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Benefits of Using Independently Updated Views In Databases for Decision Making

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Introduction

The purpose of this research is to determine the benefits of using independently updated views (IUVs) in databases for decision making. IUVs were introduced as a tool for storing and accessing derived data in relational databases (Kulkarni and Ramirez, 1997; Ramirez et al., 1992, 1996). This research proposes to use a field study to validate the perceived advantages associated with IUVs mentioned in the prior research.

IUVs are a tool that can be used to support decision making. As an example, consider a decision task such as budgeting. Budgeting decisions may include determining sales units and revenues for multiple departments and estimating revenues and costs for different product lines. Such decisions often require the decision-maker to create and evaluate multiple scenarios. Moreover, these budget scenarios very often require some form of derived data (e.g. totals, averages, joins of multiple tables). In this process, multiple copies of large amounts of data with only a few differences must be physically maintained. Also, manipulating such data, keeping track of multiple versions, and maintaining consistency between the various scenarios is a major task.

IUVs aid in accessing and storing the forms of derived data used for decisions such as budgeting and planning as mentioned above. The features of IUVs that are relevant and desirable for decision making in general are summarized as follows (Ramirez et al., 1996).

1. IUVs offer derivation transparency. Data may be treated identically regardless of whether it is derived or not. In addition, derived data may be updated.
2. IUVs support multiple versions. Versions are explicitly defined and no duplication of data is necessary.
3. IUVs maintain database consistency. For versions defined on updateable databases, it is possible to detect the updates that would contradict the data in a version and process those according to predefined policies.
4. IUVs allow control over derivation. The user can specify whether derived data is stored or recomputed when needed.

Base Table		Base Table
B1		B2
Base Table	Base Table	Differential Table
B3	Bn	(DT)
Parent Table (PT)		IUV
(Base Table, View or IUV)		(PT + DT)

Figure 1 - IUV Formation				
Parent Table INV				
Inv_no	Prod_name	Cost	Quantity	
P1	Widget 1	200	5	
P2	Widget 2	350	8	
P3	Widget 3	175	1	
Differential Table DIFF-INV				
Inv_no	Prod_name	Cost	Quantity	ACTION
P1	Widget 1	210	5	mod
P2				del
P4	Widget 4	400	10	ins
IUV INV-LEVEL				
Inv_no	Prod_name	Cost	Quantity	
P1	Widget 1	210	5	
P3	Widget 3	175	1	
P4	Widget 4	400	10	
Figure 2 - A Sample IUV				

Definition and Example

IUVs are virtual relations created in a relational database by query manipulation. They differ from traditional database views in that they can be changed without affecting the underlying database; the changes are stored in physical tables called differential tables. Figure 1 shows relationships among different tables involved in the formation of an IUV. An IUV is formed by making changes to a table called the parent table (PT) of the IUV. These changes are stored in a differential table (DT) and do not physically modify the PT or the base tables; they are only used to form the IUV. Conceptually, retrieving its PT and incorporating into it the changes stored in the DT forms an IUV. PT could be a base table, a view, or another IUV. For a complete discussion of the structure of IUVs and their update and retrieval mechanisms, please refer to Kulkarni and Ramirez, 1997 and Ramirez et al., 1996.

IUVs are specifically designed for storage and manipulation of derived data. Derived data is data that is derived from base tables, e.g. balances, sums, averages, totals, data obtained from more than one tables, etc. Most managerial decisions require manipulation of derived data.

Figure 2 shows a sample IUV *INV-LEVEL* based on PT *INV* and DT *DIFF-INV*. The IUV is obtained by outer-joining the PT and DT on the primary key *Inv_no*. The rows in PT that have a matching row in DT are changed / deleted (as per the ACTION code *mod* / *del*). See rows pertaining to *Inv_no* P1 and P2. Non-matching rows in DT (ACTION = *ins*) are inserted into the IUV (*Inv_no* P4). Rows in PT that have no matching rows in DT are incorporated in the IUV without change (*Inv_no* P3).

Problem Statement

This research will determine the benefits to managers of using IUVs in a database to support budgeting decisions. Since traditional views are the only other generalized way of representing derived data, this research compares IUVs with traditional views in supporting budgeting decisions. There are commercial tools for extracting information from databases made for specific types of decision making. Our research does not compare IUVs to such special purpose tools.

The first budgeting decision in our field study is determining sales units and revenues for multiple departments. This decision involves changing the levels of sales units and average selling prices in individual departmental budgets according to certain criteria. The budgeting manager may create different combinations of units and selling prices and save them as scenarios or versions of an original budget. The decision may also involve combining or aggregating the different department budgets into a company-wide budget. As with the departmental budgets, changes in units and selling prices may also be made at this level of aggregation.

The second budgeting decision is estimating revenues and costs for different product lines. This decision involves changing the levels of revenues and costs in product budgets again, according to specific criteria. As in the first example, the different combinations of revenues and costs can be saved as scenarios or versions of an original budget. The decision may also involve combining or aggregating the affects of the product changes into departmental views. Once again, changes in revenues and costs can also be made at this level of aggregation.

This research will determine both quantitative and qualitative benefits of using IUVs. Quantitative benefits are important for any successful information system project. However, the literature points out (Keen 1981) that qualitative benefits are of central importance to the evaluation of decision support systems. Several frameworks have been proposed for measuring and assessing both qualitative and quantitative benefits of using decision support systems (Money et al., 1988; Udo and Davis, 1992). Our research will be based on these frameworks.

