

A METHOD FOR EVALUATING THE MAINTENANCE MANAGEMENT SYSTEM IN SOME COMMUNICATIONS COMPANIES

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Abstract:

Today, maintaining the operations of communications firms is an essential component of their business management. To maximize system efficiency and reduce downtime, the management's tactics and the effectiveness of its maintenance engineers are crucial. By employing a suitable methodology that will give a framework for analyzing maintenance management and present insight into what is necessary to manage maintenance, the current study aims to evaluate and examine whether the current maintenance management system, through local companies, is qualified for a world-class level. The results of using a proposed approach; to both Almadar and Libyana companies; indicated that both of them fall within the range of fewer than 224 points. Precisely, Almadar Algadeed company gained only 219 points out of 320 points; while Libyana company gained only 182 points out of 320 points. Finally, this study may provide a framework and options to the decision-makers, allowing them to select the best way to manage their maintenance activities.

Keywords: Maintenance, goals, Almadar, and Libyana.

الملخص

اليوم ، يعد الحفاظ على عمليات تشغيل شركات الاتصالات عنصراً أساسياً في إدارة أعمالهم. من أجل زيادة كفاءة النظام وتقليل وقت التوقف عن العمل ، فإن تكتيكات الإدارة وفعالية مهندسي الصيانة أمران حاسمان. من خلال استخدام منهجية مناسبة توفر إطاراً لتحليل إدارة الصيانة وتقديم نظرة ثاقبة لما هو ضروري لإدارة الصيانة ، تهدف الدراسة الحالية إلى تقييم وفحص ما إذا كان نظام إدارة الصيانة الحالي، من خلال الشركات المحلية، مؤهلاً لمستوى عالمي . نتائج استخدام الأسلوب المقترح ؛ لكل من شركتي المدار وليبيانا ؛ أشار إلى أن كلاهما يقع في نطاق أقل من 224 نقطة. وعلى وجه التحديد، تحصلت شركة

المدار الجديد على 219 نقطة فقط من أصل 320 نقطة، فيما تحصلت شركة ليبيا على 182 نقطة فقط من أصل 320 نقطة. أخيرًا، قد توفر هذه الدراسة إطارًا وخيارات لصانعي القرار ، مما يسمح لهم باختيار أفضل طريقة لإدارة أنشطة الصيانة الخاصة بهم.

1. Introduction

Maintenance is a routine and recurring process of keeping a particular machine or asset in its normal operating condition to deliver its expected performance or service without causing any loss of time on account of accidental damage or breakdown. In other words; maintenance means the work that is required to be done to keep equipment running so that it can be utilized for the maximum amount of time. It involves looking after the safety aspects of certain equipment where the failure of a component may cause a major accident (Azouz and Elfasi, 2021; Safety culture topics, [What is Maintenance? Types of Maintenance | SafetyCulture](#), 2023). Any communications company's maintenance management program has a very specific and well-defined goal. This is done to keep repairs to a bare minimum, allowing for optimum system uptime and utilization at the lowest possible cost of maintenance. Maintaining a complete history of the system is critical for improving maintenance and cost performance, as well as keeping records that allow for evaluation of the system's efficiency, maintenance costs, and repair/replacement costs. The goal should be to limit the chances of unexpected asset failures and unplanned asset write-offs. The current study aims to evaluate and examine whether the current maintenance management system is qualified for a world-class level by using a suitable method that will provide a framework for analyzing maintenance management (Upkeep reports, [What is maintenance management? \(upkeep.com\)](#), 2023), and present an insight into what is necessary to manage maintenance.

1.1. Maintenance Objective

The most important objective of the maintenance function is the maximization of the availability of equipment or facilities to extend help for achieving the ultimate goals of the organization. Another important objective of maintenance is the establishment of safe working conditions both for operating and maintenance personnel (Lindly and Morrow, 1977; Velmurugan and et al, 2022; Zimmermann, and Duffy, 2023). The numerous other objectives of maintenance are depicted pictorially in Fig.1 (Safety culture topics, [What is Maintenance? Types of Maintenance | SafetyCulture](#), 2023).

