NEW RESEARCH

A decision model for self-assessment of business process based on the EFQM excellence model

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Keywords European Foundation for Quality Management, Modelling, Self-assessment, Decision making

Abstract In response to the criticism on the measurement system of self-assessment against the European Foundation for Quality Management (EFQM) model, this paper reports the development of a more scientific and accurate scoring method. The decision model constructed has focused on the "processes" criterion of the EFQM model and can perform three main tasks: to score the self-assessment submission document; to identify strengths and areas for improvement; and to simulate different scenarios for improvement planning. The model was implemented and tested using two award simulation documents from an electricity distribution utility and a water-supply company. The results for one of the companies are reported and analysed in this paper. The analysis of the results has proved the reliability and accuracy of the new model. Using the decision model, two systematic methods were developed to identify strengths and areas for improvement and the findings are reported. The model's ability to link self-assessment with the strategic-planning process is also commented upon.

Introduction
Although the current scoring system of the European Foundation for Quality Management (EFQM) model has been widely accepted by both academics and practitioners as a sound approach for self-assessment, writers such as Porter and Tanner (1996) and Siow et al. (2001) are in agreement that organisations have encountered problems applying them because the scoring criteria are too generally defined. As a consequence, large scoring variations are common, especially with inexperienced assessors (Yang et al., 2001). In a survey of the British part of a major European project on the use and benefits of self-assessment, Coulambidou and Dale (1995) found that the majority of the companies experienced problems with measurement, including variations in scoring. Other writers such as Lascelles and Peacock (1996), Teo and Dale

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(1997), Schmidt and Zink (1998) have also identified and criticised the scoring system of the EFQM model. However, since the EFQM model was launched in 1991, little research has been undertaken into the scoring system. The research outlined in this paper proposes a new scoring method using multiple criteria decision making (MCDM) techniques to improve the scoring accuracy.

According to Yang and Xu (1998), MCDM techniques have developed significantly over the last two decades and have been used in various fields of science and technology as well as management. MCDM refers to making decisions in the presence of multiple criteria (Hwang and Yoon, 1981). Multiple criteria decision-making problems are common occurrences in everyday life. For example, a job one chooses may depend on its prestige, location, salary, working conditions and so on. Similarly, the measurement and evaluation of self-assessment also constitute an MCDM problem. In the EFQM (2000) model, nine criteria need to be assessed to generate a final score. Furthermore, there are 32 sub-criteria under the nine criteria and nearly 200 areas to address. According to the present scoring system, assessors give a score to each sub-criterion against specific guidelines detailed in the latest version of the Model. The score is a decision made by individual assessors through comprehensive analysis of all the information, which is provided to them. It also represents the assessor’s individual background, experience of self-assessment, interpretation of the EFQM criteria and the individual perception of excellence. This therefore presents issues of consistency and accuracy.

In order to measure the success of self-assessment in a more objective and evidence based way, a new decision model is constructed, using the criterion “processes” against the EFQM (2000) model. By bringing a more scientific approach (the evidential reasoning approach) the new model can be used to identify, interpret and eventually reduce variations in scoring and also assist in the planning of improvement strategies.

Model construction

Evaluation framework

Figure 1 outlines the evaluation framework proposed in this research. The framework accurately describes the relationship between attributes from top level through intermediate level to the lowest level. In this research, enabler 5 “processes” is the top level attribute of the evaluation framework. According to the EFQM (2000) model, the “processes” enabler is assessed based on the evaluation of five sub-criteria. These sub-criteria are considered to be level 2 attributes. Under these level 2 attributes, the EFQM model is broken down to lower attributes – “areas to address”, which detail relevant sub-criteria and are considered as level 3 attributes. For example, 5a “processes are systematically designed and managed” is broken down to five level 3 attributes: 5a.1-5a.5. Since “processes” is an enabler criterion, it is assessed through approach, deployment, assessment and review (A&R) which form the level 4 attributes of
the evaluation framework. In this research, level 4 elements are referred to as basic attributes, which are assessed directly. Direct assessments at the basic attribute level are referred to as initial assessment.

It is important to note that “processes” is a highly subjective enabler. The researcher must make the decision where to stop the breakdown of attributes. Researchers may have their own personal views and therefore produce different frameworks for various purposes. For example, the framework can stop at level 2 attributes and this allows experienced assessors to conduct a quick and brief “health check” of the company’s overall performance against the five sub-criteria. Alternatively, the basic attributes at level 4 of the evaluation framework shown in Figure 1 can be further broken down if a specific business process is chosen to be assessed for process change or re-engineering. Therefore each person’s perception of how much to breakdown an attribute can be subjective. However, there is a stage where further breakdown will not provide any more accuracy, whilst increasing the complexity of the assessment. In this research, it is believed that the four-level framework best describes the EFQM (2000) model in terms of accuracy and complexity.

**Evaluation grades**

The EFQM enabler criteria are qualitative attributes and it is natural to measure the qualitative attributes using qualitative grades rather than numerical scores. Unlike the EFQM scoring method in which percentages (quantitative numbers) are used to represent assessment results, qualitative evaluation grades are used in the new decision model. The grades are defined in two steps. First, grade scales are established which indicate how many grades are going to be defined in this decision model. Following this step, evaluation grades are defined including indicators and grade definitions. They
are generated based on literature reviewed in the field of quality management in line with the EFQM (2000) scoring guidelines.

Grade scales and their characteristics. Based on the EFQM (2000) guidelines, the scores are grouped into five grades with descriptors for each of these categories, 100 per cent, 75 per cent, 50 per cent, 25 per cent and 0 per cent. Therefore, to be consistent with the EFQM model five grades are chosen in this new decision model. Applying the total quality management (TQM) adoption model developed by Dale and Lascelles (1997), the five grades are termed as:

1. world class;
2. award winners;
3. improvers;
4. drifters; and
5. uncommitted.

Each grade represents a different TQM maturity level. Therefore the evaluation grades can be defined as:

\[ H = \{ H_1, H_2, H_3, H_4, H_5 \} \]

\[ = \{ \text{world class, award winners, improvers, drifters, uncommitted} \} , \]

\[ P\{H\} = \{ P(H_1), P(H_2), P(H_3), P(H_4), P(H_5) \} \]

\[ = \{ 1, 0.75, 0.5, 0.25, 0 \} , \]

where \( P(H_i) \) represents the utility (scores) of the grade \( H_i \).

The characteristics of the five evaluation grades are defined in the EFQM (2000) scoring matrix as follows:

1. Approach, systematic of the deployment, A&R:
   - 0 per cent: no evidence or anecdotal;
   - 25 per cent: some evidence;
   - 50 per cent: evidence;
   - 75 per cent: clear evidence;
   - 100 per cent: comprehensive evidence.

