THE USE OF AN EVALUATION MATRIX TO INFORM THE IT STRATEGIC PLANNING PROCESS FOR MAINTENANCE MANAGEMENT

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ABSTRACT: The systematic review of information systems is an essential part of the IT strategic planning process. In the context of maintenance management systems this process is normally performed by the maintenance manager. However, many maintenance managers are ill prepared for this task and, as such, new opportunities may be missed or poorly performing computerised systems accepted as the norm. This paper describes the development of a set of practical guidelines in the form of benchmarks which could be used to assist maintenance managers when they review their systems. The benchmarks were based on an evaluation matrix methodology which was used in conjunction with a substantive questionnaire survey of maintenance managers to identify and evaluate the importance and performance of key computerised maintenance functions. The performance of computerised maintenance management systems was evaluated using an evaluation grid and areas of weakness were identified. The potential use of the benchmarks in the strategic review of computerised maintenance management systems is discussed. The paper concludes that the evaluation matrix method can be a useful tool to establish the general level of performance of computerised systems and thus it can inform the IT strategic planning process. In the context of maintenance management systems the evaluation method identified weaknesses in key maintenance processes and these may need to be fundamentally reengineered.

KEYWORDS: Maintenance Management, Performance Benchmarks, Information Technology

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1.0 INTRODUCTION

Maintenance is regarded by many as one of the most unattractive aspects of the construction process (Kirkwood 1986). Unlike ‘New Build’ it does not convey a glamorous image linked to high finance, entrepreneurship and dynamic development projects. Instead it is associated with leaking roofs, rotting windows and general repairs. In reality, property maintenance involves the annual expenditure of many billions of pounds (£24 billion in the UK in the year ending September, 1994) and accounts for approximately 50% of the British Construction Industry's output (RICS 1994).

Computers have been used to assist the maintenance management process since the early 1970s, with, by the mid 1980s, a substantial number of maintenance organisations using software packages developed for large main frame computer systems (Pettit 1983). During the late 1980s and early 1990s many of these packages migrated from main frame computers onto micro computers. Irrespective of platform, most maintenance systems were designed around a central computerised database onto which maintenance and repair information was recorded. The information was then manipulated to produce works schedules and job orders. Report generators allowed work in progress to be monitored and statistical management information to be produced. A study (Jones & Collis 1994) of maintenance management systems showed that, whilst IT was being widely used for budget monitoring, condition assessments and repair scheduling it was not fully integrated into the maintenance management process but had been applied on an ad-hoc basis to specific aspects of the process. This was clearly underlined by the finding that, of 9 maintenance activities listed in a questionnaire survey, over 60% of respondents had computerised systems dealing with three activities or less. The study also identified a number of specific problems with existing computerised maintenance management systems and found that 77% of respondents believed their systems required substantial modifications to meet growing demands. In particular, the need for networked and multi user applications; integration with other systems and management information facilities were identified. The study concluded that now was probably an opportune time to re-examine the fundamental basis of the maintenance management process and its associated information management models. The efficiency gains that can be achieved through the simple automation of existing processes have been questioned by Hamer (1990) who argued that business processes need to be fundamentally reengineered if the full potential of IT is to be realised. However, if current processes and their associated computerised systems are working well and meeting the aspirations of maintenance managers then reengineering is probably not worth pursuing. One of the primary aims of the project reported in this paper was to establish the general level of performance of computerised maintenance management systems across a range of organisational groups.

A thorough and objective evaluation of existing computerised systems is an essential aspect of the IT strategic planning process. In such 'bottom-up' evaluations it is important not only to quantify the scope and performance of existing systems, but to identify any gaps in provision and new opportunities that could be addressed. In many maintenance organisations the review of existing systems is performed via a survey or audit carried out by the maintenance manager. However, Jones & Collis (1994) found that 68% of maintenance managers experienced difficulty in identifying their specific needs and selecting appropriate computerised maintenance management systems to match their particular circumstances. Thus, if the benefits of involving users directly in the evaluation process are to be realised, practical guidelines are required which would focus their attention on the detail on their system, whilst providing sufficient awareness of the way others were tackling similar problems to allow them to take a wider, more strategic view. By applying such an approach, maintenance managers would not only be able to identify weaknesses in their systems but also suggest potential developments. Thus another aim of the project reported in this paper was to establish the basic functional requirements of computerised maintenance management systems and develop a series of practical guidelines which could be used by maintenance managers to inform the IT strategic planning process.

