The high cost and long lead times of acquiring specialized document processing equipment in the Consumer Financial Services Division of American Express demonstrated the need for a Capacity Planning System. The system was designed to aid management in anticipating changes in demand for capacity and in planning for additional needs before they arise. Forecasts of future patterns of equipment utilization have been developed by combining:

- knowledge of historical trends,
- forecasts of basic business indicators, and
- notices of planned changes in operations.

**INTRODUCTION**

As the costs associated with labor and capital have escalated, management has become increasingly sensitive to the need for capacity planning. The common objective of capacity planners is the determination of the quantity, configuration, cost, and timing of adding or changing existing capacity conditions. The benefits of capacity planning are:

1. the ability to understand the impact of capacity utilization levels on service levels,
2. the ability to knowledgeably minimize the effects of uncertainty on capacity needs, and
3. the ability to anticipate and efficiently allocate labor and capital resources.

Applications of capacity planning are found throughout business and government organizations. Examples of such applications include rearranging a communications network, adding additional machinery, replacing existing equipment, and expanding current office space. Regardless of the size of the project, the efficient commitment of the capital required depends on making informed decisions relevant to management needs and priorities.

**BACKGROUND**

At American Express, the processing of charge card receipts is highly labor and capital intensive. A major portion of the work is executed by Optical Character Recognition (OCR) equipment. The OCR equipment optically reads information from the charge slips as they are passed through the machine. Through a subsequent series of passes, the slips are sorted into a predetermined order.

The equipment is very costly and must be ordered from the supplier at least nine months before it is needed. The addition of capacity resembles a stepwise function whereas the growth in document volumes is relatively smooth. Therefore, it is essential to accurately estimate when additional equipment is needed to avoid costly overcapacity or poor service conditions.

**METHODOLOGY**

The approach used at American Express to examine capacity requirements for OCR equipment is a five-step process (Exhibit I):

1. study historical performance levels,
2. forecast future volumes to be processed,
3. identify planned operational changes,
4. forecast equipment utilization levels, and
5. perform "What-If" sensitivity analyses.

1. **Historical Performance Levels**

Data on historical performance is collected manually since an automated method is not currently available. The key data elements are:

- number of documents,
- number of documents processed,
- number of hours used, and
- available hours.

From these four elements, historical profiles of the following basic performance indicators are derived:

- number of passes per document,
- number of passes per hour, and
- utilization of available hours.

These indicators vary with labor and capital productivity levels.

2. **Future Volume Forecasts**

Forecasts of the number of documents to be processed in the future are prepared based on basic business indicators. Combining these forecasts with forecasted levels of the performance indicators and expected capacity levels yields a forecast of the total number of hours required to process the expected number of documents.

3. **Planned Operational Changes**

Information relevant to any changes planned for document processing is collected. Such changes may include a change in the physical process, a change in the scheduling of labor resources, or an external change that may affect internal document processing. Modifications are made to the model to simulate the effects of any such changes on total required processing time.

4. **Equipment Utilization Forecasts**

Utilization levels can then be forecasted using
the information collected in the first three phases of analysis. An examination of the impact of utilization on associated levels is then made to determine when additional equipment will be needed.

5. "What-If" Sensitivity Analyses

Additional analyses are then performed by varying the initial input assumptions to gain a measure of the sensitivity of the capacity requirements to these assumptions. This process enables management to fully understand the impact of changes in the operation on capacity needs. In addition, the effects of uncertainty on capacity needs can be anticipated and minimized.

CONCLUSION

Upon completion of the five-phase capacity planning approach, management is presented with final capacity recommendations. In addition to considering historical performance and forecasted processing volumes, the recommendations reflect expected operational changes and service versus utilization level tradeoffs.

This approach can be easily adapted for use in other types of capacity planning.
EXHIBIT I
5-STEP CAPACITY PLANNING FLOW

1. STUDY HISTORICAL PERFORMANCE LEVELS
   - HISTORICAL DATA
     - TREND ANALYSIS

2. FORECAST FUTURE VOLUMES
   - FORECAST PERFORMANCE RATES
     - FORECAST VOLUMES
     - PLANNED CHANGES

3. IDENTIFY PLANNED OPERATIONAL CHANGES
   - MODIFY MODEL
     - PLANNED CHANGES

4. FORECAST EQUIPMENT UTILIZATION
   - TRADEOFF UTILIZATION V. SERVICE
     - SERVICE LEVEL

5. PERFORM "WHAT-IF" ANALYSES
   - MEASURE SENSITIVITY
     - RECOMMENDATIONS

SAS PROCEDURES
- MEANS
- PLOT
- CHART
- GLM
- PRINT
- GLM
- PLOT

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