Integrating decision support and human resource information systems

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Human resource information systems (HRIS) have vastly improved structured human resource management decision making while failing to improve semi- or unstructured decision making. This paper describes a human resource decision support system (HRDSS) which integrates DSS capabilities with those of HRIS to overcome the limitations inherent in the design of HRIS.

Introduction

Although Human Resource Information Systems (HRIS) have been addressed in terms of their implementation and availability (Frantzreb, 1986; Magnus & Thomesen, 1986), purpose (Johnson, Moorhead, & Griffin, 1983; Nardoni, 1985), and current status (DeSanctis, 1986; Magnus & Grossman, 1985; Moore & Clavadetscher, 1985) future directions for such systems have for the most part been ignored. HRIS are relatively new subsystems of organizational Management Information Systems (MIS). Their development has been similar to that of information systems of other functional areas although slower to develop. The most apparent difference between HRIS and the information subsystems maintained by other functional areas is the relatively recent interest in the development of such systems (Tomeski, Yoon, & Stephenson, 1976).

At present, HRIS provide the traditional transactional data operations and reports for personnel/human resource management administration (e.g., payroll, benefits administration, compensation administration, etc.), but are not designed to support managerial decision making (DeSanctis, 1986). Moore and Clavadetscher (1985) conclude that organizations will need to be firmly convinced that HRIS
will save money and improve decision making before they pursue the acquisition of state-of-the-art systems.

That observation suggests that the allocation of additional resources to, and higher priority for, future HRIS development will require very persuasive justification. The human resource area will need to develop HRIS which extend their effect from the traditional transaction/report generating function to that of explicitly providing support for organizational decision making. This paper develops the integration of HRIS with Decision Support Systems capabilities to formulate a Human Resource Decision Support System (HRDSS) as a means to accomplish that goal.

**Current Status of Human Resource Information Systems**

As mentioned above, HRIS developed much later than information systems in other functional areas. Compared to other areas, researchers have shown relatively little interest in decision support systems for the human resource area. Articles proposing specific systems have been few in number (Davis & Steen, 1983; Enderle, 1987; Harris, 1986; LaPointe & Verdin, 1988). It appears that a very limited number of current HRIS have incorporated decision support features despite their enormous potential.

DeSanctis (1986) suggested that increasing demands by government agencies for human resource information, coupled with decreasing computing costs led to the initial interest in HRIS. Some factors now stimulating interest in HRIS include:

1. increased organizational size and complexity;
2. geographical dispersion of firms;
3. government regulation and reporting requirements; and
4. an increase in white collar work which demands a greater variety of skills for any given job. (DeSanctis, 1986, p. 16).

A concise definition of HRIS is provided by Mathys and LaVan (1982), who described them as “management information systems designed specifically to provide managers and others with information necessary to improve human resource decisions.” (p. 83). Unfortunately, empirical research suggests that HRIS are not perceived by managers outside of the human resource area as contributing significantly to improved decision making (DeSanctis, 1986; Mathys & LaVan, 1982; Moore & Clavadetscher, 1985). This common misperception that HRIS offers only limited support to decision making, particularly to managers outside of the human resource organizational unit, can partially be attributed to the approach taken by system designers in developing an HRIS. An observation by Magnus and Grossman (1985, p. 43) that “automation in the personnel department to date has focused on the bread and butter issues of human resources management: employee records, payroll, and compensation and benefits administration" is representative of other studies. DeSanctis (1986), Moore & Clavadetscher (1985), and Mathys & LaVan (1982) all reported similar findings, indicating that a majority of the HRIS applications are administrative (i.e., recordkeeping) in nature.

Particularly disturbing are the findings by Verdin (1987) which suggest that HRIS may also be of limited or questionable value to decision makers in the human resources organizational unit. Verdin (1987) found that computer applications had failed to reduce the amount of time spent on decision making for a majority of human resource managers studied, and that over 50% of the respondents reported low quality for decisions made using the HRIS. Moore and Clavadetscher (1985) found that over 40% of the respondents in the human resources unit reported only moderate to low utility for computerized HRIS systems. Recent reviews of com-
mercially available HRIS software further substantiate these findings (Frantzreb, 1986; Magnus & Thomsen, 1986).

HRIS have not been totally unsuccessful. On the contrary the systems have improved the efficiency of the human resources area in accomplishing routine, structured tasks (Verdin, 1987). HRIS, by their design, are well suited for generating the voluminous routine reports associated with the human resource management areas previously mentioned. Their major limitation is in their inability to offer support for decision makers facing non-routine and/or semi-structured or unstructured problems throughout the organization.