The re-evaluation of the maintenance management process has formed the basis of a number of research projects at the University of Greenwich (Jones 1992, Jones & Burrows 1994). This paper is drawn from a project sponsored by the Royal Institution of Chartered Surveyors (Jones, Burrows & Collis 1996). The paper presents an overview of the project, and describes in detail the matrix based evaluation methodology which was used to identify generic areas of weakness with computerised maintenance management systems. The paper also presents broad performance benchmarks which could be used by maintenance managers in the strategic review of their computerised maintenance management systems.

2.0 FUNCTIONALITY AND PERFORMANCE MATRICES

The matrix based evaluation methodology used in this study was a variation of the work of Cook (1988), Shanahan (1990) and Alshawi (1992). The method involves the identification of key criteria (in this study maintenance functions) which are rated depending upon their level of importance to an organisation. From this rating a functionality matrix [F] is constructed which contains a numeric score against each of the key criteria. The functionality matrix is a 1 by n matrix in which n represents the number of key criteria. Once the key criteria have been established the performance of various computerised systems against each of the criteria is evaluated. From these evaluations a performance matrix [P] is constructed which again contains a numeric score against each of the key criteria. The performance matrix is an m by n matrix in which m represents the number of computerised systems evaluated. The functionality and performance matrices can be analysed in two ways.

An evaluation matrix [E] can be obtained by multiplying [F] by the transpose of [P] (Equation 1) which contains a single numeric score for each of the computerised systems evaluated.

$$[E] = [F] . [P]^T \qquad \text{(Equation 1)}$$

If this method is applied to an industry wide assessment of functionality and performance then the score obtained from Equation 1 can be considered an industry benchmark from which an assessment of the performance of computerised systems can be obtained. Further, by customising the industry wide functionality matrix so that it represents the organisations specific functional needs and computing its product with the transpose of the industry wide performance matrix, an organisation specific benchmark can be obtained which represents the performance that can be expected (based on the industry wide mean performance scores) from computerised systems. By scoring the performance of alternative software solutions and including these values into the performance matrix, software evaluation scores can be obtained (by computing the product of the organisation specific functionality matrix and the transpose of the performance matrix). The software evaluation scores can be compared against the organisational specific benchmark and the relative position of each software solution to the expected norm can be established. Whilst this technique can provide a numeric means of evaluating software packages, care must be exercised when interpreting the results to ensure that peripheral activities do not bias the functionality matrix as this may result in a high scoring system which performs reasonably well at everything but is good at nothing.

An alternative interpretation of the functionality and performance matrices can be obtained by plotting each of the key criteria on an evaluation grid (Figure 1). In the grid the ‘x’ axis represents the level of importance placed on the key criteria and the ‘y’ axis the level of performance achieved by the key criteria. Each of the key criteria are thus positioned into one of four quadrants. Those criteria that score ‘high’ in both functionality and performance could be considered as best practice; those that score ‘high’ in performance and ‘low’ in functionality could be considered as trivial to the organisations needs; those that score ‘low’ in performance and ‘low’ in functionality could be considered as peripheral, requiring no immediate action but possibly needing long term research and development; those that score ‘low’ in performance and ‘high’ in functionality could be considered the areas requiring the most urgent development and should attract particular attention when evaluating potential software solutions. Again, if this approach is applied to an industry wide assessment of functionality and performance then it should be possible to identify generic strengths and weaknesses in the key criteria which could in turn provide guidance when applying the methodology at an organisational level, or, when reviewing the strategic development of new computerised systems.

