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Privatizing Military Housing Through Information Technology

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EXECUTIVE SUMMARY

The armed services must provide its personnel with acceptable housing at minimum cost within the vicinity of military installations. To achieve these housing objectives, the Department of Defense (DOD) has entered into experimental joint ventures with private developers to construct attractive housing projects on military installation property, with some of the projects reserved for military personnel. To support the analysis of the joint ventures, the DOD needed a methodology that would help officials evaluate the feasibility and cost implications of the housing projects. A decision support system, called the Housing Revitalization Support Office System (HRSOS), has been developed to provide the necessary support.

The HRSOS architecture is based on a combination of database, econometric, simulation, and decision support techniques. Its deployment can help the Department of Defense to realize significant economic and management benefits. Future enhancements, motivated by the challenges from the current system, promise to increase the power of HRSOS and to further improve the DOD's ability to manage its housing projects.

To obtain the benefits, the HRSO experience suggests that system design, development, and implementation should be a team effort through an adaptive design strategy. It also indicates that an integrated suite of software development and implementation tools, offering rapid prototyping, computer assisted software engineering, and object-oriented analysis, can promote this strategy. The strategy is likely to work well in a hybrid project-technology virtual organizational form that is established and administered by the practicing top manager.

BACKGROUND

The United States Department of Defense (DOD) consists of the armed forces (mainly the Air Force, Army, Marines, and Navy) and several support offices (most notably the Inspector General, which serves as the major fiscal oversight group for the DOD). Technically, the President of the United States is the head of the DOD. In effect, however, a political appointee, the Secretary of Defense, is the DOD's chief operating officer. There are several deputies, and many department chiefs, who assist the Secretary in performing her/his responsibility.

The main roles of the DOD are to provide a national defense, enforce foreign policy, promote national interests, and support U. S. allies. A force in excess of 2 million civilian and military employees implements strategies, policies, and procedures that fulfill these roles. Such implemen-

tation requires the establishment and maintenance of hundreds of military installations throughout the United States, Europe, Asia, and other places in the world. For security and other practical reasons, personnel (and often their families) must be acceptably housed on, or near, the installations. The Department of Defense (DOD) wants this acceptable housing to be within a one-hour commute of the military installations.

Historically, the thousands of needed housing units have been acquired, maintained, and managed through the Department of Defense with government funds. The process has become quite expensive, and military personnel and officials have not always been satisfied with the resulting accommodations. To improve the situation, the DOD recently has sought remedies from the U. S. Congress. In response, Congress passed the Military Housing Act of 1995, providing the DOD with a series of desired authorizations.

In search of improved efficiency and effectiveness, public officials have proposed and experimented with the privatization of local, state, and federal government services (Chi, 1998; Brunsdon and Crossmit, 1998; Kotlikoff, Smetters, and Walliser, 1998). Governments have contracted with private organizations to collect garbage, house prisoners, build structures, and perform other essential services (Boubakari and Cossert, 1998; Helsley and Strange, 1998; Haarmeyer and Moody, 1998). Successful privatization efforts influenced the U. S. Congress to include such an initiative in the 1995 Military Housing Act.

Partially because of government budget cutting, there has been significant movement within the armed services to privatize military housing. Top-level policy makers realize that all the services can benefit from privatization initiatives. Using the 1995 Act as authority, the DOD established an agency, called the Housing Revitalization Support Office (HRSO), to develop innovative initiatives that would help achieve the housing objective. This office has a Director, four deputy directors, and a support staff of three technical specialists, one secretary, and eight armed service representatives at its suburban Washington, D. C. headquarters. There are no true IS/IT personnel in the office.

For the past five years, HRSO's management group has planned housing initiatives, developed procedures to implement the plans, and then communicated the procedures to the housing managers at each military installation. Such policies, procedures, and actions are audited by Department of Defense, Government Accounting Office, Office of Management and Budget, and other government agencies for compliance with existing laws, regulations, and guidelines. Since audit reports can significantly influence available funding, HRSO typically is very responsive to auditor suggestions on housing initiative policy and practice.