Thus, the stage is set for the development of a Human Resource Decision Support System. The HRDSS should be designed to assist decision makers throughout the organization and viewed as complementing rather than replacing an existing HRIS, an integration of the two systems.

**Benefits of Decision Support Systems**

To fully appreciate the contributions that a HRDSS will offer, one needs to consider the differences between a DSS and MIS (in this particular case, HRIS). Decision Support Systems are characterized “as interactive computer-based systems that help decision makers utilize data and models to solve unstructured prob-

<table>
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<tr>
<th>Table 1: Hierarchy of Human Resource Information Systems</th>
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<tr>
<td><strong>HUMAN RESOURCE TRANSACTION PROCESSING SYSTEMS (TPS)</strong></td>
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<td>Acquire data from various HR sub-units and functional line units to provide a consolidated data base. These systems capture fundamental data and make it available to the other HR information systems. Only highly structured problems, such as payroll, are processed within these types of systems. Data acquired would include:</td>
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<td>• Individual Employee Data</td>
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<td>• Recruitment and Selection Data</td>
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<tr>
<td>• Compensation Data</td>
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<tr>
<td>• Performance Appraisal</td>
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<tr>
<td>• Training and Development</td>
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<tr>
<td><strong>HUMAN RESOURCE REPORT GENERATING SYSTEMS (RGS OR TRADITIONAL MIS)</strong></td>
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<td>Provide HR information to managers, in the form of periodic, exception, and ad hoc reports, to support operations and decision making. Generally, systems of this nature address structured problem solving or decision making. Reports provided would include:</td>
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<td>• Date of hire reports</td>
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<td>• Salary comparisons</td>
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<td>• Turnover reports</td>
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<td>• Absenteeism reports</td>
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<td>• AA/EEO reports</td>
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<td>• Overtime reports</td>
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<td>• Budget reports</td>
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<td><strong>HUMAN RESOURCE DECISION SUPPORT SYSTEMS (DSS)</strong></td>
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<td>Assist decision makers in using data and models to solve un- or semi-structured problems. Systems are generally interactive in nature, and are designed with user-friendly interfaces to facilitate use by non-MIS professionals. Examples of HR decision support systems can be found in Table 2.</td>
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<td><strong>HUMAN RESOURCE EXPERT SYSTEMS (ES)</strong></td>
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<td>Allow users to generate solutions to problems approximating those at which “experts” would arrive. Expert system software attempts to capture the knowledge and inference procedures of experts to provide solutions to such tasks as interpretation, diagnosis, prediction, and planning. Explanation subsystems allow users to query the system concerning data required and inferences generated. Examples of expert system applications could include:</td>
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<td>• Termination programs (designed to consider the myriad of legal implications)</td>
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<td>• Selection programs (aimed at reducing selector bias)</td>
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<td>• Skill Assessment programs (appraise skill levels)</td>
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design will **support** the decision maker with appropriate data and models in their decision making process. Thus, a HRDSS should be viewed as a tool to aid decision makers in the utilization of existing human resources information in their analyses of problems and opportunities.

As shown in Figure 1, an HRIS consists of a database, database management system, an application program base, and an application base manager. The transactions are recorded, maintained, and retrieved through the database management system. Other recordkeeping activities and reports are generated by the application programs maintained in the application program base through the application program base manager. Usually there is some inquiry capability via the database management system. Depending on the type of system, however, that inquiry capability may be very user unfriendly. Thus, the HRIS satisfies a design requirement to provide only recordkeeping and report generation capabilities.

An HRDSS illustrated in Figure 2 consists of a model base with an appropriate management system and a sophisticated, interactive, user interface and dialogue system which is
integrated with the HRIS database. The model base contains analytic, heuristic, and statistical models which use the information in the HRIS data base to provide support in the decision-making process for the user. The models may vary from simple statistical means to multiple regression, linear and nonlinear programming, and sophisticated simulation models of organizational tasks.

An overriding concern of systems designers is the ability to communicate with the user of the system in the most effective and efficient manner possible. That concern is addressed in the design of the HRDSS. The user interface and dialogue system provides user friendly communication with the overall system, and in conjunction with the model base a means to ask “what if” questions as well as the ability to develop simulated scenarios of alternative solutions to problems.