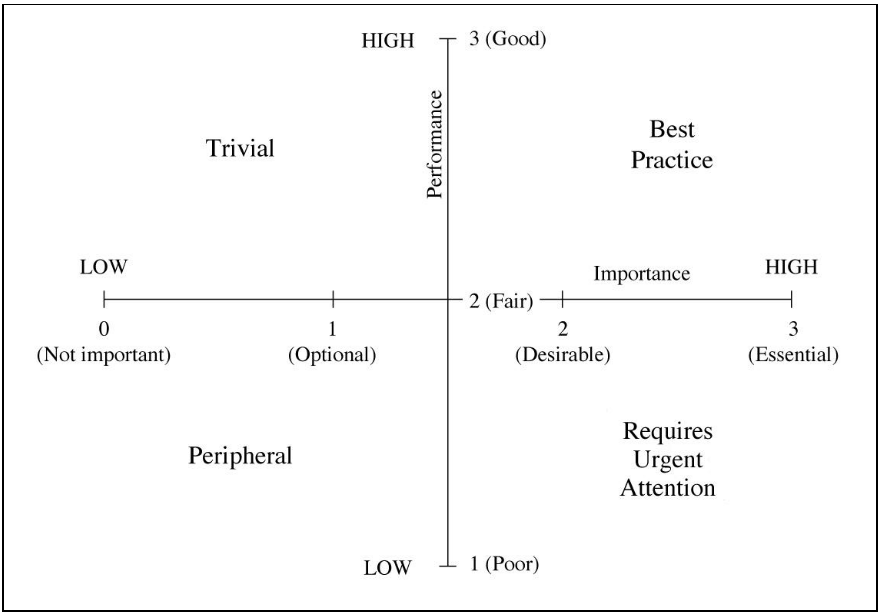

FIG. 1: Evaluation Grid

3.0 THE APPLICATION OF THE EVALUATION MATRIX METHODOLOGY TO AN INDUSTRY WIDE ASSESSMENT OF COMPUTERISED MAINTENANCE MANAGEMENT SYSTEMS

The methodology outlined above was applied to an industry wide assessment of computerised maintenance management systems in an attempt to identify general performance levels and any areas of weakness. In order to establish the basic functional requirements of computerised maintenance management systems and to measure the performance of current computerised systems a detailed questionnaire survey was undertaken of those responsible for maintenance management (Jones, Burrows & Collis 1996). The questionnaire was divided into three sections covering: organisational details; maintenance processes and computerised systems. The last section was further sub-divided into sections covering: details of existing computerised maintenance management systems; the level of user satisfaction with existing systems and the level of importance of various maintenance functions to computerised maintenance management systems. Of direct interest to this paper are the last two sections. In these sections it was necessary to obtain the views of maintenance managers in a standard and consistent form that could be readily assimilated into the functionality [F] and performance [P] matrices. In particular, it was considered necessary to provide respondents with a pre-defined list of maintenance functions against which they could indicate the level of importance they placed on each function and the level of performance that their existing computerised systems achieved against each function. To establish the maintenance functionality list, 36 computerised maintenance management systems were examined and details of 34 specific maintenance functions extracted. The functions were grouped into six generic categories: property information; property condition; maintenance planning; works order management; budgetary control and management information. To these was added a seventh category covering general performance and after sales support. The full list of maintenance functions are given in Table 1.

To establish the level of importance of the pre-defined maintenance functions, maintenance managers were asked to indicate whether they considered each as either Essential, Desirable, Optional, or Not Important to their particular organisations needs.

To establish the level of performance of existing computerised maintenance management systems against each of the pre-defined maintenance functions, maintenance managers were asked to rate the performance of their present system as either Good, Fair, Poor, or Not Applicable.

Six hundred and seventy eight questionnaires were distributed in August/September 1994 to United Kingdom organisations selected at random from District Councils, Housing Associations, Universities (property management section not academic departments) and Private Practice Building Surveyors.

3.1 Analysis of selected survey results

3.1.1 Respondents

Out of the 678 questionnaires distributed 133 responses were returned, 2 of which were excluded from the analysis because they were from organisations for whom maintenance was not one of their primary functions. Thus the survey analysis reported in this paper was based on 131 completed questionnaires, which represented a response rate of 19.32%. The breakdown of respondents by organisational grouping is shown in Figure 2. The breakdown of respondents by maintenance role showed that the 68.7% were directly involved in the maintenance of their own properties; 19.8% were acting as consultants to other property holders and 7.6% were acting in some other capacity (3.8% of respondents did not answer this question). The respondents were responsible for varied (i.e. Institutional, Industrial, Office, Residential and Retail buildings) and substantial (i.e. the majority had assets in excess of £20m) property portfolios. The majority of respondents (58.7%) were responsible for annual maintenance expenditures of between £1m and £10m.