Installation housing managers collect data pertinent to the planning process, communicate the data through various information systems to the HRSO, implement HRSO-developed procedures, and administer onpost assets. Traditionally, these installation managers have been given much discretion in exercising their responsibilities. Moreover, the HRSO has relied heavily on installation managers' input in formulating housing initiative policies, procedures, and practices.

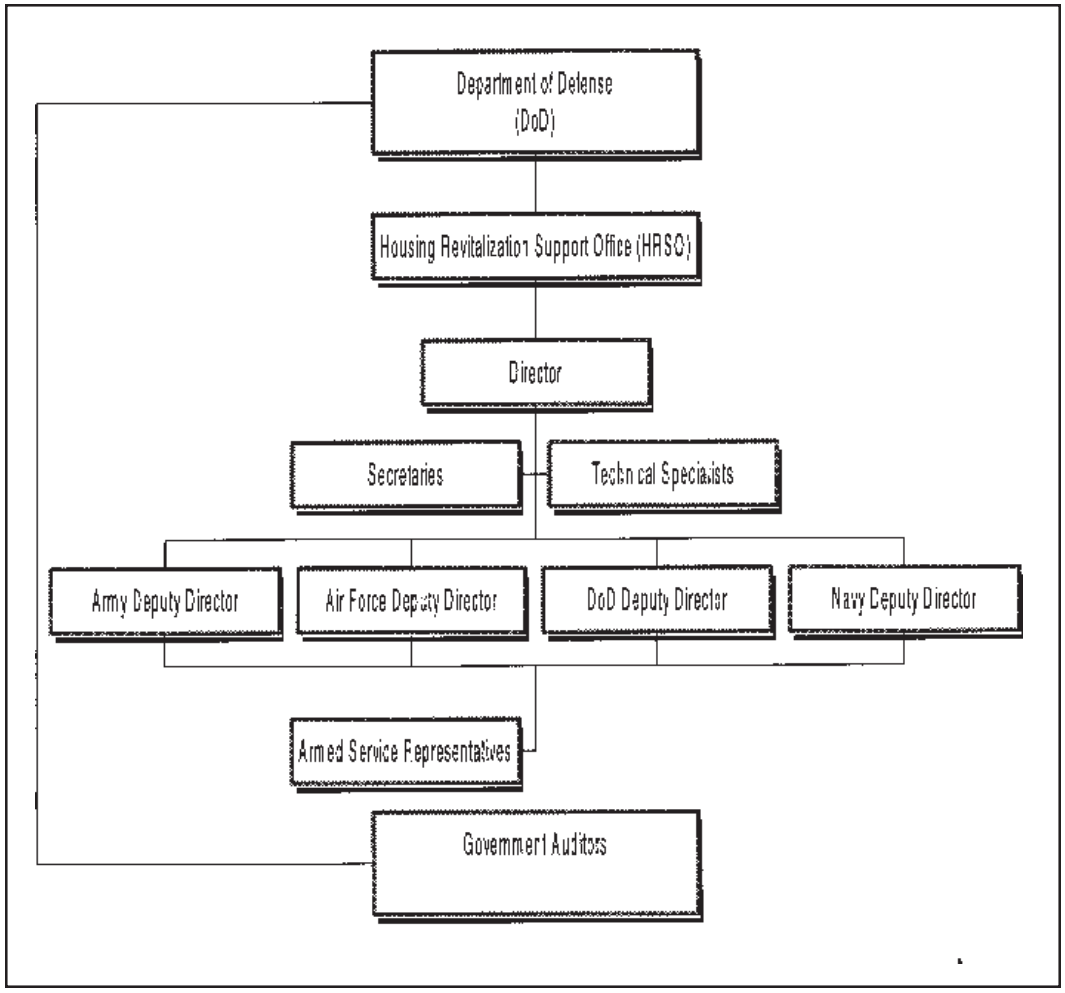
Figure 1 gives the organizational chart relevant to HRSO housing initiative management. Currently, managers in this organization influence decisions about approximately $30 billion worth of onpost housing assets. HRSO has an annual budget of about $7 million, and a long-term allocation of approximately $10 billion to design, develop, and implement housing projects that would affect these assets.

