A Decision Regarding the Selection of Estimating Software for An Offshore Contractor

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for

Executive Decision Making

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Table of Contents

Abstract

This decision is concerned with the selection of the best new estimating system software for the domestic operating division of an offshore contractor. The current software is antiquated and no longer adequate for preparing bids in the changing, more complex, offshore construction market. Four alternatives were evaluated: retaining the current system; Hyperion Essbase, the Timberline estimating package, and a spread sheet based system used at other company locations. The major objectives and their derived priorities from application of the Analytical Hierarchy process are estimating factors (0.434); IT related factors (0.155); cost (0.086); ability to interface with other systems (0.116); speed of implementation (0.055); and ability to draw on existing history (0.154).

The initial modeling exercise indicated that the two commercial packages were markedly superior to the existing system and the spread sheet system. The two commercial systems were similar in ratings with scores of 0.326 (Hyperion) and 0.317 (Timberline) and these rankings were sensitive to small changes in the variables. For this reason it was decided to do a second model with a head-to-head comparison of the two commercial systems, based on data from vendor discussions that were specifically keyed to the products' ability to meet the model's objectives. As a result of this head-to-head comparison. the Hyperion Essbase system was judged superior in achieving the specified overall goal and, therefore, is the better choice for the new estimating system software.

Estimating System Software for Offshore Contractor

Decision Requirement

This decision is concerned with the selection of the best new estimating system software for the domestic operating division of an offshore contractor.

Background

The offshore contractor designs, procures, fabricates, and installs large offshore platforms (Figure #1) and pipelines. The domestic operation primarily services projects in the Gulf of Mexico but also does some work in West Africa and South & Central America.

Figure #1 – Typical Offshore Platform

The company has a very detailed engineering estimating system, but its system for estimating the cost of fabricating and installing platforms and pipelines offshore is not as well developed. The structures are fabricated onshore in large fabrication yards. For many years the process was quite simple to estimate. The first step was to fabricate the components in a large fabrication yard and estimating consisted of determining the manhours required for the work from material quantities determined in drafting and the cost of the materials.

Figure #2 is an example of the above water deck structures which contain the processing facilities, and Figure #3 shows the jacket substructure that supports the deck as it is being loaded onto a barge at the fabrication facility for transported offshore and installation.

Figure #2 - Deck Fabrication

Early platforms were primarily comprised of very large but basic structures and some piping. The processes on the platform were very simple and any equipment was usually designed and supplied by the client.

As the development of oilfields has moved to deeper water and farther from shore, systems have become more diverse and sophisticated, and the platforms now have a great deal of engineered equipment (compressors, pumps, etc.) on them along with the accompanying piping, electrical, and instrumentation work. Also, manning levels are higher, and sophisticated life support and highly reliable staff protection and evacuation systems are required.

Figure #3 – Jacket Loadout

While the formerly uncomplicated structural and piping estimating allowed the use of simple estimating systems based on the structural weights, the newer, more complex facilities require a much more detailed estimate.

Also, fabrication work was historically performed on a cost plus basis (or at least at unit rates), but cost pressures resulting from low priced oil, and the desire to keep profit dollars within the oil companies when oil prices move up, have relentlessly pushed the industry toward fixed price contracts. At the same time competition among fabrication contractors has increased as the number of projects decreases and their individual sizes go up.

Similarly, estimating the offshore portion of the work (Figure #4), which consisted mostly of heavy lifting and welding, was simple and most of the work was done on a day-rate basis. Current projects, however, require many, more diverse services such as:

- mile deep riser installations;
- non-destructive testing;
- remote diving vehicles;
- mooring installations; and
- the use of special support vessels.

Deeper water developments are extremely expensive and field economics are very cost sensitive, so again the trend is toward putting the risk on the contractor with fixed price bids, especially for large floating platforms and their mooring and pipeline systems (Figure #5).