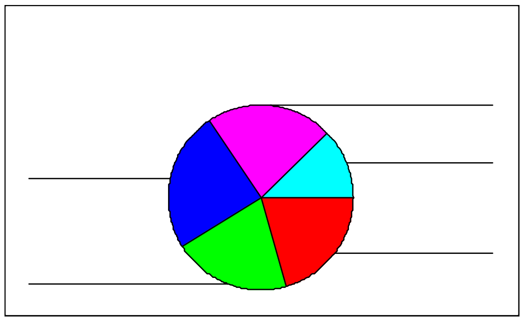

FIG. 2: Respondents

3.1.2 Computer systems

The majority of respondents (77.1%) were using computers for some aspects of maintenance management (District Councils (88%), Universities (81%), Housing Associations (78%) and Private Practice Building Surveyors (64%)). Of these, 40.3% purchased their system from a software house; 37.7% developed their system in house and 21.9% commissioned a bespoke system to meet their specific needs. Of those organisations that developed their system in-house, the majority (60%) were undertaken as a partnership between the computer centre and the maintenance department. Ninety percent of computerised maintenance management systems had been either installed or upgraded in the last two years.

Fifty four percent of computerised maintenance management systems were running on networked micro-computers; 35% on Mini/Main frame computers; 19% on UNIX work stations and 17% on stand alone micro computers (Figure 3). Note: a number of organisations used a mixture of hardware platforms. When selecting computerised maintenance management systems 55% of respondents relied on personal research; 21% on the advice of consultants; 2% on articles in the trade press and 1% in a direct sales approach (21% of respondents did not answer this question). In the majority of organisations (66%) both the maintenance manager and the IT manager were involved in the purchasing/commissioning of maintenance management systems. Networking, multi-user applications and integration with other systems were identified as the most important areas for development over the next five years.

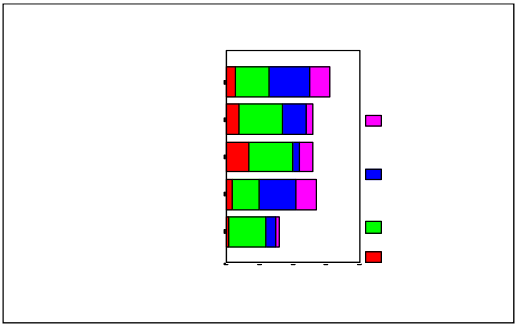

FIG. 3: System hardware

From the results presented above it is clear that the majority of respondents were from organisations who had substantial property portfolios and considerable experience of computerised maintenance management systems.

3.1.3 Level of importance of maintenance functions

The average level of importance placed on each maintenance function was calculated by considering its mode and mean scores. The mean score was calculated by applying a linear scoring system to the data (i.e. Essential = 3, Desirable = 2, Optional = 1 and Not Important = 0). The results of the analysis are given in Table 1. It is clear from Table 1 that, based on mode score, the majority of maintenance functions were considered as either Desirable or Essential to a computerised maintenance management system. Further insight into the relative level of importance of the various maintenance functions can be gained by examining the numeric value of the mean scores. Those functions that had a mean score closer to three could be considered the most Essential attributes of a computerised maintenance management system. In general these functions were those which dealt with the financial management aspects of the maintenance management process and those which were concerned with the usability of the system. Those functions which dealt with maintenance planning were ranked on the Essential/Desirable boundary.

3.1.4 Level of satisfaction with existing computerised maintenance management systems

The average level of performance of each maintenance function was calculated by considering its mode and mean score. The mean score was calculated by applying a linear scoring system to the data (i.e. Good = 3, Fair = 2, Poor = 1). Whilst in a purely statistical sense the applicability of an interval scale to ordinal data is open to debate, its use in the present investigation, where no attempt has been made to correlate the responses against any specific product or system, offers valuable insight and aids understanding of the data. The outcome from the conversion may be differentially interpreted and in this paper two interpretations are presented. In the first, any function that scored between 1.000 and 1.666 was categorised as Poor; any that scored between 1.667 and 2.333 was categorised as Fair and any that scored between 2.334 and 3.000 was categorised as Good. In the second, the Fair category was all but eliminated, with any function that scored less than two being categorised as Poor and any function that scored greater than two being categorised as Good. It should be noted that with both interpretations, because the mean score calculation excludes cases where the maintenance function was Not Applicable the performance of some functions are based on very few responses. The mode and mean scores are given in Table 1.