As Figure 1 indicates, the HRSO organization is largely hierarchical in nature. For the most part, major decisions are made by the Director, with considerable input from the deputies, service representatives, and installation managers. Such input is sought after and valued by the Director. Supporting analyses are implemented and managed by the deputies and service representatives. Some, but not all, of these deputies and representatives are IS/IT literate, but none are IS/IT experts.

SETTING THE STAGE

At any military installation, the projected supply of available government housing may be insufficient, or of inadequate quality, to meet the personnel demand expected at the site. To reduce,

Figure 1: Housing Revitalization Support Office (HRSO) Organizational Chart



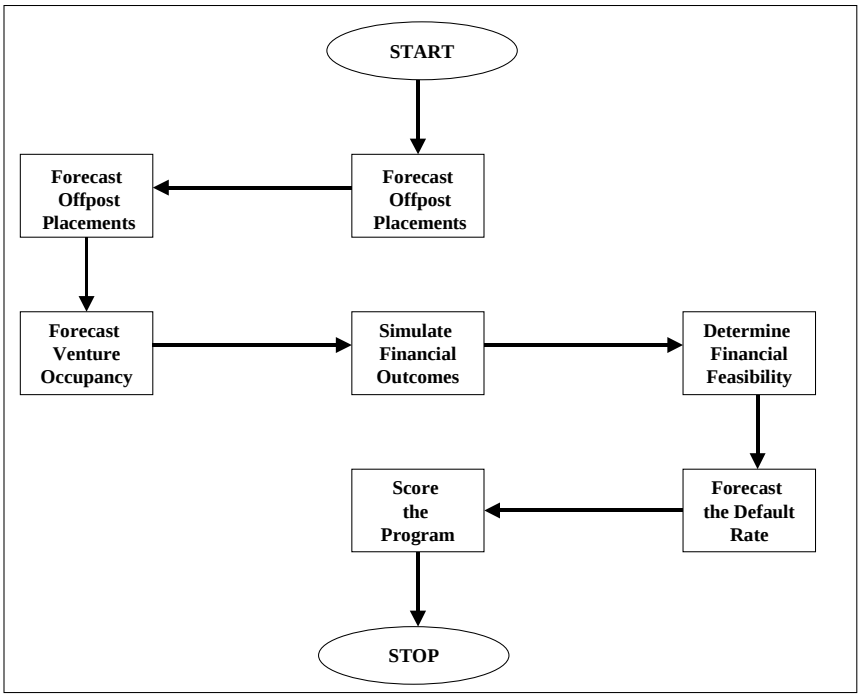
or possibly eliminate, this deficit, the DOD's Housing Revitalization Support Office (HRSO) has developed experimental programs for revitalizing the stock of military housing by attracting private capital investment. In these programs, private developers construct attractive housing projects on military installation property, and the federal government provides subsidies, loan guarantees, or other financial commitments to the developers.

The Federal Credit Reform Act of 1990 established a system of budgeting that requires agencies to: (a) measure a program's total cost and (b) set aside budget authority sufficient to cover the commitment. Furthermore, the Manual on the Federal Budget Process and the Office of Management and Budget (OMB) Scoring Model establish procedures and processes to measure the dollar amount to be set aside. As a result, any HRSO program must be supported by detailed and systematic analyses of the joint venture's financial feasibility and potential credit impact on the federal government. Such analyses involve the process shown in Figure 2.

Venture Capital Analysis

Any venture capital analysis begins with a forecast of the number of military personnel renting or owning offpost. Next, HRSO officials forecast the number of military personnel that ordinarily will be placed in onpost government-owned housing. These two forecasts become the basis for predicting the number of personnel expected to rent newly constructed or renovated onpost housing after the implementation of the venture project.

Figure 2: HRSO Venture Capital Analysis Process



Multiplying the expected rentals by the soldiers' housing allowances gives the revenue generated from the venture. This revenue less the corresponding operating and management cost provides the annual cash flow yielded by the program. Using these flows over the housing's life, officials can simulate the internal rate of return and net present value from the investment. Such financial outcomes then determine whether or not the project is financially feasible.