2. “Implementation” of “deployment”:
   - 0 per cent: no evidence or anecdotal;
   - 25 per cent: implemented in about 1/4 of relevant areas;
   - 50 per cent: implemented in about 1/2 of relevant areas;
   - 75 per cent: implemented in about 3/4 of relevant areas;
   - 100 per cent: implemented in all relevant areas.
The characteristics of the five-grade scale can also be found in the TQM adoption model developed by Dale and Lascelles (1997) and in *Baldrige Award Winning Quality* by Brown (2000).

According to Dale and Lascelles (1997), the level of the “world class” is characterised by the total integration of continuous improvement and business strategy to delight the customer, while “uncommitted” organisations have no long-term plan for continuous improvement and are not convinced of its benefits. According to Brown (2000), an overall score of 100 per cent should be considered impossible to achieve, however it is possible to receive a score of 100 per cent for an individual assessment item. On the other hand, scoring at 0 per cent indicates that the organisation being assessed has no system.

In between “world class” and “uncommitted” lie three other evaluation grades. “Improver” is an important milestone or key indicator in many organisations. According to Dale and Lascelles (1997), it is at this level that TQM begins to have a real impact on business performance. According to Brown (2000), a score of 50 per cent is not considered average but is considered a high score and is not easy to achieve. According to the EFQM (2000) guidelines, organisations applying for European Quality Award (EQA) will be given a site visit if their score is over 500 which is equivalent to “improvers”.

Evaluation grade “award winners” lies between “world class” and “improvers”. According to Dale and Lascelles (1997), “award winners” organisations have reached a point in their TQM maturity where the kind of culture, values, trust, capabilities, relationship and employee involvement in their business required to win such an award have been developed, a point at which continuous improvement has become total in nature. Brown (2000) also points out that these are companies which achieve scores sufficient to win a MBNQA or an EQA.

Finally, “drifters” is the evaluation grade which lies between “uncommitted” and “improvers”. According to Dale and Lascelles (1997), organisations in this category drift, without a clearly defined baseline, from one programme to another in a stop-start fashion, with concepts, ideas and initiatives being reborn and re-launched under different guises. Brown (2000) also points out that organisations scoring at 25 per cent lack an overall system to their approaches, but a number of good things are happening in a number of areas of the organisation. Many pockets of disconnected systematic approaches are often found in organisations at this level.

*Indicators.* Before defining evaluation grades for each basic attribute, it is important to look for items that are most important for that attribute. In this research these items are called indicators and they serve as checklists and provide the researchers and assessors with a clear picture of what to look for in that attribute. In the evaluation framework, the basic attributes are approach, deployment, and A&R. When identifying indicators for them, different methodologies are used.
Approach. The indicators for approach are mainly established from earlier work of other researchers in line with the EFQM (2000) guidelines. For example, the indicators of the basic attribute – approach of 5a.1 ("Designing the organisation's processes, including those key processes needed to deliver policy and strategy") – are defined on the basis of the following literatures. First of all, according to the EFQM (2000) scoring guidelines. The assessment of an “approach” attribute will take into account:

- soundness of the approach, which includes if the approach has a clear rationale, if there are well defined and developed processes, and if the approach focuses on stakeholder needs; and
- integration of the approach, which includes if the approach supports policy and strategy, and if the approach is linked to other approaches, as appropriate.

According to Oakland (1999), key business processes should be defined accurately, clearly and concisely. It is essential to have a document system to define the key processes and support processes (e.g. Fisher, 1993; Oakland, 1995; Harrington, 1995). When designing key processes, however, Saco (1997) points out that it is crucial to bring in customers from the very outset. Oakland (1995) and Conti (1997) also agree that identification of key processes is based on customer requirements. According to Brown (2000), a systematic process must be in place to translate customer requirements into business process design. Once the key processes are identified, a control system needs to be established to ensure that the products and/or services meet the standards. Therefore indicators (a) and (b) can be identified for the approach of 5a.1 as shown below:

(a) Identification and documentation of key processes and support processes to deliver policy and strategy. Identification of linkages between customer requirements, process measures and standards.

(b) Existence of a systematic process to identify key business processes and support processes.

Integration is also an important indicator of approach according to the EFQM guidelines. Therefore Indicator (c) is included as follows:

(c) Integration of key business processes and support processes within the organisations' management system.

In this way, indicators for basic attribute – approach of 5a.1 – are generated which include indicators (a) (b) (c).

Deployment. According to the EFQM (2000) guidelines, “deployment” is concerned with the extent to which the approach has been implemented, and whether the approach is deployed in a systematic way. The indicators for deployment are summarised as follows:
(a) Extent to which the approach has been implemented. (The extent to which the indicators of approach has been implemented.)

(b) If the approach is deployed in a systematic way. (If those indicators of approach are deployed in a systematic way.)

Although these indicators are as generally defined as approach in the EFQM scoring guidelines, they are sufficient to guide assessments. This is because once indicators are identified for approach, the indicators for deployment become clear under the same area to address, such as 5a.1. By referring to indicators identified for approach, indicator (a) of deployment would systematically become “the extent to which those indicators of approach has been implemented”. The same principle applies to indicator (b) of deployment.

A&R. When identifying indicators for A&R, the same approach is used as deployment. According to the EFQM (2000) scoring guidelines, the assessment of an “A&R” attribute will take into account:

(a) measurement – regular measurement of the effectiveness of the approach and deployment is carried out;

(b) learning – learning activities are used to identify and share best practice and improvement opportunities; and

(c) improvement – output from measurement and learning is analysed and used to identify, prioritise, plan and implement improvements.

By referring to indicators identified for approach, the above indicators (a) (b) (c) can be used to guide the evaluation of A&R in the evaluation framework established.

Definitions of evaluation grades. In the new decision model, all the basic attributes are defined in terms of indicators as mentioned above and each of these indicators details the relevant basic attribute in terms of each evaluation grade $H_1 - H_5$. Therefore each of the indicators of the basic attribute is defined in terms of five evaluation grades. By using the general definition in the EFQM (2000) scoring matrix, the five grades can be defined. Table I shows an example of grade definitions for each indicator of the basic attribute – approach 5a.1. It must be mentioned that different weightings are given to the indicators which can be found in each indicator, such as (40 per cent).