Along with specific benefits relating to the features of IUVs, our research will also measure some more general benefits of using IUVs. The following discussion presents some of the benefits of using decision support systems as described in the literature. These benefits will be among those measured in our research.

Twelve benefits of decision support systems were proposed by Keen in 1981. These include (1) an increase in the number of alternatives examined, (2) a better understanding of the business, (3) a faster response to unexpected situations, (4) the ability to carry out ad hoc analysis, (5) new insights and learning, (6) improved communication, (7) control, (8) cost savings, (9) better decisions, (10) more effective teamwork, (11) time savings, and (12) making better use of the data resource.

More recently, Udo and Davis, 1992, identified four tangible and four intangible benefits associated with using decision support systems. The tangible benefits include (1) production cost reductions, (2) timesavings, (3) increased productivity, and (4) overall cost effectiveness. The intangible benefits include (1) decision quality, (2) competitive edge, (3) overall satisfaction, and (4) improved communication.

Research Methodology

The methodology used in this research involves a pilot study using a number of observations and subjects. It then involves a lab experiment in a field setting. Managers from a real company will perform a controlled exercise. A survey instrument will be used to obtain data on the general and specific benefits of using IUVs. The four phases of the methodology are as follows.

Phase I - Data Gathering (completed). Phase I of the methodology included an initial company interview. There were two purposes of the semi-structured interview. First, the interview was used as a means to introduce the experiment to the participating managers. Second, the interview was used to discuss the company's budgeting process. A follow-up to this interview was made in order to obtain several reports used in the company's budgeting process.

Phase II - Experiment Design (current phase). This phase includes preparing a computerized budget program, preparing case exercises, and testing the experiment. The computerized budget tool uses Microsoft Access and Visual Basic. Microsoft Access was chosen as the database software because it can easily and adequately simulate a portion of the company's database. The simulated database will contain

attributes similar to those the managers use in their work. Microsoft Visual Basic provides a means for the managers to manipulate the database without having previous programming knowledge.

The case exercises will contain written descriptions about the budgeting decisions the managers are to perform using the program. These decisions will be similar to those mentioned earlier. In addition, a sample case, unrelated to budgeting, will be created to help the managers learn the software. The experiment will be then be tested for clarity and understanding in a pilot study.

Phase III - Survey Instrument Design. The survey questions will be directed to determine the perceived benefits of using IUVs in budgeting decisions. In order to achieve this, the questions will be structured to relate to the various features of IUVs and to provide answers that indicate if the feature is actually a benefit. The following are some of the specific features that will be tested, along with a sample high-level question. The high-level questions will be broken down into multiple, easy-to-read, questions in the survey instrument.

1. *Feature* - Differences in scenario are easier to obtain. *Question* - "When your supervisor asked you what the differences were between the "Optimistic" and "Very Optimistic" scenarios, how long did it take you to come up with this information and what steps did you take to get it?"
2. *Feature* - Updates to base tables are easier to incorporate into scenarios. *Question* - "When you were informed that costs in the master budget had changed, how did you incorporate these changes?"
3. *Feature* - Views built on summarized data are easier to create and manipulate. *Question* - "In the revenue targeting module, did you notice any differences in performance of the software?"
4. *Feature* - More time is spent on decision making than data manipulation. *Question* - Did you feel that an appropriate amount of your time in this exercise was spent on the actual decision process?"

In addition to these questions, a series of more structured questions will also be asked relating to general benefits of decision support systems.

Phase IV - Experiment and Result Analysis. The budgeting managers will first run through a non-budget task in order to learn the general nature of the software. The managers will then perform the case exercises at least twice, using the programs made with and without IUVs. This will result in each manager performing 4 sets of cases. The managers will each perform the case exercises, in varying orders. During the case exercises, the managers will complete the survey instrument. There will be explicit instructions in the survey instrument on when to fill in the answers and when to proceed with the case. The more general decision support system related questions will be asked when all the case exercises have been completed.

The findings of this research will include a summary of the managers' responses. This summary will present an analysis of both the quantitative and qualitative benefits of using IUVs. The survey responses will be categorized into the general and specific benefits of using IUVs in the budgeting decision.

Conclusion

We shall present both our findings and conclusions on the benefits of using IUVs in databases for decision making at the Association for Information Systems 1997 Americas Conference held on August 15-17, 1997.

Selected References

1. Keen, P.G.W. "Value-analysis: Justifying Decision Support Systems," *MIS Quarterly*, March 1981, pp. 1-15.

2. Kulkarni, U.R., and R.G. Ramirez. "Independently Updated Views," *Forthcoming in IEEE Transactions in Knowledge and Data Engineering*.

3. Money, A., Tromp, D., and T. Wegner. "The Quantification of Decision Support Benefits Within the Context of Value Analysis," *MIS Quarterly*, June 1988, pp. 223-236.

4. Ramirez, R.G., Kulkarni, U.R., and K.A. Moser. "Performance Analysis of What-If Databases Using Independently Updated Views," *Journal of Management Information Systems*, Summer 1992, pp. 185-203.

5. Ramirez, R.G., Kulkarni, U.R., and K.A. Moser. "Derived Data for Decision Support Systems," *Decision Support Systems*, May 1996, pp. 119-140.

6. Udo. G.J., and J.S. Davis. "Factors Affecting Decision Support System Benefits," *Information and Management*, 1992, pp. 359-371.

Other references are available from Nancy K. Gustafson upon request.