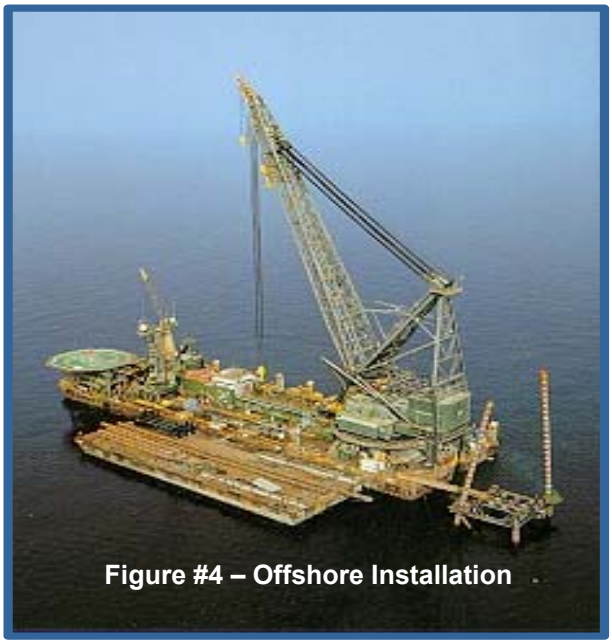


Figure #4 – Offshore Installation

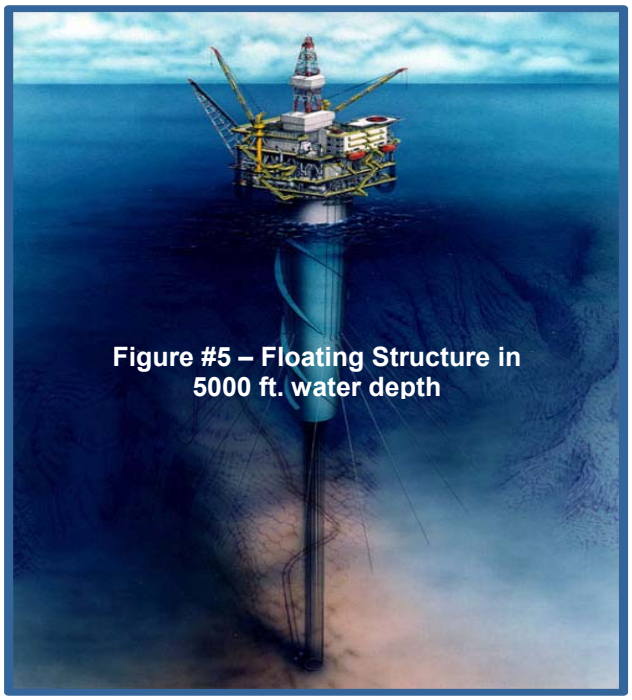


Figure #5 – Floating Structure in 5000 ft. water depth

The correlation of all the above forces has necessitated a review of the company's domestic bidding and estimating process and one result of that review is the determination that a more accurate and flexible estimating system is critical to the company's survival. The key step in the development of the new system is a decision on the choice of estimating software.

The Existing Estimating System

The existing system is a mini-computer based adaptation of software originally develop for use on mainframe computers called Mapper. This is used primarily for offshore estimating as fabrication avoids it and uses custom spread sheets whenever possible. This leads to integration problems on large, multi-division estimates because of the use of different systems for different parts of the business.

Also, Mapper does not fit the requirements for larger, more complicated, more expensive, integrated projects with many outside parties involved. It is prone to errors, especially when changes occur and is slow and clumsy to operate. Comparison of options is very tedious and time consuming. Too much of the estimators' time is spent manipulating the

software, rather than developing the most efficient and competitive estimate for the project.

Possible Alternatives

Four possible courses of action or alternatives were identified for comparison. These are given below along with the variable names assigned in the decision model:

- **MAP** - Live with Mapper.
- **HE** - Hyperion Essbase hub & spoke system.
- **TIM** - Timberline estimating system software.
- **SS** - Develop spreadsheet system internally, based on a system used in overseas areas.

Each of the various outcomes has advantages and disadvantages which are discussed in the descriptions below.

Mapper (MAP)

The principal advantage of Mapper is that the estimating staff and the executives reviewing bids and setting the final margins are familiar with the software and its outputs. The introduction of new software will be perceived as additional work even though one of the major objectives is to make the estimating process more efficient and user friendly. The estimates will not stop and wait for the personnel to learn the new system and estimating is often the process of moving from one crisis to another.

Additionally, the Mapper's files contain much of the offshore estimating history for domestic operations and on simpler bids it is often feasible to simply update a previous estimate for a similar project. On the other hand, this sometimes makes the introduction of new concepts more difficult and important items are missed because the new job does not quite fit the old template.

The disadvantages of Mapper have been discussed above, but one additional one is that it is no longer compatible with the existing accounting and forecasting systems and is not easily re-programmable to be so.

Hyperian Essbase (HE)

Hyperion Essbase is an enabling technology that supports many different categories of analytical applications. It allows the reconciliation of data from a variety of sources and provides a number of analysis tools. It is primarily geared to financial reporting and has its own spreadsheet capability for the organization of data. There is the possibility that it is overkill for the estimating application that is the basis of this decision.

It is advertised to have the ability to bring together data from a variety of applications and databases, organize that data, and export it to other applications. This would allow drawing on old Mapper files and interfaces could be developed to allow easy transfer of data to the accounting and forecasting systems. Initial set-up time would be longer than for the other systems.

Timberline (TIM)

The Timberline Precision software is an integrated suite of applications for construction estimating. While it appears to be geared primarily toward commercial and building construction it also allows specialty estimating processes that could be adapted to the offshore fabrication and installation business. It is bill of materials driven, as is the offshore business, and provides for a variety of estimating reports.

The degree to which it can be customized to match our requirements is the most serious question to be answered, but it is known to be in use by at least one of the company's competitors.

Existing Spreadsheet (SS)

A spread sheet estimating system exists at some of the company's overseas locations and works quite effectively there. It has certain

advantages of familiarity and ease of use of spreadsheets. It currently covers most of the company's conventional areas of operation since it is designed for our older conventional business. Significant work will be required to make it adaptable to the more complex domestic market.

