Manuals of the Machines, Equipment, Skids, etc. into QR Code and to installed these QR codes near equipment at site, Control Room / Site administration building for ease of accessibility & retrieval of the O&M while scanning the same from mobile. This shall help to achieve the objective of customer satisfaction / site person satisfactions and to increase the efficiency of the machine & reducing the machine idle time.

Subject Classification: C88, E37, C44.

Keywords: QR (Quick Response) code, O&M (Operation & Maintenance) manuals, Customer satisfaction, Total quality management (TQM).

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1. Introduction

Electrical & Mechanical Machines at project sites are the key component for any power or Industrial Plant. These machines consist of highly advanced technical design & require the skilled manpower for their operations. Generally, a plant life varies between 15-20 years and in some cases may be more also. For any plant, successful operation for plant life, regular maintenance is an essential requirement. Such maintenance at regular intervals of a year is called Annual Maintenance. A part from annual maintenance, in case of a breakdown of a machine during running operation, the breakdown maintenance becomes very critical as the stoppage of operation shall stall the production. Hence for breakdown maintenance and regular maintenance, Operation & Maintenance Manuals becomes very essential documents for engineers or operators.

These Operation & Maintenance Manuals have generally covered Technical Literatures about the Machine and either are stored in Hard Copies in Customer office/site archives or stored in Computers in soft forms. After a long period generally the accessibility of these documents becomes difficult due to change of site persons / change of office / hard disk crash etc. which increase difficulty of retrieval of these documents & increase the machine idle time & customer dissatisfaction.

The subject Project covers aspects of the Implementation of the Latest Digitalization effort of converting the Operation & Maintenance Manuals of the Machines, Equipment, Skids, etc. into QR Code and to pasted at equipment at the site, Control Room / Site administration building for ease of accessibility & retrieval of the O&M while scanning the same from mobile. This shall help to achieve the objective of customer satisfaction/site person satisfaction (TQM objectives) and increase the efficiency of the machine & reduce the machine's idle time.

This study briefly covers the introduction of Total Quality Management (TQM), Operation & Maintenance Manuals and Quick Response Code (QR Code) & its brief features. The outcome of the study shall derive further course of action toward the implementation of QR codes throughout the company and for all technical & quality documentation including the standard documentation. The future directions shall be derived from this study for any new dimension of QR codes for O&M Manuals to meet customer expectations also. This study shall be useful to establish the overall customer satisfaction and site personnel's recommendations for improvement in the present state of documentation status shared with them.

- The following are the major objective were monitored from the study:
- Contribution of Quick Response (QR) Codes implementation towards TQM.
- Contribution of Information Technology (IT) tools to Quality objectives.
- Customer Satisfaction by implementing QR Codes for Machines at site.

2. Literature Review

QR Code has been used in operation management in various domain of operation management. These areas are Artifitial intellegene system, Defect Management system, Training, Electronic Manuals, Material flow in manufacturing.

LingQing (2019) has carried out their research work in use of QR codes in Defect Management On other hand, Huo, L. (2021) published research paper on the application of QR image with the help of Artificial Intelligence is highly innovative idea. Ma, (2021) has made elaborate application of QR Code in Training. Peltokorpi, J (2021) has described QR code use in manufacturer Material flow.

The brief overview of TQM, O&M Manual AND QR code is described below:

Total Quality Management (TQM)

(asq.org/quality-resources/total-quality-management, n.d.).

Primary elements of TQM

TQM has 8 major principles.

- **Customer-focus:**
- **Total employee involvement:**
- **Process-cantered:**
- **Integrated system:**
- **Strategic and systematic approach:**
- **Continual improvement:**
- **Fact-based decision making:**
- **Communications:**

Operation & Maintenance Manuals

Components of an operation and maintenance manual

- **Overview**
- **Construction Details**
- **Operating procedures**
- **Maintenance procedures**
- **Emergency procedures**

The Hard Copies O&M Manuals are having following issues / Problems

- **Chances of getting Lost or destroyed**
- **Outdated information.**
- **Delays in Printing / Dispatch**
- **Limited functionality**
- **Access or Retrieval of information**
- **Storage of Hard Copies**

3. Research Methodology

After understanding basic concepts of O&M and QR Codes based on the review of existing literature, researcher studied and has tried to highlight that how the digitization of O&M Manual into QR Codes and make accessible to users help the user during breakdown maintenance and increase machine effectiveness and help in customer satisfaction. This study is an extract from the thesis work of researcher, where researcher has spent almost six months for the implementation of QR codes for O&M Manuals for various Electrical, Mechanical, Instrumentation machines observed the processes as per the objectives of the study.

In the study, the survey conducted over a mixed population of Engineers of one large company comprise of different age groups, different official designations, different departments (Engineering, IT, Quality, HR, Other Service departments) with questionnaire to find out the actual & perceptive impact on the population. The researcher wishes not to mention the name of the company as a part of confidentiality measure agreed between the researcher and the respondent.

The Primary Data

Quantitative data has been collected through the **Questionnaire** consisting of 12 questions related to the study various domains & aspects. The same have been sent through mail & the response have been collected through mail attachment of the filled up questionnaire by the respondents.

Qualitative data has been collected from various **personal interviews & interaction** held with cross sections of executives in various meetings & interactive session on the related subjects. The feedback has been collected & presented for the study results.

Secondary Data

about the subject study has been collected from available Literature, Books, Online Journals, Article from leading News-Papers, Magazines, Websites.

4. Data Analysis of the study

Each Individual response received in mail & has carefully analyzed, collected, store the data & has been tabulated in Excel file, Individual response has been reflected against each question. The total responses have been summarized & accordingly the chart is plotted against each point.

The answers have been given suitable weightage and the same is analyzed against each objective of the study (Table 1). Composition along with response of total population of 52 nos. respondents are indicated in below chart.

Table 1

Do you recommend for further Developing QR Codes for most of Standard Engineering Documentations?

Response	Sr. Management	Middle Management	Executives	Total
Strongly Recommended	11	25	8	44
Not Sure	2	5	1	8
Total	13	30	9	52

Conclusion & Recommendations

In view of above, Implementation of QR Code for Technical & Quality Documentation is highly recommended.

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