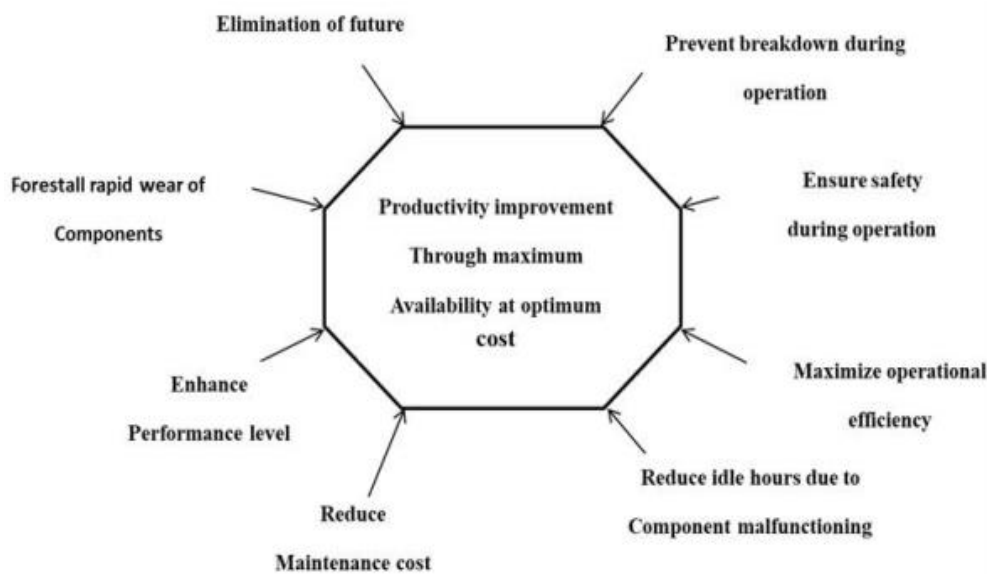


Fig. 1 Objective of Maintenance (Safety culture topics, [What is Maintenance? Types of Maintenance | SafetyCulture](#), 2023)

1.2. Functions of Maintenance

Maintenance is necessary for all manufacturing establishments because machines break down, parts wear out, and buildings deteriorate. All of the many segments that comprise the industrial enterprise require attention, including the buildings, grounds, machinery, equipment, materials handling equipment, heating and generating equipment, waste disposal systems, air-conditioning equipment, washrooms, cafeterias, and so forth.

The maintenance engineering handbook classifies maintenance engineering into the following primary and secondary functions (Patton, 1982):

➤ Primary functions:

- ❖ Maintenance of existing plant equipment.
- ❖ Maintenance of existing plant buildings and grounds.
- ❖ Equipment inspection and lubrication.
- ❖ Utilities generation and distribution.
- ❖ Alterations to existing equipment and buildings.
- ❖ New installations of equipment and buildings.

➤ **Secondary function:**

- ❖ Storekeeping,
- ❖ Plant protection, including fire.
- ❖ Waste disposal.
- ❖ Salvage.
- ❖ Insurance administration.
- ❖ Janitorial service.
- ❖ Property accounting.
- ❖ Pollution and noise abatement.
- ❖ Any other service delegated to maintenance engineering by plant management.

2. Assessment Approach

The approach used in this study (Wireman, 1988) provides a framework to analyze maintenance management and to present an insight into what is required to manage maintenance. It is not a total answer to every maintenance management problem, however, it will introduce a base with options allowing maintenance decision makers to select the most successful way for them to manage their maintenance. The analysis is organized into (8) parts as shown in Table 2 in the appendix.

2.1 Study Procedure

The suggested analyzing method of maintenance management system was used to examine the status of the maintenance management system of the mentioned companies in Benghazi city from a world-class maintenance management point of view. These communications companies are:

- Almadar Algadeed Company
- Libyana Company

Both Al-Madar Algadeed Company and Libyana Company were established; as mobile network operators; in 1995 and 2004, respectively. They both provide the following services:

- Voice calls.
- SMS.
- Internet.

Principles of data collection recommended by the author who designed this method (Wireman, 1988), were followed. Table 1 shows the total number of questions and the maximum points possible for each part.

Table 1 Total 4 of Multi Questions and Max. Points Possible for Each Study Part

Part #	Total # of multi questions	Total points possible
1	10	40
2	10	40
3	10	40
4	10	40
5	10	40
6	10	40
7	10	40
8	10	40
Σ	80	320

3. Results and Analysis

Recorded values of each part that were answered by company maintenance managers are shown in Tables 2 and 3.