Anthony’s (1965) classification of management decision making is a useful tool for the illustration of the various levels at which HRDSS could support human resource decision making. According to Anthony’s classification scheme, there are three distinct levels of decision making: operational, managerial, and strategic. These levels were defined by Anthony (1965) as:

1) Operational level decisions focus on the execution of day-to-day activities, and are highly influenced by the direction established at the managerial level;
2) Managerial level decisions are concerned with establishing policies, procedures, and programs to provide necessary and sufficient resources to accomplish goals established at the strategic level; and
3) Strategic level decisions are generally more long-term, concerned with goal setting and policy formulation. (pp. 16-18).

Human resource decision making can be further classified according to the types of human resource problems or decisions facing managers at each of the decision making levels described by Anthony. The majority of human resource decisions could be classified as:

Table 2: DSS Applications for Human Resource Areas Across Decision Making Levels

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<tr>
<th>Staffing</th>
<th>Training/Development</th>
<th>Performance Review and Appraisal</th>
<th>Compensation Administration</th>
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<td>Manpower Planning Models</td>
<td>Succession Planning Models (Simulation, Markov Analysis)</td>
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<td>Contract Costing Models</td>
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<tr>
<td>Labor Force Tracking (Forecasting, Markov Analysis, Decision Trees)</td>
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<td>Salary Forecasting Models</td>
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<td>Budget Analysis Models</td>
<td>Training Effectiveness Models (Goal programming)</td>
<td>Correlation Model (performance/training)</td>
<td>Compensation Effectiveness Model (relative to performance)</td>
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<tr>
<td>Turnover Analysis Models</td>
<td>Career Match Models</td>
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<td>Benefit Preference Models (Conjoint Measurement)</td>
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<td>Turnover Cost Models</td>
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<td>Absenteeism/Performance Models</td>
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<td>Recruiting Models</td>
<td>Skill Assessment Models</td>
<td>Computer-Based Evaluation Programs and Models</td>
<td>Compensation Equality (evaluation factors relative to compensation)</td>
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<td>Structured Interview/Assessment Models</td>
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<td>Workforce Planning Models</td>
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<td>Scheduling Models (Cost Minimization)</td>
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<td>Selection Models (Bayesian, LP)</td>
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1) staffing, 2) training and development, 3) performance review/appraisal, or 4) compensation administration. Table 2 contains examples of HRDSS applications (models) for these four areas of human resource decisions across Anthony’s decision making classification.

It should be noted that the applications described in Table 2, and similar applications/models, could be utilized by both human resource professionals and managers external to that functional area. The paucity of analytic models specific to the human resource area can be attributed to its “qualitative” reputation. The accessibility to human resource data provided by HRIS, and the growing interest in more quantitative human resource decision-making, should provide the necessary impetus for further advancements in this area.

While the contributions of DSS and HRIS, are somewhat dependent upon one another, they are distinctly different and yet very complementary. Keen (1980) described DSS as efforts to synthesize MIS and Management Science. The following descriptions of the potential benefits of HRDSS are presented with this relationship in mind.

**Competitive Advantage.** The development of HRDSS to augment the information provided to managers by existing HRIS should be viewed by organizations as an opportunity to develop a competitive advantage (Rynes & Milkovich, 1986). According to Rynes and Milkovich (1986):

> The consequences of employer hiring decisions are both substantial and far reaching. For organizations, the quality of selection procedures determines the willingness and ability of workers to master immediate job requirements, as well as to adapt and contribute to future organizational changes. (p. 154).

Based on this observation, the authors concluded that more effective selection procedures can provide organizations with a competitive advantage not unlike those provided by advances or improvements in other functional areas (e.g., revolutionary technological improvements in production processes).

The utilization of information systems such as HRDSS to develop a competitive advantage is not a unique concept. Branchau and Wetherbe (1987) reported that a recent survey of information system professionals indicated that the use of such systems for competitive advantage was the second most critical issue facing information system executives over the next three to five years. Recent interest in the need for close alignment of strategic planning and human resource planning for the achievement of organizational goals also supports this position (Golden & Ramanujam, 1985; Lavin, 1981; Scarpello & Ledvinka, 1988).