Once financial feasibility has been established, HRSO must forecast the likelihood of default (the default rate) by the private developer of the onpost housing project. This default rate, in turn, will be entered into the OMB scoring model for potential credit impact on the federal government. Scoring seeks to ensure that the actual and expected costs associated with the use of each program are fully recognized in both budget and financial reporting. Every potential DOD housing revitalization program must be "scored" by the OMB model.

Process Support

The Statement of Federal Financial Accounting Standards (SFFAS) No. 2 requires the establishment of a systematic methodology, such as econometric modeling, to project default costs of each housing revitalization program. The methodology should create an audible procedure that: (a) formalizes and documents the subsidy authority performance and assumptions, and (b) defines the key relationships between the program performance, economic and other private and military housing indicators.

The HRSO has neither the staff, nor the internal technical expertise, to fully comply with the SFFAS, Federal Credit Reform Act, Manual on the Federal Budget Process, and OMB Scoring Model analysis requirements. Consequently, officials have relied on large consulting firms to support the venture capital analysis. These firms have assigned knowledgeable domain experts to collect the necessary data, generate projections, and convert the projections into financial reports and OMB scores. Such support is offered on a fee-for-service basis.

Data are collected from military information-system-generated status reports and through interviews with HRSO personnel and military installation housing managers. Projections are generated by simple extrapolation of current parameter values. Financial outcomes are simulated

with a spreadsheet-based model that replicates defined relationships between expected rentals, cash flows, project investments, and returns. The project's default rate is estimated mainly through the collective opinion of the domain experts. A score is obtained by substituting the estimated default rate and other forecasted parameters into the OMB scoring model.

As part of the fee-for-service contract, the consulting firms provide the software, maintenance, and technical help needed to capture and store the collected data, project parameters, simulate financial outcomes, and generate reports. As in many organizations, then, virtually all of the IS/IT requirements are outsourced to these firms (Sridhar and Balachandran, 1997). All IS/IT tasks are initiated and managed by the consultants, with some oversight by HRSO deputies and service representatives.

Support Deficiencies

The consultant-based support is labor intensive, time consuming, and costly. Typically, a variety of senior HRSO officials, military housing officers, and private consultants take many weeks to gather the pertinent data, forecast parameters, perform the spreadsheet-based financial analyses, and report and document the venture capital analysis. During the process, the agency spends approximately $60,000 per installation in consulting fees.

There are also conceptual flaws in the consultant-based support. The extrapolation forecast assumes that current patterns will persist, and the methodology offers no explanation for the underlying pattern. In addition, the spreadsheet simulation is based on restrictive subjectively determined assumptions and an averaging process that may be unrepresentative of actual housing and financial conditions. These flaws make it difficult to provide the objectively based evaluations desired by government regulators, and they could result in erroneous project decisions.

CASE DESCRIPTION

The conceptual flaws, high cost, and potential adverse project consequences encouraged HRSO officials to investigate alternative forms of support for the venture capital analysis. Campaigning by a visionary service representative at HRSO funded an external study that researched the use of internal IS/IT tools for such analysis. This research has resulted in the development of improved forecasting and simulation models and the ***Housing Revitalization Support Office Systems (HRSOS)*** decision support system for delivering the consequent knowledge in a timely, cost effective, and transparent manner to affected officials.