The spreadsheets are rigid in format in many areas, although some customization is possible. This program would require continuing internal IT maintenance without any vendor support, since support of this type is not available from the company's IT outsource provider. Also, their operation is complex and, while inexpensive manpower is available overseas to maintain the system and manipulate the estimates, domestic costs are much higher and may be prohibitive.

First Tier Objectives for New Software

The top tier of the hierarchy is comprised of six goals:

Estimating Related Goals (EST)

The primary goal of the effort is to select a new estimating software system, so obviously the meeting of a series of estimating related goals that overcome the limitations and problems with the existing estimating system is one of the goals. This category has a number of sub-goals that are evaluated to determine the comparative rating of the various possible outcomes. These are discussed in the Appendix.

Information Technology Related Goals (ITF)

While achieving the estimating goals is the first priority, it is also desirable to have a system that is reliable and easily maintained from an IT point of view. This is particularly true of such areas as customer support from the vendor and minimization of downtime for maintenance. As with the estimating goals, the IT goals are evaluated at a lower level which is described in the Apendix.

Initial Setup Cost (CST)

As in most decisions, cost is a factor. This particular variable deals with the initial cash outlay for hardware & software, system programming, and user training. Such things as maintenance cost and user time and operating costs are included in the judgements of other variables.

Interface With Other Systems (IOS)

Changes in the accounting system have removed one of the big advantages of the old Mapper system: its compatibility with the accounting and forecasting systems. Newer software systems could be designed to redevelop this capability. This variable deals with the ability of the selected system to interface with existing systems. This could be achieved via a direct relationship or through custom programmed interfaces. Manual inputting of data is also a feasible alternative.

Speed of Implementation (SOI)

While it is important to take the time to do the job right, the need for an improved system exists now and is becoming more acute. A perfect system, long delayed, will not do much good. Implementation time includes the time to procure the software, install and test it, program any interfaces or custom screens required and train the users.

Ability to Draw on Existing History (HST)

All systems will be able to make use of the project history files, but compatibility with existing systems or a custom programmed tied to the Mapper system will simplify this factor and eliminate the need to perform manual operations.

Lower Tier Sub-Goals

The first tier Estimating and IT Related Goals were further divided into sub-goals with the Estimating category having one lower tier and IT category having two.

These lower tier branches are shown in Figure #6 and a more detailed explanation of their relationship to the first tier goals is given in the Appendix . The lower tier goals are:

Estimating Related Goals

- SPD – Speed of use
- WBS – Use of standard WBS
- OPT – Ease of evaluating options
- IO – Ease of input and output

IT Related Goals

- SPT - Minimize IT support
- REP - Reputation of vendor
  - LNG – Supplier years in business
  - MKT – Supplier market position
- SCA - System scalability
  - MUR – Multi-user capability
  - MSP – Ability to maintain speed
- HDW – Hardware requirements
  - RMA – Remote access capability
  - MNT – Maintenance ease
- EOU – Ease of use for IT personnel
  - CUS – Ease of customization
  - REW – Report flexibility