Weighting
In a typical decision hierarchy, not all attributes at a single level play the same role in the evaluation of an attribute associated at a level immediately above. The decision maker may have different views on the importance of attributes in evaluation. In this new model, all the attributes in the evaluation framework will be given the same weightings as in the EFQM (2000) model. However, it is believed that some indicators are slightly more important than others.
<table>
<thead>
<tr>
<th>5a.</th>
<th>Processes are systematically designed and managed</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a.1</td>
<td>Designing the organisation’s processes, including those key processes needed to deliver policy and strategy</td>
</tr>
</tbody>
</table>

**World class**

(a) Comprehensive evidence shows that key processes and support processes are clearly defined and documented to deliver policy and strategy. Linkages between customer requirements, process measures and standards are comprehensively identified (40 per cent)

(b) Comprehensive evidence shows that a well defined and developed, mature process exists to identify key business processes and support processes (30 per cent)

(c) Comprehensive evidence shows that key business processes and support processes are fully integrated within the management system (30 per cent)

**Award winners**

(a) Clear evidence shows that key processes and support processes are defined and documented to deliver policy and strategy. Linkages between customer requirements, process measures and standards are clearly identified (40 per cent)

(b) Clear evidence shows that a well-defined and developed process exists to identify key business processes and support processes (30 per cent)

(c) Clear evidence shows that key business processes and support processes are nearly always integrated (30 per cent)

**Improvers**

(a) Evidence shows that the structure of key processes is defined and flowcharted. Some support processes are defined and documented. Linkages between customer requirements, process measures and standards are being identified (40 per cent)

(b) Evidence shows that a rational process exists to identify key business processes and support processes (30 per cent)

(c) Evidence shows that key business processes and some support processes are being integrated (30 per cent)

**Drifters**

(a) Some evidence shows that the organisation is starting to identify key business processes and support processes. Some key processes may be documented in the early stage. Linkages between customer requirements, process measures and standards are considered when identifying key processes and support processes (40 per cent)

(b) Some evidence shows that the organisation is starting to have a process to identify key business processes and support processes (30 per cent)

(c) Some evidence shows that the organisation is starting to integrate key processes and support processes (30 per cent)

**Uncommitted**

(a) There is no evidence to show that key processes and support processes are defined and documented to deliver policy and strategy (40 per cent)

(b) There is no evidence to show that there is a process to identify key business processes and support processes (30 per cent)

(c) No integration exists between processes (30 per cent)
Therefore, different weightings are given to the indicators of basic attributes. The overall weightings given to all the indicators for one basic attribute are normalised to one. In such a large decision model, weights indicate relative importance and the assignment of weightings is based on the researchers' own presumption, understanding and experience. Weights can be changed by organisations according to their own purpose of self-assessment and their TQM practices.

Data analysis approach
The evidential reasoning (ER) approach is chosen in this research as the MADM tool to analyse assessment data (Yang and Singh, 1994; Yang and Sen, 1994, 1997; Yang, 2001). The ER approach itself is well established and is under constant development to deal with wider range of information. It has been applied to many real-world decision problems and is a unique approach that can deal with both quantitative and qualitative assessments with uncertainty.

Application
Two award simulation documents from two major utility companies have been used to test the new decision model. Company A is a water supply company and company B is an electricity distribution utility. Due to the limited space, however, only the results for company A will be reported in this section. The data analysis consists of three main sections. First, assessment results are analysed which includes initial assessment results, combined results at upper attribute levels, and overall assessment results. Second, various ways to identify strengths and areas for improvement are described. Finally, computer simulations of two improvement scenarios are generated using the new decision model. In addition to producing more accurate assessment results for self-assessment against the EFQM model, the new approach is also able to assist assessors to produce feedback reports effectively and help organisations being assessed to design improvement strategies and scenarios.

Results analysis
Initial assessment. The initial assessment is the key evaluation process during which assessors give original assessments directly to basic attributes by evaluating the award simulation document against the set of evaluation grades defined. Although each evaluation grade of basic attributes is defined, it is still not easy to extract the relevant data from the award simulation report and match them with the evaluation grades. This is because the terms and words used by organisations are not the same as the definitions of the evaluation grades. For example, when assessing the basic attribute (approach of 5a.1 “Designing the organisation’s processes, including those key processes needed to deliver policy and strategy”), the definitions of evaluation grades can be found in Table I.
The following is the relevant data obtained from company A's award simulation report:

A business process analysis was carried out with the assistance of consultants, with representatives from each department/function to identify all our activities in the former operations area of the business. The core processes (4 in number) and supporting management processes (11) were identified and mapped from these activities. A manual was produced to provide the philosophy of the system and this manual describes links between the documentation produced for the system and the delivery of the business goals and key performance measurements.

Each department/function has generated its own lists of key processes, and these are contained within their own quality systems or process documentation. Prior to 1998 there had been no attempt to show how the processes and activities listed within department/functions linked together to deliver the business goals. Within the organisation, different processes/procedures have been developed, sometimes with no links between department/functions or other departments, causing serious interface issues.

How this extracted data is categorised into the evaluation grades depends on the assessors' interpretation. From the evidence described above, it is clear that the core processes (key processes) and supporting management processes (support processes) are defined and mapped. The business management system describes links between the documentation produced for the system and the delivery of the business goals and key performance measures. It is clear that in the newly defined business management system, linkages between customer requirements, process measures and standards are identified. This evidence matches grade “award winners” of indicator (a). It is not graded improvers because not only is the structure of key processes and support processes identified, but also each of the key processes and support processes is clearly defined. It is not graded world class because the key processes and support processes are not fully integrated and still need to be improved.

For indicator (b), however, it is clear that a rational process exists to identify processes. A business process analysis was carried out and external consultants were involved. However, since this process was carried out after 1998, the process still needs time to mature. Therefore this can only be graded “improvers”.

For indicator (c), the new system was identified after 1998 and is still not fully integrated into business operations. Some departments have developed their own processes and these need to be integrated within the single system. Therefore grade “improvers” is achieved at this stage.

Considering the weight given to each checklist of this basic factor, the initial assessment results would be:

- indicator (a): award winners (40 per cent);
- indicator (b): improvers (30 per cent); and
- indicator (c): improvers (30 per cent).
In total, the initial assessment results would be Award Winners (0.4) and Improvers (0.6). Applying simplified grade expressions A-E, the initial assessment for the approach of 5a.1 is B(0.4) and C(0.6).

The initial assessments for other attributes were conducted according to the same principle and the results are shown in Table II with examples of evidence and comments given in Table III.