Based upon mode scores the performance of 14 (38%) maintenance functions were rated Good; 18 (49%) were rated Fair; and 8 (22%) were rated Poor (Note: some functions had a shared mode score). A similar analysis based on the first interpretation of the mean scores rated the performance of 5 (14%) maintenance functions as Good with the remainder being rated as Fair. One possible weakness in the above analysis is the lack of functions which were rated Poor by the mean score analysis. If the second interpretation of the mean score was applied (where the Fair category is all but eliminated) then 13 (35%) maintenance functions were rated Poor. The 5 functions (in ranking order based on the mean score) rated Good by both the mode score and the first interpretation of the mean score were:

1. the use of hand held computer for data collection;
2. contractors details;
3. summary of work orders placed to date;
4. summary of expenditure incurred to date;
5. summary of expenditure committed to date.

The 8 functions (in reverse ranking order based on mean sore) rated Poor by both the mode score and the second interpretation of the mean score were:

1. integration with other property systems;
2. use of bar code readers;
3. producing defects and remedies schedules;
4. setting and forecasting budgets for specific maintenance works.
5. producing repair schedules;
6. integration with other software (e.g. spreadsheet);
7. accommodating price scheduling;
8. producing cost estimates.

It is clear from the results presented above that, whilst certain aspects of computerised maintenance management systems were working well, others were not. Further insight into the strengths and weaknesses of computerised maintenance management systems can be gained by examining the functionality and performance scores in more detail.

4.0 PERFORMANCE BENCHMARKS

The functionality and performance scores given in Table 1 can be considered as benchmarks against which an organisation can review its own computerised maintenance management system. The benchmark scores can be used in a number of ways. In this paper two uses are described.

4.1 Evaluation matrix benchmarks

The functionality and performance scores given in Table 1 can be used as the basis for numeric comparisons between the performance of an organisations computerised maintenance management system and the industry norm. In order to use the evaluation matrix benchmarks as the basis for a review of an organisations computerised maintenance management system the functionality [F] and performance [P] matrices are customised ([F_O] and [P_O]) to reflect the practices of the organisation. To achieve this maintenance managers must establish the level of importance of each of the maintenance functions given in Table 1 to their organisation and then evaluate the performance of their existing computerised maintenance management system and any alternative systems against each of the functions. In order for direct comparisons to be made with the industry wide benchmark figures the numeric scores used for the organisation specific functionality matrix [F_O] and performance [P_O] must be from the same scale. Note: continuous values can be used if required. If the industry wide performance scores are included as the first row of [P_O] then, multiplying [F_O] by [P_O]^T produces a range of evaluation benchmarks. The first benchmark represents the expected performance of software solutions (based on industry wide experience) for the organisations specific functional requirements (organisation specific benchmark). The remaining benchmarks represent each software solution's performance which can be compared against the organisation specific evaluation benchmark and each other. A detailed evaluation of the above methodology forms part of an ongoing research project. However, an initial view of the overall performance of computerised maintenance management systems can be gained by considering the relationship between the evaluation matrix benchmark value obtained from the functionality and performance scores given in Table 1 (173) and its upper (248) and lower (83) bounds. The upper and lower bounds were calculated by assuming that all the maintenance functions performed either well (numeric score = 3), or poorly (numeric score = 1). It can be seen that the evaluation matrix benchmark is located approximately mid way along the available scale and as such it would appear that there is considerable room for general improvements in the performance of computerised maintenance management systems.

4.2 Evaluation grid benchmarks

The functionality and performance scores given in Table 1 summarise the views of maintenance managers with respect to the level of importance prescribed to each of the maintenance functions and the performance of their existing computerised maintenance management systems against each of the maintenance function. By plotting the mean scores on an evaluation grid (Figure 1) each maintenance function was located into one of the quadrants (note: due to the scoring methodology adopted one function falls between two quadrants). By considering the location of each function in the grid it was possible to identify those functions which were:

1. Desirable/Essential and whose performance was Good;
2. Desirable/Essential and whose performance was Poor;
3. Not Important/Optional and whose performance was Good;
4. Not Important/Optional and whose performance was Poor.

By describing each of the maintenance functions by the quadrant in which it was located (evaluation grid benchmark, Table 1) it was possible to use them to inform the IT strategic planning process.

As can be seen from the mean scores given in Table 1, 21 of the maintenance functions were located in the high importance high performance quadrant (i.e. functionality score > 1.5, performance score > 2.0). Whilst it was not surprising to find those functions that were concerned with budgetary control located in this quadrant (as these activities are subject to external financial audit) it was a little more surprising to find the use of hand held computers for data capture in this quadrant (as less than 15% of organisations were using them). However, from its location in the evaluation grid it appears that those who were using hand held computers found they performed well and as such this could be an area where other maintenance management systems could benefit from adopting their use. In general maintenance functions located in this quadrant could be considered as best practice.