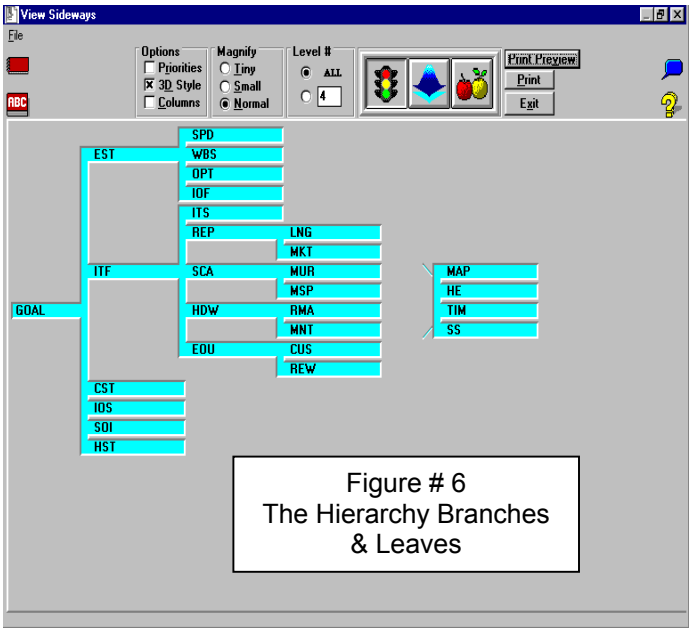


Figure # 6
The Hierarchy Branches & Leaves

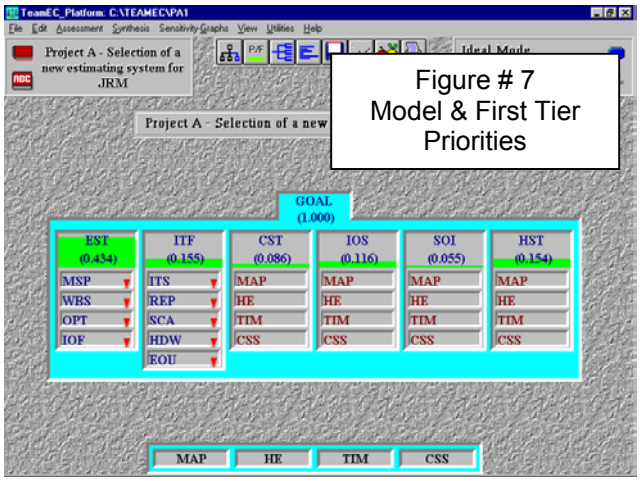


Figure # 7
Model & First Tier Priorities

Derived Priorities

Pairwise comparisons of the first tier goals were made by the evaluation team. These comparisons resulted in the derived priorities shown in the model in Figure #7.

As would be expected with an estimating system decision, the primary goal is a software system that is user friendly. This is confirmed in the derived priorities for the estimating sub-goals given in Figure #8, where ease of input/output and the ability to easily compare options and do "what if?" comparisons are the primary variables. Speed is rated as secondary to flexibility in this area.

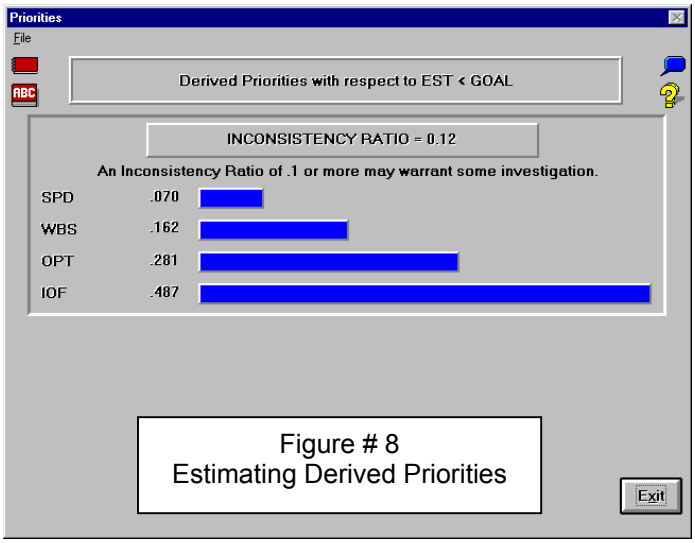


Figure # 8
Estimating Derived Priorities

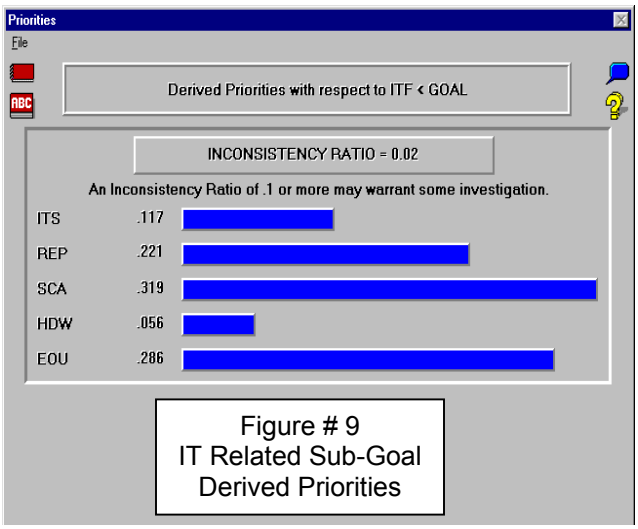


Figure # 9
IT Related Sub-Goal
Derived Priorities

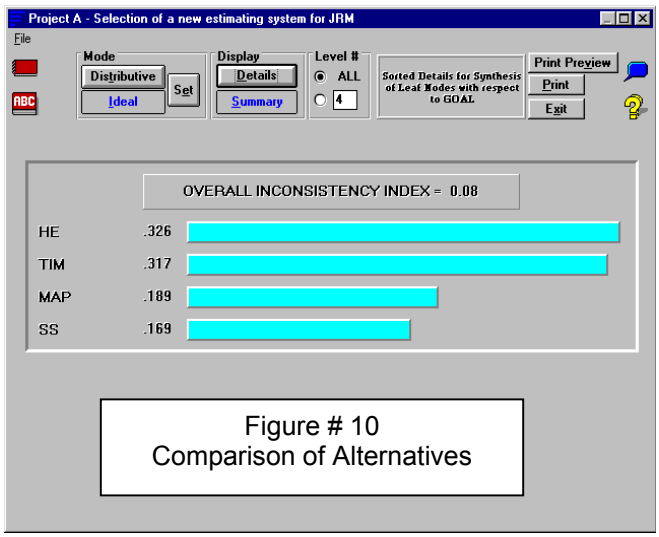


Figure # 10
Comparison of Alternatives

The IT related goals were broken down into two levels of sub-goals and the results of the derived priorities resulting from pairwise comparisons are given in Figure #9. Lower order comparisons are available in the model. The highest derived priority in this category is scalability followed closely by ease of use and vendor reputation. The low rating of hardware appears to reflect the simplicity and reliability of the server required for all the systems.