*Combined assessment results at upper attribute levels.* According to the ER approach, the assessment of an upper level attribute is determined by attributes associated at the level immediately below. The ER approach works in the following principle. The proposition that an attribute at a level

<table>
<thead>
<tr>
<th>Approach</th>
<th>Deployment</th>
<th>A&amp;R</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a.1</td>
<td>B(0.4) C(0.6)</td>
<td>B(0.8) C(0.2)</td>
</tr>
<tr>
<td>5a.2</td>
<td>B(0.5) C(0.5)</td>
<td>C(0.5) D(0.5)</td>
</tr>
<tr>
<td>5a.3</td>
<td>B(0.5) C(0.5)</td>
<td>B(0.5) C(0.5)</td>
</tr>
<tr>
<td>5a.4</td>
<td>B(0.2) C(0.2) D(0.2)</td>
<td>C(0.5) D(0.5)</td>
</tr>
<tr>
<td>5a.5</td>
<td>B(0.5) Missing (0.5)</td>
<td>B(0.9) C(0.1)</td>
</tr>
<tr>
<td>5b.1</td>
<td>B(0.25) C(0.5) D(0.25)</td>
<td>C(0.5) D(0.5)</td>
</tr>
<tr>
<td>5b.2</td>
<td>B(0.6) C(0.4)</td>
<td>B(0.4) C(0.1) D(0.5)</td>
</tr>
<tr>
<td>5b.3</td>
<td>C(0.7) E(0.3)</td>
<td>B(0.4) C(0.1) D(0.5)</td>
</tr>
<tr>
<td>5b.4</td>
<td>B(0.35) C(0.35) E(0.3)</td>
<td>C(1)</td>
</tr>
<tr>
<td>5b.5</td>
<td>B(0.5) Missing (0.5)</td>
<td>B(0.9) C(0.1)</td>
</tr>
<tr>
<td>5b.6</td>
<td>B(1)</td>
<td>B(0.4) C(0.6)</td>
</tr>
<tr>
<td>5b.7</td>
<td>B(0.25) Missing (0.75)</td>
<td>C(0.5) Missing (0.5)</td>
</tr>
<tr>
<td>5b.8</td>
<td>B(1)</td>
<td>B(0.4) C(0.1) D(0.5)</td>
</tr>
<tr>
<td>5b.9</td>
<td>B(0.35) D(0.65)</td>
<td>B(0.4) C(0.1) D(0.5)</td>
</tr>
<tr>
<td>5c.1</td>
<td>C(1)</td>
<td>C(1)</td>
</tr>
<tr>
<td>5c.2</td>
<td>B(0.5) C(0.5)</td>
<td>B(1)</td>
</tr>
<tr>
<td>5c.3</td>
<td>B(0.7) Missing (0.3)</td>
<td>B(0.5) Missing (0.5)</td>
</tr>
<tr>
<td>5c.4</td>
<td>B(0.5) C(0.5)</td>
<td>B(0.4) C(0.6)</td>
</tr>
<tr>
<td>5c.5</td>
<td>B(0.67) D(0.33)</td>
<td>B(0.4) C(0.1) Missing (0.5)</td>
</tr>
<tr>
<td>5d.1</td>
<td>B(0.75) C(0.25)</td>
<td>B(0.4) C(0.6)</td>
</tr>
<tr>
<td>5d.2</td>
<td>B(0.35) C(0.65)</td>
<td>B(0.4) C(0.6)</td>
</tr>
<tr>
<td>5d.3</td>
<td>B(0.5) Missing (0.5)</td>
<td>B(0.4) C(0.6)</td>
</tr>
<tr>
<td>5d.4</td>
<td>B(0.5) Missing (0.5)</td>
<td>B(0.5) Missing (0.5)</td>
</tr>
<tr>
<td>5e.1</td>
<td>B(0.65) C(0.35)</td>
<td>B(0.9) C(0.1)</td>
</tr>
<tr>
<td>5e.2</td>
<td>B(1)</td>
<td>B(0.5) D(0.5)</td>
</tr>
<tr>
<td>5e.3</td>
<td>B(0.5) C(0.5)</td>
<td>C(1)</td>
</tr>
<tr>
<td>5e.4</td>
<td>C(0.65) E(0.35)</td>
<td>C(1)</td>
</tr>
<tr>
<td>5e.5</td>
<td>B(0.35) C(0.3)</td>
<td>C(1)</td>
</tr>
<tr>
<td>5e.6</td>
<td>Missing (0.35)</td>
<td>C(1)</td>
</tr>
</tbody>
</table>

*Table II.*

Initial assessment results of company A

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Table III: Example of evidence and comments

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Comments</th>
<th>Belief degree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approach</strong></td>
<td><strong>Comments</strong></td>
<td><strong>Belief degree</strong></td>
</tr>
<tr>
<td>(a) The structure of business processes was formulated. Processes with an immediate impact on customers have been mapped</td>
<td>(a) Match grade C</td>
<td>C - 35 per cent</td>
</tr>
<tr>
<td>(b) Processes are now designed or re-designed in the light of competitive and regulatory pressures, external benchmarking, process improvement activity and increased customer expectations. However it is not clear how. Quality tools need to be used to explain this</td>
<td>(b) Quality tools need to be used to capture customer needs and translate them into process design. Would be graded D</td>
<td>D - 35 per cent</td>
</tr>
<tr>
<td>(c) Re-organisation to a functional structure was conducted in 1996 and restructured in 1999. Processes identified still need time to be mature and fully integrated into business activities.</td>
<td>(c) Full integration needs to be sought which falls into grade C</td>
<td>C - 30 per cent</td>
</tr>
</tbody>
</table>

The initial assessment for approach 5a.1 is C(0.65), D(0.35)

<table>
<thead>
<tr>
<th>Deployment</th>
<th><strong>Comments</strong></th>
<th><strong>Belief degree</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Only processes with an immediate impact on customers have been mapped</td>
<td>(a) About 1/4 to 1/2 processes have been identified which falls between C and D</td>
<td>C - 25 per cent, D - 25 per cent</td>
</tr>
<tr>
<td>(b) Two facilitated workshops were held and the structure of the processes were formulated</td>
<td>(b) The approach is implemented in a structured way in an early stage.</td>
<td>D - 50 per cent</td>
</tr>
</tbody>
</table>

The initial assessment for “deployment” of 5a.1 is C(0.25), D(0.75)

<table>
<thead>
<tr>
<th>A&amp;R</th>
<th><strong>Comments</strong></th>
<th><strong>Belief degree</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Processes are reviewed and restructured twice in 1996 and 1999</td>
<td>(a) Match grade C.</td>
<td>C - 100 per cent</td>
</tr>
<tr>
<td>(b) UMS Benchmarking program and the strategic review were held in 1998</td>
<td>(b) Learning activities are used. Graded C</td>
<td></td>
</tr>
<tr>
<td>(c) As the output of the strategy review workshop, a new process was designed to service new customer base of electricity suppliers</td>
<td>(c) Some improvements have been achieved. At least one improvement cycle existed. Graded C</td>
<td></td>
</tr>
</tbody>
</table>

The initial assessment for A&R of 5a.1 is C(1)
immediately above would be assessed to world class (grade A), award winner (B), improver (C), drifter (D), and uncommitted (E) is regarded as a hypothesis, and the assessment result immediately below is viewed as a single piece of evidence. The chance that a hypothesis is true will be improved if more pieces of evidence are available to support the hypothesis.