Table 2 Recorded Values for Almadar Algadeed Company

Part No.	Section No.	1	2	3	4	5	6	7	8	9	10
	Score	Selected Choice									
1	33	A	A	C	B	A	B	B	B	B	A
		4	4	2	3	4	3	3	3	3	4
2	31	C	B	A, B, C, D	A	A	C	A	A	C	B
		1	3	4	4	4	2	4	4	2	3
3	28	B	A	B	E	A	B	B	B	D	A, B, C, D
		3	4	3	0	4	3	3	3	1	4
4	27	C	A, B, C, D	B	B	D	A	B	B	B	A
		2	4	3	2	1	4	1	3	3	4
5	13	B, C	E	D	D	E	A	E	C	E	B
		2	0	1	1	0	4	0	2	0	3
6	24	D	A	A	A	A	C	C	D	E	B
		1	4	4	4	4	2	2	0	0	3
7	29	A	B	A, B, C, D	A, D	A, B, C, D	A, B, C	A, C	A, B, C, D	A	A, D
		4	3	4	2	4	3	2	4	1	2
8	34	A	B	A	A	A	A	B	B	A	A
		4	3	4	4	4	4	0	3	4	4
Total	219	21	25	25	20	25	25	15	22	14	27

Table 3 Recorded Values for Libyana Company

Part No.	Section No.	1	2	3	4	5	6	7	8	9	10
	Score	Selected Choice									
1	25	B	A	C	E	C	C	B	B	C	A
		3	4	2	0	2	2	3	3	2	4
2	26	D	E	A, B, D	A	B	D	A	A	B	B
		1	0	3	4	3	1	4	4	3	3
3	25	C	A	B	E	A	B	B	A	E	A, C
		2	4	3	0	4	3	3	4	0	2
4	22	B	B, D	A	B	E	E	A, D	A	B	C
		3	2	4	2	0	0	2	4	3	2
5	20	A, B	D	A	D	B	B	B	D	E	C
		2	1	4	1	3	3	3	1	0	2
6	23	B	B	A	A	E	A	C	D	C	D
		3	3	4	4	0	4	2	0	2	1
7	20	C	B	A, B	A	C, D	B, C	C, D	B, C	A, B	A C
		2	3	2	1	2	2	2	2	2	2
8	21	B	B	A	B	A	B	B	C	B	B
		3	3	4	0	4	0	0	2	2	3
Total	182	19	20	26	12	18	15	19	20	14	19

The data analysis procedure as recommended by the used method (Wireman, 1988), shows that both companies fall in the range of fewer than 224 points, which indicates that it needs to examine the goals and priorities. The result regarding the observed gap in each part of the Almadar Algadeed Company is shown in Fig. 2. Figure 2, shows the maximum gap size obtained in part 5 (Preventive maintenance).

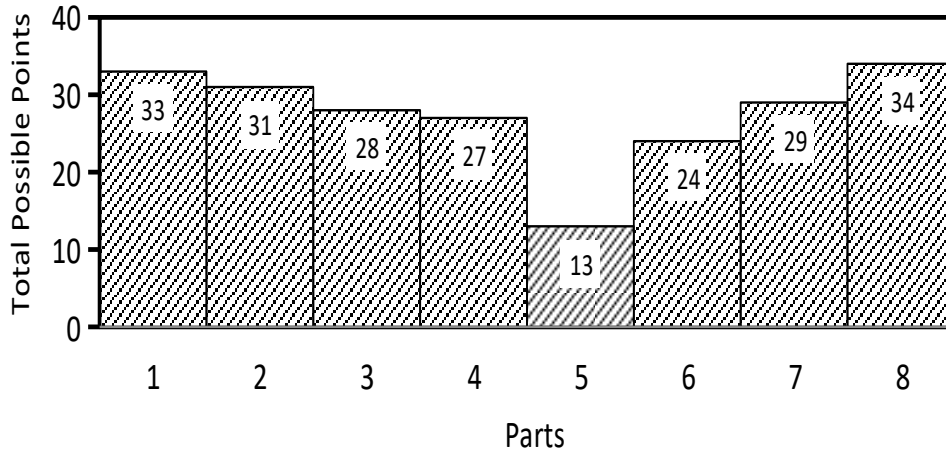


Fig. 2 Observed gap in each part of the study (Almadar Algadeed company)

On the other side, Fig. 3 shows the observed gap in each part of the Libyana company. It can be noted from Fig. 3 that there are no big differences between all parts.