HRSOS Architecture

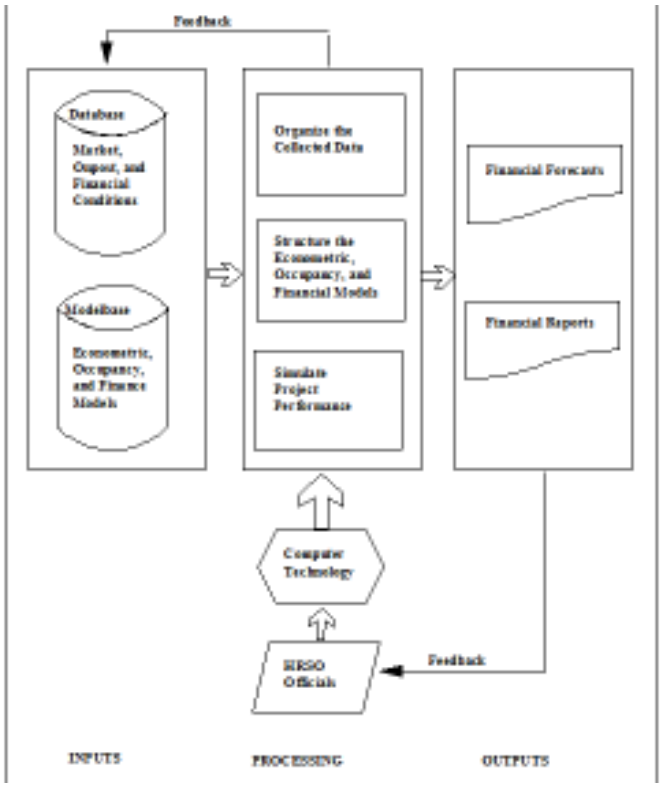
HRSOS was developed iteratively, using the Adaptive Design Strategy (ADS), by two university researchers working in conjunction with HRSO officials, OMB support staff, and the consultants. During the development, the researchers, usually in a collective manner, reviewed the latest roll out with the participating officials. Comments and suggestions for enhancements were tested and evaluated in real time, typically in prototype form using rapid application development (RAD) toolkits available within the development software. Detailed technical changes were made by the researchers over a relatively short period of time (typically a few weeks), and the system changes were presented to the officials for review and evaluation. The evolutionary process continued until the latest version of the system was finalized. The entire process took about six months.

The system is made available through an easy-to-use computer system with the conceptual architecture shown in Figure 3. As this figure shows, the decision support system interactively processes inputs into the outputs desired by HRSO officials.

Inputs

HRSOS has a data base that captures and stores economic variables and housing characteristics for the military installations' Housing Market Areas (HMAs), relevant onpost data, and pertinent financial conditions. Economic variables (such as the poverty rate and average population age) and housing characteristics (such as average rents and housing stocks) are collected from the U.S. Census.

Figure 3: HRSOs Conceptual Architecture



The onpost data (such as installation populations and military housing allowances) are extracted from other military information systems. Financial conditions (such as borrower characteristics and the effective interest rate) are obtained from: (1) the U. S. Department of Housing and Urban Development's (HUD's) Consolidated Single Family Default Monitoring System and (2) FHA Trends of Home Mortgage Characteristics for Section 203(b) Mortgages Insured. Economic theory, officials' judgment, previous HRSO analyses, and preliminary statistical analyses suggested the data to capture and store.

There is also a model base that contains statistical procedures, data conversion, econometric, occupancy, and finance models. The statistical procedures are used to categorize attribute data within the HMAs and to calculate summary statistics for the economic variables, housing characteristics, and financial conditions within the HMAs. Data conversion formulas are used to convert the captured economic, housing characteristic, financial condition, and military data into the variables needed for HRSOS's analyses, evaluations, and reports.

One econometric model forecasts the number of military personnel renting or owning offpost. The offpost forecasts become inputs into an occupancy model that predicts the number of military personnel that can be expected to rent newly constructed or renovated onpost assets after the venture project has been implemented. A simulation model transforms the onpost rental projections into financial outcomes. These outcomes, which include the cash flows, internal rate of return, and net present value from the venture project, predict the financial feasibility of the housing project. A second econometric model predicts the default rate that can be expected from the program (housing revitalization tool) used to finance the venture project. A score is obtained by substituting the estimated default rate into the OMB scoring model.

Processing

The decision maker (a HRSO official or staff assistant) uses computer technology to perform the financial analyses and evaluations. Currently, the system executes on an IBM-compatible

Pentium-based microcomputer with 16MB of RAM, a color graphics display, and a printer compatible with the microcomputer. It runs the SAS information delivery system through the OS/2 (or Microsoft Windows) operating system. Computer assisted software engineering was implemented through SAS/BASE, SAS/ETS, SAS/ASSIST, SAS/AF, and SAS/FSP, while object-oriented analysis (OOA) concepts were supported through SAS/FRAME. This configuration was selected because it offered a more consistent, less time-consuming, less costly, and more flexible development and implementation environment than the available alternatives.