Initial Outcome

Figure #10 gives the results of the synthesis process. The Hyperion Essbase software was rated as the alternative that best satisfies the objectives for the decision. It was closely followed, however, by the Timberline system. Both rate markedly higher than the Mapper or spread sheet solutions.

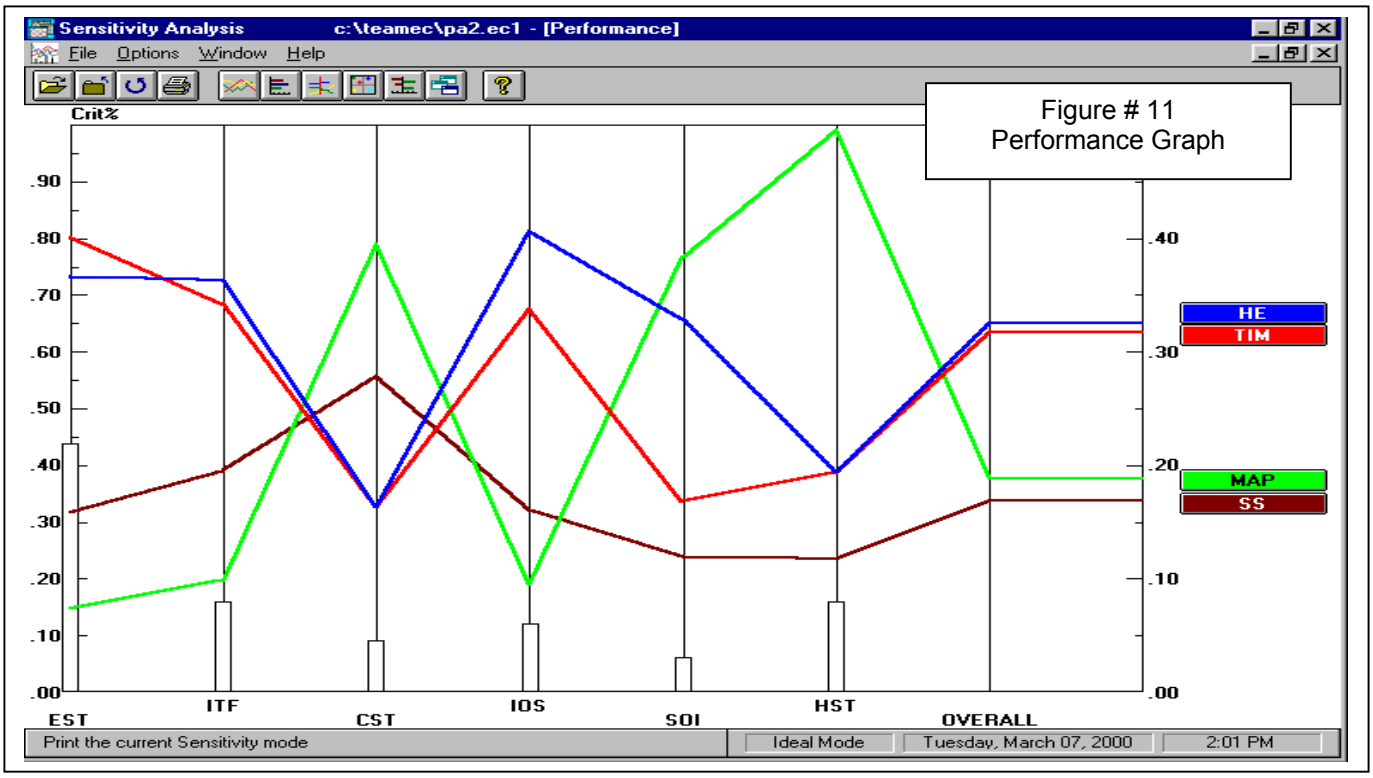


Figure # 11
Performance Graph

Several of the goal derived priority sets have an inconsistency ratio between 0.10 and 0.13, but the overall ratio of 0.08 is less than 0.10 and considered satisfactory for the comparison.

Discussion of Sensitivities

The two commercial software systems scored significantly higher than Mapper and the spread sheet system on both the Estimating and IT related factors. The relative scores in each of the Tier #1 areas are shown on the performance graph in Figure # 11. The commercial systems outscored the spread sheet system in all areas except cost. While Mapper was faster and cheaper to implement (existing system) and has better access to history files, this was not enough to overcome its operational and IT disadvantages,

Hyperion Essbase scored equal to or above Timberline in all categories except the estimating goals, where it was slightly lower.

An examination of the sensitivities of the comparison between Hyperion Essbase and Timberline indicates that the decision is very sensitive to the estimating goals and to the ability of the software to interface with other software.