The ER combination process is explained using the following example. The initial assessments for basic attributes 5a.1 of company A are:

- approach: B(0.4) and C(0.6);
- deployment: B(0.8) and C(0.2);
- A&R: C(1) (as shown in Table IV).

The total degree of belief (DOB) is 1.2 to grade B and 1.8 to grade C. By using the algorithmic average method introduced in the EFQM (2000) model, the combined assessment result would be 0.4 (1.2/3) for grade B and 0.6 (1.8/3) for grade C. However it is noted that amongst the evidence given, more pieces of evidence support grade C (1.8) than grade B (1.2). It is reasonable and rational that the overall assessment result of grade C is higher than its average result of 0.6 and the overall result of grade B is lower than its average result of 0.4. By using the ER approach, the assessment result for 5a.1 is indeed B(0.37) and C(0.63). This demonstrates that the assessment results combined using the ER approach are generated based on the accumulation of evidence but not on averaging. By using the ER approach, the combined assessment results for areas to address of level 3 attributes are shown in Table V for company A. The combined results for sub-criteria of level 2 attributes are shown in Table VI and the final assessment results for enabler “processes” are shown in Table VII.

It can be seen from Table VII that the final assessment for company A is B(0.39), C(0.4), D(0.1) and E(0.01). The majority of the performance falls into “award winners” and “improvers”. However since the performance of some areas falls into “drifters” and even “uncommitted” on occasions, the average assessment result is closer to Improvers. It is also seen from Table VII that there are three possible results, maximum utility representing the best possible performance, minimum utility representing the worst possible performance, and average utility representing the average performance. The three outcomes are obtained by taking into account missing evidence.

<table>
<thead>
<tr>
<th>Grade</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>0.4</td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deployment</td>
<td>0.8</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A&amp;R</td>
<td></td>
<td></td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Total degree of belief (5a.1)</td>
<td>1.2</td>
<td>1.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table IV. Initial assessment of 5a.1
### Combined assessment results (level 3 attributes)

<table>
<thead>
<tr>
<th>Item</th>
<th>Assessment Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a.1</td>
<td>B(0.37) C(0.63)</td>
</tr>
<tr>
<td>5a.2</td>
<td>B(0.15) C(0.33) D(0.52)</td>
</tr>
<tr>
<td>5a.3</td>
<td>B(0.3) C(0.7)</td>
</tr>
<tr>
<td>5a.4</td>
<td>B(0.05) C(0.35) D(0.47)</td>
</tr>
<tr>
<td>5a.5</td>
<td>B(0.81) C(0.03)</td>
</tr>
<tr>
<td>5b.1</td>
<td>B(0.41) C(0.34) D(0.25)</td>
</tr>
<tr>
<td>5b.2</td>
<td>B(0.62) C(0.13) D(0.14) E(0.11)</td>
</tr>
<tr>
<td>5b.3</td>
<td>B(0.09) C(0.69) D(0.14) E(0.08)</td>
</tr>
<tr>
<td>5b.4</td>
<td>B(0.2) C(0.72) E(0.08)</td>
</tr>
<tr>
<td>5b.5</td>
<td>B(0.49) C(0.03) D(0.09)</td>
</tr>
<tr>
<td>5b.6</td>
<td>B(0.85) C(0.15)</td>
</tr>
<tr>
<td>5b.7</td>
<td>B(0.08) C(0.16) D(0.23)</td>
</tr>
<tr>
<td>5b.8</td>
<td>B(0.46) C(0.03) D(0.51)</td>
</tr>
<tr>
<td>5b.9</td>
<td>B(0.21) C(0.03) D(0.76)</td>
</tr>
<tr>
<td>5c.1</td>
<td>B(0.07) C(0.82)</td>
</tr>
<tr>
<td>5c.2</td>
<td>B(0.77) C(0.23)</td>
</tr>
<tr>
<td>5c.3</td>
<td>B(0.53) C(0.09)</td>
</tr>
<tr>
<td>5c.4</td>
<td>B(0.53) C(0.36)</td>
</tr>
<tr>
<td>5c.5</td>
<td>B(0.38) C(0.23) D(0.11)</td>
</tr>
<tr>
<td>5d.1</td>
<td>B(0.5) C(0.5)</td>
</tr>
<tr>
<td>5d.2</td>
<td>B(0.22) C(0.69) D(0.09)</td>
</tr>
<tr>
<td>5d.3</td>
<td>B(0.27) C(0.46) D(0.1)</td>
</tr>
<tr>
<td>5d.4</td>
<td>B(0.45) D(0.22)</td>
</tr>
<tr>
<td>5e.1</td>
<td>B(0.89) C(0.11)</td>
</tr>
<tr>
<td>5e.2</td>
<td>B(0.51) C(0.1) D(0.39)</td>
</tr>
<tr>
<td>5e.3</td>
<td>B(0.36) C(0.64)</td>
</tr>
<tr>
<td>5e.4</td>
<td>B(0.3) C(0.59) E(0.11)</td>
</tr>
<tr>
<td>5e.5</td>
<td>B(0.08) C(0.7) D(0.1)</td>
</tr>
<tr>
<td>5e.6</td>
<td>C(0.83) E(0.17)</td>
</tr>
</tbody>
</table>

### Assessment results (level 2 attributes)

<table>
<thead>
<tr>
<th>Item</th>
<th>Assessment Values</th>
<th>Maximum utility</th>
<th>Minimum utility</th>
<th>Average utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a</td>
<td>B(0.33) C(0.43) D(0.18)</td>
<td>0.5673</td>
<td>0.5073</td>
<td>0.5373</td>
</tr>
<tr>
<td>5b</td>
<td>B(0.4) C(0.25) D(0.22) E(0.03)</td>
<td>0.5799</td>
<td>0.4780</td>
<td>0.5289</td>
</tr>
<tr>
<td>5c</td>
<td>B(0.46) C(0.34) D(0.02)</td>
<td>0.7004</td>
<td>0.5237</td>
<td>0.6121</td>
</tr>
<tr>
<td>5d</td>
<td>B(0.36) C(0.43) D(0.09)</td>
<td>0.6303</td>
<td>0.5053</td>
<td>0.5678</td>
</tr>
<tr>
<td>5e</td>
<td>B(0.35) C(0.52) D(0.07) E(0.04)</td>
<td>0.5605</td>
<td>0.5411</td>
<td>0.5508</td>
</tr>
</tbody>
</table>

### Final assessment results (company A)

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a</td>
<td>B(0.39) C(0.4) D(0.1) E(0.01)</td>
</tr>
</tbody>
</table>

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From this finding it is easy to understand that the assessment is not as simple as a number or a score. The average utility 0.5650 is only used to give an overall and yet average indicator which can be compared with the performance of other organisations or departments against the same criteria. By looking back at the assessment results of lower level attributes and the evidence and comments provided to initial assessments, a clearer picture of how the overall result is achieved can be seen.