Acting as an electronic counselor, the decision support system sequentially guides the user through an effective financial analysis and evaluation. The system delivers pertinent expertise by: (a) including audit-supportable economic analyses, (b) automating the complex financial computations, and (c) generating policy-specified detailed supporting reports. System operations, which are performed in an intuitive, timely (typical five-minute-session), and error-free fashion, liberate the user to focus on the creative aspects of venture capital management.

As indicated by the top feedback loop in Figure 3, organized data, structured econometric, occupancy, and financial models, and performance reports created during HRSOS' analyses and evaluations can be captured and stored as inputs for future processing. These captured inputs are stored as additional or revised fields and records, thereby updating the data and model bases dynamically (Wijnhoven, 1998).

Outputs

Processing automatically generates visual displays of the outputs desired by HRSO officials. Outputs include return and default rate forecasts and financial reports that provide the justified knowledge and wisdom needed to effectively plan venture capital projects. These reports are in the form of tables that display forecasted net present values, internal rates of return, and default rates for various HRSO program (mainly direct loan and loan guarantee) initiatives. The user has the option of printing or saving the reports.

As indicated by the bottom feedback loop in Figure 3, the user can utilize the outputs to guide further HRSOS processing before exiting the system (Tuttle and Stocks, 1997). Typically, the feedback will involve sensitivity analyses in which the user modifies market conditions, program initiative parameters, financial terms, or other pertinent factors and observes the effects on financial outcomes.

CURRENT CHALLENGES/PROBLEMS FACING THE ORGANIZATION

Scientific testing revealed that HRSOS' models generated accurate forecasts of market conditions, housing requirements, and financial outcomes. Based on the test results, the Housing Revitalization Support Office decided to examine the potential value of HRSOS. The system has been in an evaluation phase for the past nine months. Preliminary results from this ongoing evaluation indicate that the decision support system will have significant economic and management benefits, present key challenges, and offer important lessons for the Housing Revitalization Support Office.

Successes and Failures

By utilizing the decision support system, HRSO officials can rapidly: (a) obtain accurate, consistent, objective, and reliable housing data, (b) analyze the local housing market and its impact on military housing, (c) perform error-free financial feasibility and default rate computations and evaluations, (d) justify the analysis with detailed reports, (e) examine the sensitivity of the analysis to local market and privatized housing policy changes, and (f) flag data and information deficiencies. These enhanced capabilities can enable HRSO officials to more efficiently and effectively manage the revitalization programs under their control. The gain in efficiency and effectiveness can save the DOD a total of

$30,000 per site x 60 sites = $1,800,000

The decision support system was developed and implemented for about $60,000. These cost savings are quite timely in light of federal budget restrictions and the military's current direction of large scale

force reductions and base closures (Chu, 1996).

Despite these economic and management benefits, the HRSO still is evaluating the system. During this evaluation, the decision support system serves mainly as a backup to the consultant-based methodology. Such reticence can be traced to organizational inertia, internal politics, and the system's profound challenges to the organization's culture and climate (Ione, 1997; Tolsby, 1998).

Limitations and Challenges

During implementation, system experimentation educated users about the devastating consequences of inaccurate housing projections, while the development demonstrated the irrelevance and redundancy of much pre-innovation collected data. When implemented fully, the innovation will alter the work design for, and supervision of, the venture capital analysis process. Requisite operations and computations will be simplified, automated, and made error-free. Training requirements will be reduced to a minimum. Processing efficiency will be dramatically increased. User-inspired creative market-area and housing policy experimentation will be facilitated and nurtured. Management learning will be promoted. Knowledge capture will be expedited.

In short, HRSOS's usage would substantially reshape the organizational culture. Faced with significant time pressures and limited staff, HRSO leadership may be reluctant to take on this burden at the present time. In addition, officials have developed and cultivated strong and enduring relationships with the consultants. These consultants also have important contacts and allies within the government agencies that oversee HRSO programs. For these reasons, it may be politically wise for HRSO to preserve these consultant relationships.