Twelve maintenance functions were located in the high importance low performance quadrant (i.e. functionality score > 1.5, performance score < 2). Integration with other software; after sales support and specific aspects of maintenance planning and the management of maintenance works were those functions which were considered important to maintenance managers but which existing computerised maintenance management systems were performing poorly. The lack of integration of computerised maintenance management systems and the poor after sales support received from software companies confirmed the main findings of a previous study (Jones & Collis 1994) and is probably a result of developments being made on an ad-hoc basis with very little attention being placed on strategic considerations. The poor performance of maintenance planning supports the findings of other studies reported by the author (Jones 1992, Jones & Burrows 1994) in which it was argued that certain aspects of maintenance planning were based on flawed processes and data inconsistencies. The poor performance of specific aspects of the management of maintenance works could be due to changing expectations amongst maintenance managers. Maintenance functions falling in this quadrant require urgent attention.

Two maintenance functions, both associated with the use of Direct Labour Organisations (DLO's), were located in the low importance high performance quadrant (i.e. functionality score < 1.5, performance score > 2). Again this was not unexpected as changes in the organisational structure of many maintenance organisations in the UK has resulted in DLO's being largely obsolete. Maintenance functions located in this quadrant could be considered trivial to needs.

The use of barcode readers was the only maintenance function located in the low importance low performance quadrant (i.e. functionality score < 1.5, performance score < 2). From its location in the evaluation grid it would appear that barcode readers are currently seen as peripheral by the majority of maintenance managers. However, automated data collection probably offers the greatest potential to improving the maintenance management process by addressing one of the fundamental problems of data reliability. Thus, although this function was located in the low - low quadrant it should not be dismissed but seen as a possible area for further research that could offer benefit if properly exploited. The use of Optical Mark Readers was located on the boundary between the low importance low performance and low importance high performance quadrants.

4.3 Application of the evaluation grid benchmarks to the IT strategic planning process

The application of the performance benchmarks to the IT strategic planning process forms part of an ongoing research project. To date the author has only applied the evaluation grid benchmarks to one organisation and as such the conclusions drawn must be treated with caution.

The evaluation grid benchmarks were used to assist in the development of an IT strategy for an organisation that had a substantial property portfolio to manage. During the formulation of the IT strategy the organisation decided to completely replace all existing computerised systems with an integrated information management system. The evaluation grid benchmarks were used in meetings with the organisations maintenance manager and IT manager to establish the functionality of the maintenance management aspect of the new system. The evaluation grid benchmarks proved a very useful too as they tended to broaden the discussions beyond the immediately obvious problems that existed with the organisations current computerised maintenance management system, to considerations of the way others were using IT for maintenance management. In particular the benchmarks focused attention on the poor performance of certain aspects of maintenance planning and resulted in extensive discussions on how best to tackle these issues in the new system. The benchmarks also focused attention on the apparent benefits of using hand held computers for data capture (which had not originally been considered) and resulted in their use being added to the systems specification. Whilst it can not claimed that these issues would not have been addressed without the use of the evaluation grid benchmarks, the author found the benchmarks a useful tool for the organisations particular circumstances. This project is ongoing.

5.0 CONCLUSIONS

The project reported in this paper was one of a series of ongoing studies into the use of IT in the maintenance management process. The studies were driven by the view that current computerised maintenance management systems have developed on an ad-hoc basis and have had very little impact, except for automation of the manual processes being performed. If this is the case then maintenance management could benefit from adoption of more formal IT strategies and possibly the application of business process reengineering. However, if current processes and their associated computerised systems are performing well and meeting the aspirations of maintenance managers then reengineering is probably not worth pursuing. The evaluation matrix methodology outlined in this paper was applied to an industry wide review of computerised maintenance management systems. From the results of the analyses it is clear that, whilst certain aspects of computerised maintenance management systems were working well, others, particularly those concerned with integration of computerised systems and aspects of maintenance planning were not. The author recommends a further, more detailed investigation be undertaken of those aspects of computerised maintenance management systems which were performing poorly.