**Sensitivity analysis.** As shown in Table II, there are some indicators of basic attributes that cannot be assessed directly. This is because the evidence for those indicators is not available in the award simulation document. For example, when assessing the basic attribute – approach of 5a.5 – there are two indicators to be evaluated. For indicator (a), clear evidence can be found in the award simulation document that “details of process responsibilities and the interfaces are described in the business management system. Good examples are provided to show that mapping and defining responsibilities has already enabled cycle time reduction on some end-to-end processes”. This evidence matches grade B and therefore grade B is given to indicator (a). However, for indicator (b), it is not clear “whether cross-functional teams are in place to resolve interface issues”. Since the evidence is not available in the award simulation document, no grade is assigned to indicator (b) and the evidence is regarded “missing”. Therefore the overall assessment to approach of 5a.5 is “B(0.5) and missing(0.5)”, and the total DOB for this basic attribute is 0.5. This results in a total DOB being less than 1 and the assessment is regarded as an incomplete assessment with 50 per cent uncertainty.

According to the EFQM (2000) guidelines, a site visit is an opportunity to talk to people of the organisation to clarify unclear aspects and this is one way to solve the problem of incomplete assessment. However, there are occasions when a site visit is not possible. According to the EFQM (2000) guidelines, for the last three years, only organisations that are scored over 500 were given an opportunity for site visits. As an alternative, the ER approach provides a way of analysing these uncertainties without a site visit.

First of all, the range of the worst possible assessment result and the best possible assessment result can be identified by the ER approach to the attributes with uncertainty. To obtain the worst result, “uncommitted” (grade E) will be given to all the missing evidence. For example, grade E will be given to indicator (b) of approach of 5a.5 as the worst possible result. It leads to the worst possible result of B(0.5) and E(0.5) for the basic attribute – approach of 5a.5. Since the utility value of grade B is 0.75 and the utility value of grade E is 0, the worst possible score for the basic attribute would be 0.375 (0.75 × 0.5 + 0 × 0.5). On the other hand, to obtain the best possible result, “world class” (grade A) will be given to all the missing evidence. For the same example, grade A will be given to indicator (b) as the best possible result and this becomes B(0.5) and A(0.5). Since the utility value of grade A is 1, the best score for the basic attribute would be 0.875 (0.75 × 0.5 + 1 × 0.5). Therefore the assessment
result of the basic attribute is between 0.375 to 0.875, shown in Figure 2. It must
be noted that these two results are not realistic as extreme evaluation grades
are given to the missing evidence. However, the advantage of this is that it
allows the organisation to judge how far they can go in terms of the worst and
the best possibilities without having the certainty of missing evidence.

In order to give a more realistic assessment result, the ER approach uses the
average grade as the expected assessment result. It gives no preference to any
of the grades and the DOB is spread equally over all five grades. For example,
when assessing the indicator (b) previously described, the DOB is divided into
the five evaluation grades that is 20 per cent for each grade. As indicator (b)
only carries 50 per cent weight of the basic attribute, 10 per cent for each grade
is given that is 10 per cent grade A, 10 per cent grade B, 10 per cent grade C, 10
per cent grade D and 10 per cent grade E. Therefore the assessment result for
the basic attribute becomes A(0.1) B(0.6) C(0.1) D(0.1) E(0.1), and the expected
score is 0.625 (0.1 × 1 + 0.6 × 0.75 + 0.1 × 0.5 + 0.1 × 0.25 + 0.1 × 0), as
shown in Figure 2. In this way, a neutral assessment is given to those attributes
with missing evidence. It is believed that this neutral method is more realistic
and less subjective and improves scoring reliability.

It can be seen that the assessment to the basic attribute described above is
associated with 50 per cent uncertainty. However, the certainty of the
assessment will be improved as assessment results are combined at upper
levels and this is because the basic attributes with missing evidence are only a
small number of basic attributes in the decision model. As shown in Table II,
amongst the 15 basic attributes of sub-criterion 5a, only two basic attributes
are assessed with some missing evidence. As shown in Table V, the assessment

Figure 2.
The assessment range
of approach 5a.5
(company A)
result for 5a.5 (immediate upper level attribute) is B(0.81) and C(0.03). The total DOB is 0.84 which indicates that the assessment for 5a.5 is 84 per cent certain. The same principle applies to upper level attributes. As shown in Table VI, the assessment result for 5a is B(0.33), C(0.43) and D(0.18) and the total DOB is 0.94. As shown in Table VII, the overall assessment result for 5 "processes" is B(0.39), C(0.4), D(0.1) and E(0.01) and the total DOB is 90 per cent. It indicates that the overall assessment is 90 per cent certain and at this certain level, even scoring the missing evidence with extreme scores will not affect the score to a great extent. As shown in Figure 3, the gap between the best and worst possible scores is decreased dramatically compared with Figure 2. It is therefore believed that the average score of 568 has realistically presented the actual performance of the process management of company A.

Independent of this research, a team of nine experienced external assessors assessed the same submission document as part of the self-assessment process of company A. The results given by the external assessors and the results generated using the ER approach are shown in Table VIII. It is clear in

<table>
<thead>
<tr>
<th>Expected score (ER approach)</th>
<th>Assessment score (external report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a</td>
<td>537.3</td>
</tr>
<tr>
<td>5b</td>
<td>528.9</td>
</tr>
<tr>
<td>5c</td>
<td>612.1</td>
</tr>
<tr>
<td>5d</td>
<td>567.8</td>
</tr>
<tr>
<td>5e</td>
<td>550.8</td>
</tr>
<tr>
<td>Final score</td>
<td>568.0</td>
</tr>
<tr>
<td></td>
<td>620</td>
</tr>
<tr>
<td></td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>720</td>
</tr>
<tr>
<td></td>
<td>610</td>
</tr>
<tr>
<td></td>
<td>570</td>
</tr>
<tr>
<td></td>
<td>600</td>
</tr>
</tbody>
</table>

Table VIII. Results comparison with external assessors' report
Table VIII that the final score generated using the ER approach is 568 and the final consensus score given by the external assessors is 600, a difference of 32 (5.8 per cent). If the consensus score given by the external assessors is used as a benchmark, the overall assessment score with only 5.8 per cent difference can be regarded as accurate.