There is a final data challenge. At the present time, there is limited data available to measure the default rate for HRSOS's second econometric model. These data limitations precluded a meticulous application of theoretical financial models and, as in the consultant-based analysis, resulted in potentially underestimated default rates for some military installations. If the politics can be worked out, the requisite data can be obtained from other government agencies, thereby eliminating this shortcoming.

System Lessons

Improved accuracy in forecasting housing privatization requirements is important to the military and society. Underestimating requirements can alienate civilian populations competing with military personnel for housing, leave thousands of military personnel inadequately housed, lower personnel morale and family well-being, and jeopardize military preparedness. Unnecessary housing construction and renovation can waste scarce natural resources and, in the process, alienate local residents, environmentalists, military housing managers, and other interest groups.

The potential of HRSOS may convince the DOD that the privatization initiatives can be substantially enhanced with decision support systems. Consequently, the HRSOS-supported venture capital analysis can be offered as the standard for the process. With adaptations, the HRSO's decision support system may also be applicable to potential privatization efforts of other federal, state, and local public housing authorities (You, 1998).

Regardless of HRSOS' legacy, the application offers useful lessons for decision support systems development and management. These lessons involve team composition, development tools, and organizational issues.

Team Composition. The HRSOS decision support system is effectively delivering to the user, in a virtual manner, embedded econometric, management science, finance, housing, and information systems expertise specifically focused on the management problem. Any single human technical specialist typically will not: (a) be proficient with, or even aware of, all pertinent tools, or (b) possess sufficient domain knowledge to fully understand the management situation, propose trials, or interpret outcomes (King, 1998). While practicing managers will have the domain knowledge, they usually will not have the technical expertise to effectively develop and implement relevant technology (Osterlund, 1997).

The HRSO experience suggests that decision support system design, development, and implementation should be a team effort. In addition, the team should be composed of the affected

managers, information system personnel, and technological specialists proficient with the tools needed to address the management problem. When the personnel have decision support system education and training, the team may consist of relatively few people. For example, the HRSO needed a team of only four people. There were two top HRSO officials (who participated on a sporadic basis), one decision support system professor (with technical expertise in various information systems, econometrics, and management science), and a finance professor (with technical expertise in housing analysis).

Development Tools. The HRSO experience suggests that decision support system design, development, and implementation should be a team effort executed through an adaptive design strategy. It also indicates that an integrated suite of software development and implementation tools, offering rapid prototyping, computer assisted software engineering, and object-oriented analysis, can promote this strategy (McGibbon, 1997). While the SAS System for Information Delivery offers one such suite, there are others available (such as the FOCUS toolkit offered by Information Builders).

Organization Issues. Forecasting by top managers for planning purposes is inherently a semi-structured (or even ill structured) problem. When initially confronted with such situations, these managers have a partial understanding of the problem elements and relationships. Typically, their understanding evolves as they acquire more information, knowledge, and wisdom about the problem (Eardley, Avison, and Powell, 1997). Decision support systems are designed to support such decision-making. Relying on the information center, or other traditional information system organization, to design and develop a decision support system will likely be ineffective (AlBanna and Osterhaus, 1998). These types of organizations are staffed by personnel with general skills, limited technological expertise, and restricted problem-specific knowledge. Development and implementation will follow a prescribed pattern designed to provide standard solutions to relatively well-understood and well-structured problems.

At the start of the HRSOS development process, the research team was assembled by the visionary HRSO official. Each expert was assigned respective data location, extraction strategy, and system development tasks by this official. System development and implementation was managed by the HRSO official. Most work was performed at the sites of the technology specialists. Distributed collaborative work tools, most notably electronic mail and audio conferencing, were used extensively to communicate work in progress and manage the effort.

This experience suggests that the HRSO's hybrid project-technology organization may work well for decision support system design, development, and implementation. The organization would be virtual rather than physical. A project team would be established and administered by the practicing top manager. Team technology specialists would be drawn from within and outside the organization to match the expertise needed for the specific project (Joyce, McGee, and Slocum, 1997). Telecommuting and distributed collaborative work would be allowed and possibly encouraged.

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