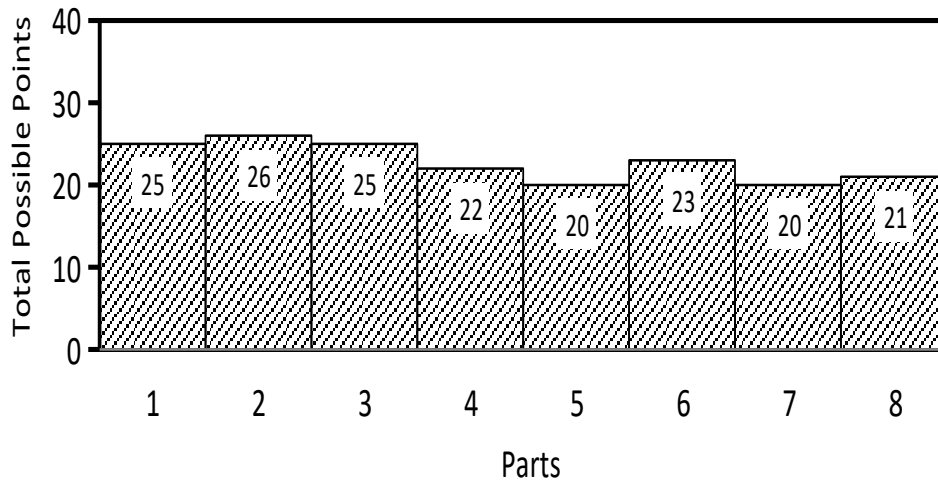


Fig. 3 Observed gap in each part of the study (Libyana Company)

As can be observed in Fig. 4, aside from part 5, which is about preventive maintenance, the Almadar Algadeed Company outperformed the Libyana Company in every part. This might be because the Libyana company performs inspections more frequently, preventative maintenance is completed more quickly, and/or its staff is more efficient.

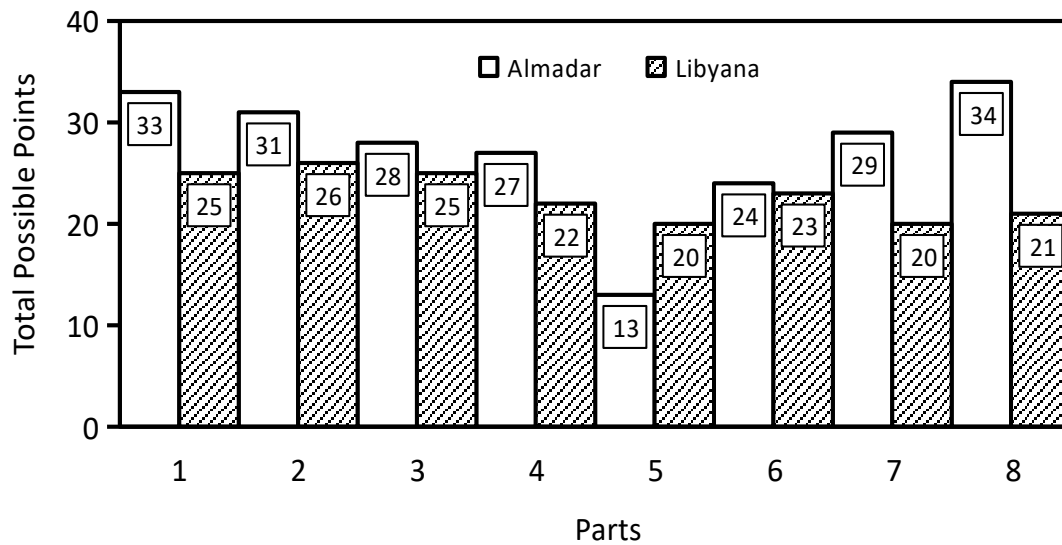


Fig. 4 Observed gap between the two companies

4. Summary and Remarks

To achieve excellent system performance and reduce downtime, an efficient maintenance program must be diligently implemented. It is necessary to regularly and accurately evaluate the different maintenance tasks to accomplish this goal. In this study, a methodology was used to assess the performance activities of the maintenance department in both the Al-Madar and Libyana companies and determine whether they are qualified for a global level. The following conclusions were drawn from the findings:

- The suggested method for analyzing maintenance organization can be employed easily to analyze the maintenance organization systems in government communication companies of Benghazi city.
- The proposed method, when applied to the Almadar and Libyana firms, results in scores that are less than 224 points:
 - ❖ Almadar Algadeed company gained only 219 points out of 320 points.
 - ❖ Libyana company gained only 182 points out of 320 points.
- The highest percentage of total possible points is 68.43% for Almadar Algadeed company.
- The absence of planners/schedulers in the maintenance management system is the weakest point in both companies studied, which leads to a downward trend in maintenance activity performance and irregular completion of all jobs.

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Appendix

Part 1. Maintenance organizations:

1. Maintenance organizational chart:

- Current and complete – 4 pts.
- Not complete or over 1-year-old – 3pts.
- Not current and not complete – 2pts.
- None – 0 pts.

2. Job descriptions are available for:

- All maintenance positions (including supervisors) – 4 pts.
- All maintenance positions (except supervisors) – 3 pts.
- All maintenance supervisors (and no others) – 2 pts.
- Less than 50% of all maintenance positions – 1 pts.
- No job descriptions – 0 pts.