Identifying strengths and areas for improvement

According to Porter and Tanner (1996), to many organisations which conduct self-assessment against the EFQM model, the feedback report is a major output from the assessment process. Not only do these organisations want to know their assessment results and scores, they also want to know their strengths and areas for improvement (AFIs). Therefore the new model built in this research should be able to assist in producing the feedback.

There are various ways of identifying strengths and AFIs during assessments. In this paper, two logical and systematic ways are identified to fulfil different objectives of the assessments:

(1) the benchmarking method; and

(2) the detailed analysis method.

Both methods are bottom-up methods from the basic attribute level of the hierarchy. The assessment results of upper level attributes are achieved by combining initial assessment results at basic attribute level. It is at the basic attribute level that direct assessments are given by assessors with evidence and comments to explain how assessment results are achieved. It is also at this level that organisations should start to look for improvement opportunities.

Benchmarking method. The benchmarking method uses the chosen benchmarking grade as a gauge to identify strengths and AFIs. By identifying all the basic attributes assessed higher than the benchmark grade, the strengths can be identified (see Appendix 1). In the same way, AFIs can be identified by focusing on all the basic attributes assessed lower than the benchmark grade.

For example, to identify strengths and AFIs of the company A’s 2000 award simulation document, first of all the benchmark grade needs to be chosen. Because the average score of the assessment is 565 which falls into the category of “improvers” (grade C), grade C is chosen as the benchmark grade for company A. All the assessment results above grade C would be considered as strengths and below grade C would be considered as AFIs. As shown in Table II, there are 58 grade B and 28 grade D or E which are fully or partially given to basic attributes. Most of grade B or grade D are jointly given with grade C which indicates that these assessment results are between grade B and C, or between grade D and C. In order to make the process more efficient, it is decided that only basic attributes assessed 100 per cent grade B or above are identified as strengths, and only basic attributes assessed 100 per cent grade D or below are identified as AFIs. In this way, nine strengths and eight AFIs are identified.
**Detailed analysis method.** Even when an attribute is assessed above average grade, it is still be open to improvement. To give a detailed assessment to an organisation especially at the first self-assessment practice, the detailed analysis method is an alternative method to identify strengths and AFIs. By using the detailed analysis method, strengths are identified for all attributes unless the attribute is assessed to grade D (drifters) or below. On the other hand, AFIs are identified for all attributes unless the attribute is assessed world class. By going through this practice, organisations being assessed will have a detailed picture of how their business processes are managed against the EFQM criteria.

Using the approach 5a.1 of company A as an example, the indicator (a) is graded B which can be identified as a strength because “the key processes and support processes of company A are clearly identified and mapped”. From the evidence given, however, the reason why it is not assessed as “world class” is because “some departments have developed and documented their own processes and this needs to be integrated within one system”. Therefore, even though an “award winner” is given to this indicator, there are still some areas to improve.

This method is time-consuming and is only recommended when a few areas are selected to work on improving. As shown in Tables II and V-VII, assessment results for company A at all levels are provided in detail and it is up to the company to choose which areas to focus on improving. The areas can be sub-criteria level attributes or attributes below. When areas are chosen, the evidence and comments provided by assessors in the areas should be fully investigated. However, it is recommended that only around top 10 areas for improvement should be focus upon each time.

**Improvement scenarios and simulation**

According to Van der Wiele and Brown (1999), it is important to link the self-assessment process with the organisation’s business cycle of strategic planning. Brown (2000) also agrees that self-assessment can provide an important input to business planning. As mentioned earlier, the objective of constructing the decision model is not only to improve the scoring method of the EFQM (2000) model, but also to use the decision model as a strategic planning tool. In this section, different improvement scenarios are designed, and improved assessment results are predicted by simulating the self-assessment process using a number of scenarios. The simulation function of the decision model allows organisations to plan effectively to achieve the best results.

By using the new decision model, many different improvement scenarios or action plans can be developed for different purposes of implementation. The number of scenarios to test and simulate is unlimited. However according to Brown (2000), it is important to mention that organisations must not try to fix everything at one step. A smarter approach is to select the most important ten to 20 areas to work on each time.
By analysing evidence given by assessors, it can be noted that some improvements can be implemented within a short period of time, such as three months, while others need a longer period of time. For example, from the evidence given for 5a of company A, it can be seen that a major problem of the quality system is integration. Some departments have developed and documented their own processes and the business management system only covers 70 per cent of the business. As the implementation of the business management system is in the early stages, it indicates that a longer period of time is needed to become mature and reach the award winner level. Therefore one of the longer term improvement scenarios for company A would be further integration of the quality system (see Appendix 2).

For the short term or immediate improvement, however, 5a.5 presents an opportunity for company A. In the simulation document, it is not clear whether cross-functional teams are in place to resolve interface issues. According to the evaluation grades established, “establishing cross-functional teams to resolve interface issues” is indicator (b) of 5a.5. Due to missing evidence of this indicator, its assessment becomes uncertain. However from improvements achieved on some end-to-end processes described in the simulation document, it can be assumed that cross-functional teams are in place. There is a possibility that this evidence can be provided immediately by the writer of the simulation document. If this is true, the assessment result of this indicator can be improved immediately to “award winner”.

Based on the evidence provided, a short term improvement scenario and a longer term improvement scenario are produced for simulation purposes.

Simulation results. The assessment results generated by simulating the short term improvement scenario of company A are shown in Figure 4. The
predicted overall assessment result is 598. Compared with the current assessment result of 568, a 5.7 per cent improvement is achieved. The assessment results generated from the simulation of the longer term improvement scenario are shown in Figure 5. The predicted overall assessment result is 620, a 9.2 per cent improvement.

From the illustrations of the two improvement scenarios, it can be seen that by simulating different scenarios or action plans, organisations can predict the assessment results without actually implementing them. It demonstrates that the new decision model can be used as a useful planning tool for organisations to study their improvement strategies in order to achieve their improvement objectives.

**Conclusion**
Based on the EFQM (2000) model, a decision model has been constructed, focused on the criterion “processes” and this has enabled a more rational approach to be introduced to the self-assessment measurement system. The decision model was successfully built following a sequence of steps. First, based on decision theory and the EFQM model an evaluation framework was designed, which properly balanced the accuracy and complexity of the evaluation process. Second, the evaluation grades were defined based on the EFQM (2000) scoring guidelines and previous research work (Yang et al., 2001; Siow et al., 2001). It was found that terms used in the TQM adoption model developed by Dale and Lascelles (1997) can adequately represent the five grades defined in the decision model. Finally, the ER approach was chosen as the appropriate MADM approach for aggregating self-assessment information with uncertainty. By using the intelligent decision system (IDS) software
(Yang and Xu, 1998; Xu and Yang, 2001), the evaluation process using the ER approach is made relatively easy to implement.