The performance benchmarks derived from the evaluation matrix were used to assist an organisation with the development of an IT strategy. Although the study is ongoing initial evidence suggests that the benchmarks were a useful tool in broadening discussions and identifying new areas for development.

The following general conclusions were drawn from the project.

1. The evaluation matrix appeared to provide a simple and straightforward way of assessing the level of importance of maintenance functions at an industry wide level and establishing the current level of performance of computerised maintenance management systems.

2. The use of a performance grid was a valuable means of interpreting the relationships between the level of importance of maintenance functions and the performance of existing computerised maintenance management systems;

3. Twenty one maintenance functions were rated as high importance and high performance and could be considered best practice; 12 maintenance functions were of high importance and low performance and could be considered areas requiring urgent attention; 2 maintenance functions were of low importance and high performance and could be considered trivial and 1 maintenance function was of low importance and low performance and could be considered

peripheral. One function fell between the low importance high performance and low importance low performance categories.

4. Software integration; after sales support; aspects of maintenance planning and the management of specific maintenance works were identified as those areas of computerised maintenance management systems that required urgent attention.

5. A series of industry wide benchmark figures were calculated and a method by which these figure could be used in aiding maintenance managers in the IT strategic planning process was discussed. An initial trial of the method appeared to show that it was a useful tool for focusing attention during a strategic evaluation of an organisations computerised maintenance management system.

6. There would appear to be a need for a fundamental review of certain aspects of the maintenance management process which could possibly involve the application of the principles of business process reengineering.

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Table 1 Levels of functionality and performance with computerised maintenance management functions.

Maintenance Functions	Functionality		Performance		
	Mode Score	Mean Score	Mean Score	Mode Score	Benchmark Quadrant
Provide comprehensive property details	Essential	2.645	Good	2.247	A
Provide details of repairing obligations	Essential	2.355	Fair	2.014	A
Produce defects and remedies schedule	Desirable	2.181	Poor	1.783	B
Allow for prioritising maintenance work	Essential	2.524	Good	2.231	A
Use standard condition descriptions	Desirable	2.016	Fair	2.145	A
Data capture: use manual data input	Essential	2.296	Good	2.319	A
use optical mark readers	Optional	1.055	Fair	2.000	C/D
use bar code readers	N. I.	1.089	Poor	1.750	D
use hand held computers	Desirable	1.675	Good	2.400	A
Produce long/short term maintenance plans	Essential	2.607	Fair	2.148	A
Produce cost estimates	Essential	2.427	Poor	1.982	B
Identify maintenance trends	Desirable	2.106	Fair	1.925	B
Identify maintenance works	Essential	2.361	Fair	2.268	A
Access to historical information	Essential	2.411	Good	2.189	A
Produce repair schedules	Essential	2.202	Poor	1.884	B
Set & forecast budgets	Essential	2.363	Poor	1.842	B
Schedule of M & E testing	Essential	2.234	Good / Fair	2.243	A
Accommodate various procurement methods	Essential	2.260	Good / Fair	2.210	A
Accommodate price scheduling	Essential	2.049	Poor	1.940	B
Contain contract information	Desirable	1.966	Good	2.093	A
DLO: comprehensive staff details	N. I.	1.377	Fair	2.172	C
details stock control	N. I.	1.386	Good	2.133	C
Contractor Base: contractors details	Essential	2.369	Good / Fair	2.397	A
contractors performance	Essential	2.213	Fair	1.967	B
Profile financial expenditure	Essential	2.669	Good	2.145	A
Summarise orders placed to date	Essential	2.718	Good	2.383	A
Summarise expenditure incurred to date	Essential	2.798	Good	2.381	A
Summarise expenditure committed to date	Essential	2.782	Good	2.338	A
Allow for fee monitoring	Desirable	2.024	Fair	1.897	B
Easy report writing	Essential	2.293	Fair	2.015	A
Integration with other property systems	Essential	2.238	Poor	1.745	B
Integration with other property management systems	Desirable	2.187	Fair	1.722	B
Integration with other software	Essential	2.374	Poor	1.915	B
Multi level access to all information	Essential	2.399	Fair	2.130	A
Level of user friendliness	Essential	2.818	Fair	2.012	A
Screen layout / style	Essential	2.542	Fair	2.011	A
After sales support	Essential	2.708	Fair	1.935	B

A= Best Practice; B=Requires Urgent Attention; C=Trivial; D=Peripheral; N. I.=Not Important