3. Maintenance supervisor to hourly maintenance employee ratio:

- 8-12 to 1-4 pts.
- 12-16 to 1-3 pts.
- Less than 8 to 1 -2 pts.
- More than 16 to 1 -1Pts
- No shift maintenance supervisor – 0 Pts

4. Maintenance planner to hourly maintenance employee ratio:

- 15-20 to 1 -4 pts.
- 10-15 to 1 -3 pts.
- 20-25 to 1 -2 pts.
- 25-30 to 1 -1Pts
- No planner or any other ratio above – 0 Pts.

5. Maintenance Organizational assignments:

- Responsibilities fully documented -4 pts.
- Responsibilities clear, good coverage, good dispatching -3 pts.
- Informal supervision and coordination, some gaps in job coverage -2 pts.
- Maintenance reports to Production -1Pts
- No planner or any other ratio above – 0 Pts.

6. Maintenance Organization effort and attitude:

- Excellent, pride in workmanship at all levels -4 pts.
- steady work rate, professional operation -3 pts.
- Average work pace, only a few complaints -2pts.
- Only occasional good efforts, frequent job delays, many complaints -1Pts
- Constant disagreements within maintenance organization and between maintenance and operations/production/facilities – 0 Pts.

7. Maintenance shop/work area locations:

- Perfect -4 pts.
- Good (some improvement possible) -3 pts.
- Fair (major improvement possible) -2 pts.
- Poor (major improvement possible) -1Pts
- Unsuitable or non-existent – 0 Pts.

8. Maintenance shop/work area layout:

- Perfect -4 pts.
- Good (some improvement possible) -3 pts.
- Fair (major improvement possible) -2 pts.
- Poor (major improvement possible) -1 Pts
- Unsuitable or non-existent – 0 Pts.

9. Maintenance tool/equipment quality and quantity:

- Perfect -4 pts.
- Good (some improvement possible) -3 pts.
- Fair (major improvement possible) -2 pts.
- Poor (major improvement possible) -1 Pts
- Unsuitable or non-existent – 0 Pts.

10. What percentage of maintenance personnel are tied to a pay incentive plan based on output?

- a. All -4 pts.
- b. Greater than 90% -3 pts.
- c. Greater than 75% -2 pts.
- d. Greater than 50% -1Pts
- e. Less than 50% or other – 0 Pts.

Part 2. Training programs in maintenance:

1. Supervisory Training:

- a. All are trained when salaried and additional training is mandatory on a scheduled basis – 4 pts.
- b. All are trained when salaried and additional training is offered on an optional basis – 3pts.
- c. The majority are trained when salaried – 2 pts.
- d. The majority are offered and attend training offered on an infrequent or irregular basis – 1pts.
- e. Few are given initial training and little or no additional training – 0 pts.

2. Planner training:

- a. All planners/schedulers have been to one or more public seminars providing instruction on maintenance planning and scheduling – 4 pts.
- b. All planners/schedulers are provided with a written training program for maintenance planning – 3 pts.
- c. All planners/schedulers receive one-on-one on-the-job training for at least 1 month – 2 pts.
- d. Planner/scheduler training is on the job – 1pts.
- e. There is no planner/scheduler training program – 0 pts.

3. Details of planner training subjects (add 1 Pt for each of the subjects covered; add 0 pts if there is no planner training program):

- a. Work order planning and execution.
- b. Material planning.
- c. Scheduling practices
- d. Project planning.

4. General quality and productivity training:

- a. Includes upper management, line supervision, hourly worker, and support personnel – 4 pts.
- b. Includes upper management, line supervision, hourly workers – 3 pts.
- c. Includes upper management, line supervision – 2 pts.
- d. Is only for the upper management – 1 pt.
- e. No training program – 0 pts.

5. Maintenance craft training:

- a. Training is tied to a pay and progression program - 4pts.
- b. Formal job experience is required before employment and on-the-job training is provided – 3 pts.
- c. Formal job experience is required before hired – 2 pts.
- d. Training is provided by on-the-job experience after hire – 1pts.
- e. There is no formal training requirement for hire and no subsequent training is provided – 0 pts.

6. Maintenance training intervals: Formal maintenance training is provided to all maintenance craft employees at the frequency of:

- a. Less than one year – 4 pts.
- b. Between 12 and 18 months – 3 pts.
- c. Between 18 and 24 months – 2 pts.
- d. Not provided to all employees but to some in any of the above frequencies – 1pt.
- e. No training is offered – 0 pts.