Narrowing of the Decision

The two commercial software packages were rated far superior to the other two options. Because of this gap and the closeness of the

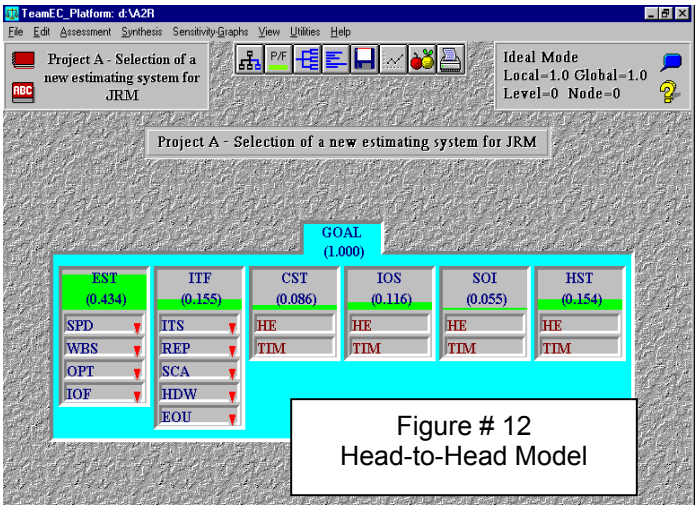


Figure # 12
Head-to-Head Model

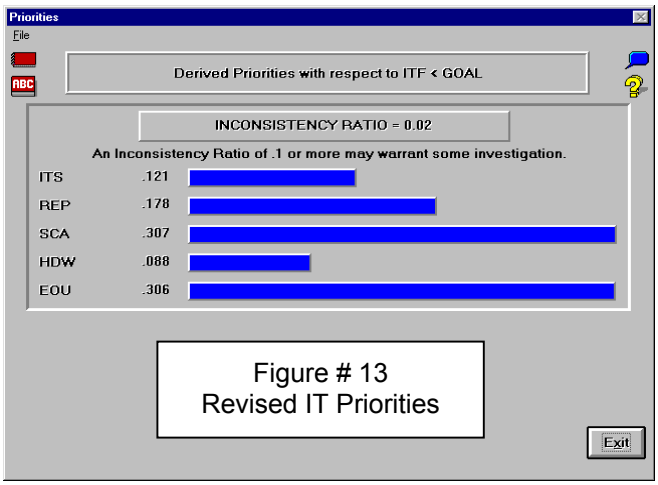


Figure # 13
Revised IT Priorities

overall ratings for the two commercial packages, it was decided to use the first model as a screening exercise and eliminate the Mapper and Spreadsheet alternatives from further consideration. It was also decided to do additional research on the commercial options, and rate the two commercial systems head-to-head. The revised model is shown in Figure #12.

Model Priorities

No changes were made in the first tier priorities of the model or in the lower tier priorities for the estimating variables. The IT priorities were modified slightly based on comments by the IT Manager during a review of the initial screening model. The revised priorities are shown in Figure #13.

Refinement of Evaluation Data

Additional information on the capabilities and characteristics of the two commercial software packages was gathered through vendor discussions that specifically emphasized the ability of the software systems to meet the goals identified in the decision model. The head-to-head comparison of the two products was then performed, based on this supplemental information. The screening model was based on the team's study of literature on the software products. This additional information obtained in discussions with the vendors caused us to change the ratings of the two software packages

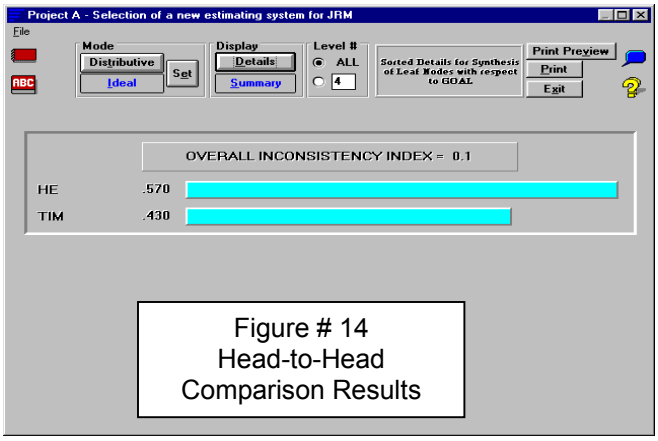


Figure # 14
Head-to-Head
Comparison Results

in a number of areas. These differences will be further explained in our discussion of the performance graph.

Results

The results of the head-to-head comparison are given in Figure # 14. Hyperion Essbase was once again the preferred alternative by a larger margin than in the screening model.