Two award simulation documents were used for model testing in this research. From the sensitivity analysis and comparison with external assessors’ results, it was found that the new decision model has the potential to improve the accuracy of the measurement system of the EFQM model and compensate for the lack of experience in assessment.

It was also found that the new decision model can assist in producing a feedback report by systematically identifying strengths and areas for improvement. The benchmark method and the detailed analysis method have been identified as useful tools to assist in producing the feedback report. Other methods can also be used to meet specific organisations’ self-assessment objectives.

The simulation function of the new decision model is found useful for organisations to plan their improvement strategies. Different improvement scenario results can be predicted without undergoing real implementation and changes. In this way, the decision model can be used as a strategic planning tool.

This research is part of a large project which is being undertaken at the Manchester School of Management of UMIST to develop models and tools to support self-assessment. Although the work reported in this paper is based on the EFQM model, the principle of decision modelling and the tools can be applied to support self-assessment using other business excellence models.

References


**Appendix 1. Strengths and weaknesses identified by using benchmarking method**

**Strengths:**

- Clear evidence shows that the business process is reviewed and improved thoroughly to resolve interface issues internally and externally (A& R 5a.5).
- Actions to identify and prioritise key improvement opportunities are regularly reviewed. Clear evidence shows that processes have been improved. Customer, employee and community surveys are used to identify improvements (A& R 5b.1).
- Good examples are provided of changes that have been carried out in a structured manner, e.g. IMS system changes, WMS staff moves, pilots in flexi-skilling, OCC trialling (approach 5b.6).
- Clear evidence shows that measures are implemented to demonstrate the derived benefits and determine the effectiveness of changes (A& R 5b.6).
• In-depth training is carried out prior to implementation change. Operation manuals are produced (approach 5b.8).

• Improvements have been identified and anticipated for both domestic customers and business customers. Clear evidence shows that the approach is implemented in most relevant areas and is implemented in a structured way (deployment 5c.2).

• Clear evidence shows that performance is monitored against the KPM's and results appear on a monthly traffic light report and the key measures indicate a good performance overall (A& R 5e.1).

• Clear evidence shows that the company has a system in place for handling all customer enquiries and complaints. Employees have been advised what action to take if they receive complaints direct from customers (approach 5e.2).

• The results from the questions asked in customer surveys are analysed and the management team determines where the focus should be to improve the levels of satisfaction. The key initiative in this year’s business plan is a result of the overall performance (A& R 5e.4).

Weaknesses:

• There is no evidence to show how satisfaction surveys and day to day customer feedback are being used to develop KPMs and actions to improve customer satisfaction (A& R 5e.6).

• Senior managers who are now responsible for the support management processes need to take ownership, review and amend the documentation, communicate these within the business and take responsibility for reviewing their use for continuous improvement (A& R 5a.2).

• Employee survey highlighted that training is not being reviewed or delivered at the time it is required (A& R 5b.8).

• Although the effectiveness of changes is reviewed at monthly meetings, little evidence is provided of measures used to review performance or mechanisms used to ensure process change achieves predicted results (A& R 5b.9).

• There is no evidence to show that frequent informal contact with customers is maintained to build strong relationships (approach 5e.4).

• There is no evidence to show that customers and partners are encouraged to input their creative ideas for improvement (approach 5b.3).

• There is no evidence to show that benchmarking techniques are used against competitors and best practice in the industry to discover and use new designs and technology (approach 5b.4).

• There is no evidence to show that benchmark data are used as a stimulus to set targets. There is no evidence to show that stretch goals are used to initiate process improvement (approach 5b.2).

Appendix 2. Improvement scenarios for simulation

Short-term action plan:

(1) To extend ISO9000 series registration to all areas of the business as planned in March of this year (2001). This will improve the assessment result of all indicators of 5a.3 to grade B.

(2) To ensure cross-function teams are in place to resolve interface issues. This will improve the assessment result of indicator (b) of approach (5a.3) to grade B.

(3) To encourage customers and partners to input their creative ideas. This will improve the assessment result of indicator (c) of approach (5b.3) to grade C.
(4) To communicate changes to external stakeholders such as suppliers and customers. This will improve the assessment result of indicator (a) of approach (5b.7) to grade B.

(5) To describe the performance measures of processes in the customer services section and clarify whether they are integrated within the business management system. This will improve the assessment result of indicator (c) of A & R (5c.3) to grade B.

(6) To explain how the new process "management of business improvements" can ensure that viable ideas and improvements are rolled out across the whole company. This will improve the assessment result of indicator (c) of approach (5c.5) to at least grade C.

(7) To further identify processes servicing products and services. This will improve the assessment result of all indicators of 5d.4 to grade B.

(8) To regularly review the customer complaint process to ensure Vertex meet their SLA commitments. This will improve the assessment of indicator (c) of A& R (5e.2) to grade C.

(9) To provide evidence and indicate that measures are used to adjudge the effectiveness of the "establish and monitor strategy and business plan" process. This will improve the assessment result of indicator (c) of A& R (5e.6) to grade C.

**Longer-term improvement scenario:**

(1) To seek full integration of the business management system and cover all areas of the business within the system. This will improve the assessment result of indicator (c) of Approach (6a.1) to grade B. This will also improve the assessment result of deployment of 5a.1 to A(0.5) B(0.5).

(2) To use control mechanisms to ensure processes stay within specific limits, to use cause analysis in processes to set performance targets, and to train process owners to control and modify the processes. This will improve indicators (c) (d) (e) of approach (5a.4) to grade C or even grade B.

(3) To use benchmark data as a stimulus to set targets and to use stretch goals to initiate process improvement. This will improve the assessment results of indicators (d) (e) of approach (5b.2) to grade B.

(4) To thoroughly review and improve the effectiveness of the training provided prior to implementing changes. This will improve the assessment result of A & R of 5b.8 to grade B.

(5) To employ a more proactive approach and multiple methodologies to gather customer needs and expectations for products and services provided, such as focus groups and regular meetings with customers. This will improve the assessment result of all indicators of 5c.1 to grade B or even higher.

(6) To review and improve the quality assurance system more regularly in order to mature the system even after ISO9000 series registrations are sought. This will improve the assessment result of A & R (5d.3) to grade B.

(7) To build a strong relationship with customers including frequent informal contact with customers, and to use a more proactive approach to follow up on sales and services of all types of products and services provided. This will improve the assessment result of approach and deployment of 5e.4 to grade B.

(8) To identify measures of assessing customer sales and servicing relationships, and to implement the creative and innovative approach to domestic customers as well as business customers. This will improve the assessment results of approach and deployment of 5e.5 to grade B.