7. Format of maintenance training:

- a. Training is a mix of classroom and lab exercises – 4 pts.
- b. Training is all in the classroom – 3 pts.
- c. Training is all in a lab or workshop environment – 2 pts.
- d. Training is all on the job – 1 pt.
- e. No formal craft training program exists – 0 pts.

8. Training program instructors:

- a. Training is done by an outside contract expert – 4 pts.
- b. Training is done by staff subject expert – 3 pts.
- c. Training is done by supervisors – 2 pts.
- d. Training is done by hourly workers – 1 pt.
- e. Training program does not exist – 0 pts.

9. The quality and skill level of the maintenance workforce is:

- a. Perfect -4 pts.
- b. Good (some improvement possible) -3 pts.

- c. Fair (major improvement possible) -2 pts.
- d. Poor (major improvement possible) -1Pts
- e. Unsuitable – 0Pts.

10. The quality and skill level of the supervisory group is:

- a. Perfect -4 pts.
- b. Good (some improvement possible) -3 pts.
- c. Fair (major improvement possible) -2 pts.
- d. Poor (major improvement possible) -1Pts
- e. Unsuitable – 0 Pts.

Part 3. Maintenance work orders:

1. What percentage of maintenance man-hours are reported to a work order:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0 Pts.

2. What percentage of maintenance materials are charged against a work order number when issued:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0 Pts.

3. What percentage of total jobs performed by maintenance are covered by work orders:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0 Pts.

4. What percentage of incomplete or backlog work orders are kept filed by equipment number:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0 Pts.

5. What percentage of the work orders are filed by equipment number upon completion:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0Pts.

6. What percentage of the work orders are available for historical data analysis:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0Pts.

7. What percentage of the work orders are checked by the supervisor for work quality and completeness:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0Pts.

8. What percentage of the work orders are closed within 8 weeks from the date requested:

- a. 100% -4 pts.
- b. 75% -3 pts.
- c. 50% -2 pts.
- d. 25% -1Pts
- e. Less than 25% – 0Pts.

9. What percentage of the work orders are generated from the preventive maintenance inspections:

- a. 80 - 100% -4 pts.
- b. 60 - 80% -3 pts.
- c. 40 - 60% -2 pts.
- d. 20 - 40% -1Pts
- e. Less than 25% – 0 Pts.

10. Add one point for each of the categories you track by work orders:

- a. Required downtime.
- b. Required craft hours.
- c. Required materials
- d. Requestor's name

Part 4. Maintenance planning and scheduling:

1. What percentage of non-emergency work orders are completed within four weeks of the initial request:

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

2. Work order planning: add one point for each of the following:

- a. Craft required.
- b. Materials required.
- c. Tools required.
- d. Specific job instructions or job planning.

3. Percentage of planned work orders experiencing delays:

- a. Less than 10% -4 pts.
- b. Between 10 and 20% -3 pts.
- c. Between 20 and 40% -2 pts.
- d. Between 40 and 50% -1Pts
- e. Less than 60% – 0Pts.

4. Who is responsible for planning the work orders:

- a. A dedicated maintenance planner – 4 pts.
- b. A maintenance supervisor -2 pts.
- c. Each craft worker -0 pts.

5. Maintenance job schedules are issued:

- a. Weekly – 4pts
- b. Biweekly – 3Pts
- c. Between 3 and 7 days – 2 pts.
- d. Daily – 1pts.
- e. Any other frequency – 0 pts.

6. The maintenance and production/facilities scheduling meeting is held:

- a. Weekly – 4pts
- b. Biweekly – 3Pts
- c. Between 3 and 7 days – 2 pts.
- d. Daily – 1pts.
- e. Any other frequency – 0 pts.

7. The backlog of maintenance work is available by (add one point for each category):

- a. Craft required.
- b. Department/area requesting.
- c. Requestor.
- d. Date needed by.

8. When the job is completed, the actual time, material, downtime, and other information is reported by:

- a. The craftsmen performing the work – 4pts
- b. The supervisor of the group – 3Pts
- c. Anyone else – 2 pts.
- d. Information is not recorded – 1pts.

9. What percentage of the time is the actual compared to the estimates for monitoring planning effectiveness:

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.

- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

10. What is reporting relationship between planners and supervisors:

- a. Both report to the same maintenance manager -4 pts.
- b. The planner reports to the supervisor -3 pts.
- c. The supervisor reports to the planner -2 pts.
- d. The supervisor and planner support to operations/facilities -1Pts

Part 5: Preventive maintenance:

1. The preventive maintenance (PM) program includes (add 1 point for each type included):

- a. Lubrication checklists.
- b. Detailed inspection checklists.
- c. Personal specifically assigned to the PM program.
- d. PM diagnostics such as vibration analysis, oil sample analysis, infrared heat monitors, etc.