Discussion of Results & Performance Graph

Figure # 15 shows the performance graph for the head-to-head model. It contains some significant variations from the performance curves for the commercial software packages shown in Figure #11. These are a result of re-evaluations made of the Hyperion Essbase (HE) and Timberline (TIM) packages utilizing the additional data from the vendors. The most significant changes are:

1. Estimating Factors (EST) – This change from a slight advantage for TIM to a slight advantage for HE resulted from an improved HE rating for its ability to do "what if" analysis and a more nearly equal rating of HE and TIM for the ease of input and output, where the previous ratings had given TIM a 2:1 preference.
2. IT Factors (ITF) - After all the priority changes and reevaluation of the IT factors,

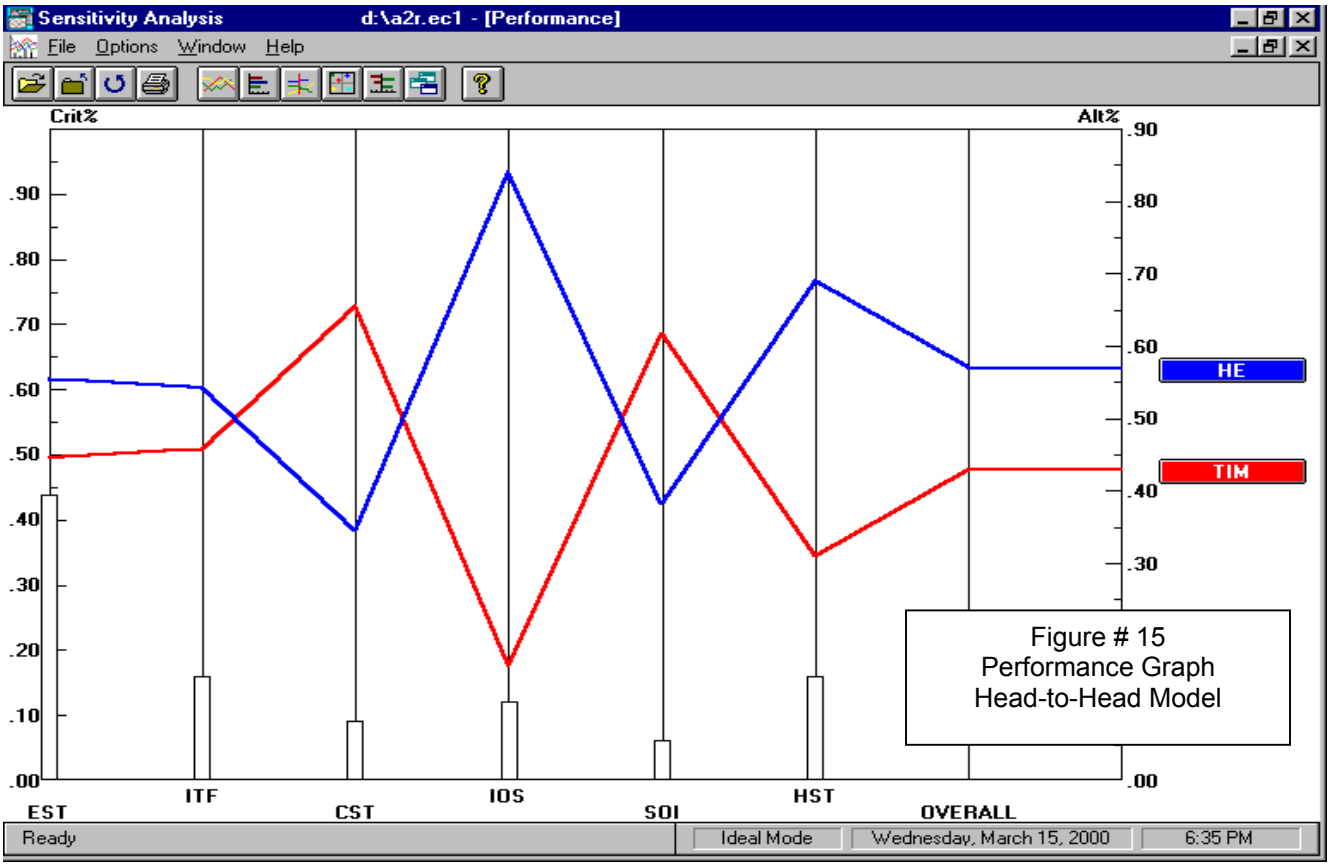


Figure # 15
Performance Graph
Head-to-Head Model

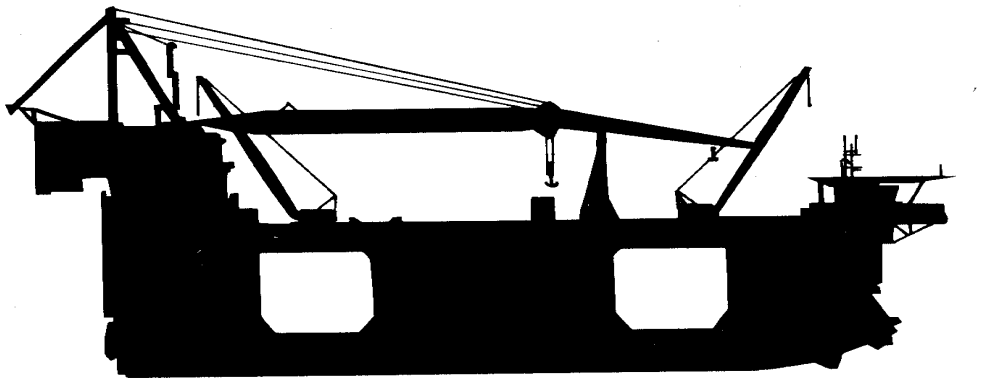
the only effect was a slight increase in the advantage for the HE product.