2. What percentage of the PM inspection/task checklists are checked to ensure completeness:

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

3. What percentage of the critical plant equipment is covered by a PM program:

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

4. What percentage of the PM program is checked against an equipment item's history annually to ensure good coverage?

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

5. What percentage of the PM's are completed within 1 week of the due date?

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

6. What determines the frequency of a PM inspection or task/service interval?

- a. Program is condition-based -4 pts.
- b. Program is based on a combination of equipment run time and fixed calendar interval -3 pts.
- c. Program is based on equipment run time only -2pts.
- d. Program is based on calendar intervals -1Pts
- e. Program is dynamic and is scheduled based on the completion date of the previous task – 0Pts.

7. What percentage of Inspections/Tasks have more than five lines of detail or instruction?

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

8. The average time to complete a PM inspection or task is:

- a. 4 hr - 4 pts.
- b. 4-8 hr - 3 pts.
- c. 2-4 hr – 2 pts.
- d. Less than 2 hr -1Pts
- e. Any other time – 0Pts.

9. PM actual and results are checked annually for time and material estimate accuracy on what percentage of the program?

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

10. Who is responsible for performing PM tasks?

- a. Dedicated PM personnel -4 pts.
- b. Specific individual on each crew -3 pts.
- c. Any individuals on each crew -2 pts.
- d. Entry-level crafts workers -1Pts
- e. Operating personnel – 0Pts.

Part 6: Maintenance inventory and purchasing:

1. What percentage of the time are materials in stores when required by the maintenance organization?

- a. More than 95% -4 pts.
- b. Between 80 and 95% -3 pts.
- c. Between 70 and 80% -2 pts.
- d. Between 50 and 70% -1Pts
- e. Less than 50% – 0Pts.

2. What percentage of the items in inventory appear in the maintenance stores catalog?

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

3. Who controls what is stocked as maintenance inventory items?

- a. Maintenance - 4 pts.
- b. Anyone else - 0 pts.

4. The maintenance stores catalog is produced in:

- a. Alphabetic and numeric listings -4 pts.
- b. Alphabetic only -3 pts.
- c. Numeric only -2pts.
- d. catalog is incomplete or non-existent -1Pts

5. The aisle/bin location is specified for what percentage of the store's items?

- a. More than 95% -4 pts.
- b. Between 90 and 95% -3 pts.
- c. Between 80 and 90% -2 pts.
- d. Between 70 and 80% -1Pts
- e. Less than 70% – 0 Pts.

6. What percentage of the maintenance store items are issued to a work order or account number upon leaving the store?

- a. More than 95% -4 pts.
- b. Between 90 and 95% -3 pts.
- c. Between 80 and 90% -2 pts.
- d. Between 70 and 80% -1Pts
- e. Less than 70% – 0Pts.

7. Maximum and minimum levels for the maintenance stores items are specified for what percentage of the inventory?

- a. More than 95% -4 pts.
- b. Between 90 and 95% -3 pts.
- c. Between 80 and 90% -2 pts.
- d. Between 70 and 80% -1Pts
- e. Less than 70% – 0Pts.

8. A reorder list is sent to purchasing:

- a. Daily -4 pts.
- b. Every 1-3 days -3 pts.
- c. Weekly -2 pts.
- d. Any other frequency -0Pts

9. Maintenance stores inventory levels are updated daily upon receipt of materials what percentage of the time?

- a. More than 95% -4 pts.
- b. Between 90 and 95% -3 pts.
- c. Between 80 and 90% -2 pts.
- d. Between 70 and 80% -1Pts
- e. Less than 70% – 0Pts.

10. What percentage of the items are checked for at least one issue every 6 months?

- a. More than 90% -4 pts.
- b. Between 80 and 90% -3 pts.
- c. Between 70 and 80% -2 pts.
- d. Between 50 and 70% -1Pts
- e. Less than 50% – 0Pts.

Part 7. Maintenance reporting:

1. What percentage of the time are the maintenance reports distributed on a timely basis to the appropriate personnel?

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

2. What percentage of the time are the reports distributed within 1 day of the end of the period specified in the report?

- a. More than 90% -4 pts.
- b. Between 75 and 90% -3 pts.
- c. Between 60 and 75% -2 pts.
- d. Between 40 and 60% -1Pts
- e. Less than 40% – 0Pts.

3. Add one point for each of the following equipment reports you to produce:

- a. Equipment downtime in order of highest to lowest total hours (weekly or monthly).
- b. Equipment downtime in order of highest to the lowest total lost (weekly or monthly).
- c. Equipment cost for equipment in order of highest to lowest (weekly or monthly).
- d. MTTR and MTBF for equipment.

4. Add one point for each of the following PM reports you to produce:

- a. PM overdue report in order of oldest to most recent.
- b. PM cost per equipment item in descending order.
- c. PM hours versus total maintenance hours per item, expressed as a percentage.
- d. PM costs versus total maintenance costs per equipment item, expressed as a percentage.

5. Add one point for each of the following personnel reports you produce:

- a. Time report showing hours worked by the employee divided by work order.
- b. Time report showing hours worked by craft in each department/area.
- c. Time report showing total hours spent by craft on emergency/preventive/normal work.
- d. Time report showing total overtime hours compared to regular hours.

6. Add one point for each of the planning reports you produce:

- a. Total work order costs estimated versus total work order actual costs by individual work order, by a supervisor, or by craft.
- b. A backlog report showing the total hours ready for schedule versus the craft capacity per week.
- c. A planning efficiency report showing the hours and materials planned versus the actual hours and materials used per work order.
- d. A planning effectiveness report showing the number of jobs closed out that were 20% over or under the labor or material estimated by the planner and supervisor.

7. Add one point for each of the scheduling reports you produce:

- a. Hours worked as scheduled compared to actual hours worked.
- b. Weekly crew or craft capacity averaged for the last 20 weeks.
- c. The Total number of maintenance work orders scheduled compared to the actual number of work orders completed.
- d. Number of work orders spent on preventive maintenance compared to emergency maintenance and normal maintenance.

8. Add one point for each of the inventory reports you produce:

- a. Stock catalog by alphabetical and numerical listings.
- b. Inventory valuation report.
- c. Inventory performance report showing stock outs and level of service, turnover rate, etc.

d. Inventory where used report.

9. Add one point for each of the purchasing reports you produce:

- Vendor performance showing promised and actual delivery dates.
- Price performance, showing the quoted and actual prices.
- Buyer or purchasing agent performance report.
- Nonstock report showing all direct buys for items not carried in stock for a specified period.

10. Add one point for each of the administrative reports you produce:

- Monthly maintenance costs versus maintenance budget with a year-to-date total.
- Comparison of labor and material costs as a percentage of total maintenance costs.
- Total costs of outside contractor usage broken down by contractor/project.
- Maintenance cost per unit of production (or by the square foot for facilities).

Part 8. Maintenance automation:

1. What percentage of all maintenance operations are computerized?

- More than 90% -4 pts.
- Between 75 and 90% -3 pts.
- Between 60 and 75% -2 pts.
- Between 40 and 60% -1Pts
- Less than 40% - 0Pts.

2. What percentage of all maintenance activities are planned and scheduled through the system?

- More than 90% -4 pts.
- Between 75 and 90% -3 pts.
- Between 60 and 75% -2 pts.
- Between 40 and 60% -1Pts
- Less than 40% - 0Pts.

3. What percentage of all maintenance inventory and purchasing functions are performed in the system?

- More than 90% -4 pts.
- Between 75 and 90% -3 pts.
- Between 60 and 75% -2 pts.
- Between 40 and 60% -1Pts
- Less than 40% - 0Pts.

4. Is there an existing interface between the maintenance information system and the production scheduling system?

- Yes -4 pts.
- No -0 pts.

5. Is the information in the integrated system reliable and accurate?

- Yes -4 pts.
- No -0 pts.

6. Is there an interface between the payroll system and the timekeeping system in the maintenance information system?

- Yes -4 pts.
- No -0 pts.

7. Is there an interface between the maintenance system and the accounting system?

- Yes -4 pts.
- No -0 pts.

8. What percentage of the maintenance personnel are using the system for their job functions with a high level of proficiency?

- More than 90% -4 pts.
- Between 75 and 90% -3 pts.
- Between 60 and 75% -2 pts.
- Between 40 and 60% -1Pts
- Less than 40% - 0Pts.

9. Is there a maintenance organization consulted when any corporate policy affecting them is made?

- Yes -4 pts.
- Sometimes -2 pts.
- No -0 pts.

10. Does a cooperative spirit exist at all levels of the cooperate structure allowing maintenance to contribute to the overall profitability of the organization?

- a. Yes -4 pts.
b. In most cases -3 pts.
c. In a few cases -1 pts.
d. No -0 pts.

Table 4 Analysis Table for Proposed Method

Score Range (points)	Illustration
288-320	Qualified for world-class.
256-288	Close areas where points are lost are to be examined.
224-256	Adjustments are needed in several areas to examine sectional totals to find weak spots and prioritize.
Less than 224	Goals and priorities are to be examined considering the points, and where to improve.