3. Cost of Implementation (CST) - Cost was initially rated equal for both packages, but indicative prices received as part of the exercise showed an advantage for TIM, primarily because of the need for more for initial programming for HE.
4. Interfacing With Other Systems (IOS) - HE remained superior to TIM in the ability to interface with the Company's other PM and accounting systems, and its rating increased markedly, primarily because of its open architecture structure and limitations uncovered in the TIM system.
5. Cost (CST) - The above advantages in ability to interface with other systems come at the cost of more initial programming time and thus more implementation time. This rather large swing had very little effect on the final result, however, since its priority is very low.
6. Ability to Draw on Historical Data (HST) – Further investigation showed the HE system could mate with old Mapper files, making the use of historical data much easier than TIM. This gave HE a clear superiority when the previous model had rated the two systems almost equal.

In general, the narrowing to two systems, more definitive data, and use of the graphical method to set relative, head-to-head ratings resulted in a more finely tuned estimate.

Conclusions

The head-to-head comparison indicates that the Hyperion Essbase system is the highest rated of the alternatives considered. These results were presented to the Estimating Manager and IT Manager for domestic operations and it is expected that negotiations will be opened with the Hyperion Essbase vendor on a formal proposal for implementation of a HE based estimating system.



APPENDIX

DISCUSSION OF ESTIMATING & IT SUBGOALS

The Estimating Related Sub-goals

Four estimating subgoals were identified for evaluation in the model:

Speed of Use (SPD)

This goal represents the user friendliness of the system: The ease with which a model of the project to be estimated can be set up, the flexibility in the model, and the ability to change the model to fit changing circumstances and plans during the bid.

Use of Existing Company WBS (WBS)

The Company has adopted a standard Work Breakdown Structure (WBS) for most projects. Direct input into this WBS from the estimating system or the ability to do estimates using the WBS as the upper tiers of the estimate model is highly desirable. This is primarily a requirement for the ability to roll the final results up under the WBS categories, and not necessarily the internal framework for the estimate.

Ability to Evaluate Options (OPT)

Numerous options are usually required to be evaluated to find the optimum bid price for a project. The ability to compare and retain a large number of options with minimal rework of the base estimate is an important goal.

Ease of Input and Output of Data (IO)

Estimating requires the input and manipulation of large amounts of data from many sources. Highly complex input screens and formats are one of the major problems with the current system. This has lead to numerous errors and extensive time must be wasted back-checking data and the calculations to resolve these input errors. Also management normally requires that the data be presented in a number of different formats during bid reviews, depending on the level of management and type of job being considered.

The IT Related Sub-Goals

There are two lower tiers of IT related sub-goals in the model. These level are presented together here for discussion:

Minimum IT Support Requirements (SPT)

It is desirable that IT support requirements be kept to a minimum. This is because IT support is currently outsourced and any of the programs being considered would be outside the current infrastructure plan for this IT support subcontract.

Reputation of Vendor (REP)

This is a critical system for the company and it must not be turned into a software development project. The sub-goals under this category are:

- **LNG** – The number of years the supplier has been in business and the maturity of the software proposed.
- **MKT** – The market position of the vendor and the acceptance of the vendor's software by other users. This is indicative of the usability and reliability of the software.

System Scalability (SCA)

Scalability is important for the long term success of the system. As multiple projects get added to the database, and as users increase on the system, it must be determined how the system will react. Will performance (speed) decrease with the increased workload? Will additional hardware need to be purchased to maintain system speed and stability? What is the maximum number of users that can access the system at the same time? All are relevant questions in understanding the durability and scalability of the new

solution? The sub-goals under this area are:

- **MUR** – The ability of the software system to accept multiple users as the requirements grow.
- **MSP** – The ability of the software system to maintain its operational speed as use grows.

Hardware Requirements (HDW)

As part of the decision process, it is important to include the hardware requirements needed in order to implement the desired solution. There could be a drastic difference in capital needed to implement various solutions. Workstation and server hardware, as well as the Operating System required to support the application need to be identified and priced. In addition, network capability may be needed or expanded to support remote users if that is desired. The evaluated sub-goals are:

- **RMA** – The degree to which the system allows remote access and the hardware and other systems required for its implementation.
- **MNT** – The ease of maintenance of the system and its ability to fit in with the existing IT system operating infrastructure.

Ease of Use for IT Personnel (EOU)

An additional aspect included in the decision making process, is an estimation of the difficulty of adapting to the new software. If there is a long ramp-up time to learn the new software, this could delay the anticipated efficiency that may have been expected when moving to the new application. Any training costs, could be included in weighing this aspect. The two sub-goals are:

- **CUS** – The ease with which the software can be customized to meet the users' unique requirements
- **REW** – The ease with which the software can be adapted to handle output reporting requirements.