The most important issue identified by IS executives in Branchau and Wetherbe’s 1987 survey was improved strategic planning. Those responsible for HRIS administration, regardless of whether they are aligned with a centralized MIS function or operate as a separate entity (MIS subsystem) within the human resources area, should recognize the potential for HRDSS to support strategic planning. The contribution that HRDSS can make to strategic planning was stressed by Golden and Ramanujam (1985), who reported that a survey of senior human resource executives indicated that HRDSS would increase their contribution to strategic planning.

**More Efficient and Effective Utilization of Information.** The utilization of HRDSS in the human resources area would provide a means for
more efficient and effective management and utilization of the massive amounts of generated information. The variety, magnitude, and complexity of information required for efficient and effective human resource decision making was highlighted by Bassett (1979) who enumerated 149 types of information pertinent to this area. This complexity, which increases the demands placed on HRIS, is compounded by the need for much of the information to be shared with managers throughout the organization at different times for widely divergent types of human resource management issues. Traditional MIS, after which the majority of HRIS are patterned, were not designed to efficiently or effectively accommodate unusual requests for reports, nor do they provide user-accessible capacities for the analysis or manipulation of information. As noted above, the strength of MIS lies in the area of structured or routine tasks. DSS, as noted previously, allow managers the flexibility to address semistructured and unstructured problems through inquiry and analysis capabilities.

Many managers external to the human resource area face semistructured or unstructured decisions, as the needs of the organization and the availability or quality of applicants and employees are ever changing. For most managers external to the human resource area, recruitment, selection, training, and development issues are typically non-routine, performed on an as needed or ad hoc basis. The situation specific nature of these types of decisions makes them all the more difficult for human resources personnel to provide assistance, and all but impossible for HRIS to adequately support.

HRDSS would allow individual managers the opportunity to identify, access, and analyze relevant information with models designed for specific applications. The DSS capacity for interfacing data and model bases, combined with its sophisticated graphic/report generators, should provide managers with a means for augmenting the information presently made available through HRIS generated routine and exception reports.

**Increased Productivity.** In keeping with Keen’s (1980) observation that “benefits of a DSS can be hard to quantify, but not necessarily to recognize...” (p. 34), the following discussion of potential gains in productivity is general in nature. The intent of this section is to illustrate the promise of improved human resource decisions through the use of HRDSS. Improved human resource management decisions resulting from the use of HRDSS could potentially result in substantial productivity gains.

Hunter and Schmidt (1983), in an effort to quantify the economic impact of improved employee selection, calculated that the potential increase in productivity achieved across the economy from improved selection criteria would result in an increase of the gross national product of from $89 to $100 billion per year. Although Hunter and Schmidt suggest that this figure is conservative, based upon only relatively minor improvements in selection, an examination of their efforts suggests that even a modest improvement in selection would lead to significant gains in productivity.

A specific DSS proposed by Davis and Steen (1983) for contract administration provides one example of the potential benefits to be derived from an HRDSS. The proposed DSS supported the administration of a collective bargaining agreement involving employee absenteeism and tardiness, grievance analysis and response, layoff and recall, overtime and job assignment.
A more detailed appraisal of the benefits afforded by HRDSS would require knowledge of existing hardware and software, the level of sophistication of data and model bases needed, and the diligence and commitment with which management would apply the new decision aid.

Implications

The following areas merit consideration in the development of HRDSS and should be of interest to HRIS administrators, Human Resource specialists, MIS/DSS designers, and MS/OR researchers.

First, types or classes of human resource decisions to be supported by HRDSS need to be identified. The classification matrix presented in Table 2 should provide some direction in this area. Human resource specialists must carefully assess the needs of decision makers in terms of required information and presentation format. Caution should be exercised to ensure that end user needs and desires are addressed both within and external to the human resource area. This process will assist in the identification of the capabilities, including models that should be incorporated in HRDSS.

Second, models specifically designed to assist managers involved in human resource decisions must be developed. Efforts in this regard are unlikely to produce models approaching optimality, however, even modest improvements in decisions involving personnel have been shown to be capable of producing significant benefits. A synthesis of MS/OR techniques and existing knowledge of employee performance with respect to various variables, combined with the information available through existing HRIS should serve as a starting point in this venture.

Third, future HRIS designs must necessarily support complementary HRDSS capabilities. This relationship holds implications for both commercial software designers and internal systems analyst and designers, as organizations are presently utilizing a variety of in-house, purchased, and external or timesharing HRIS software (Magnus & Grossman, 1985). The successful integration of DSS capabilities, through the customized development or commercially available software packages will naturally be dependent upon the degree of compatibility with HRIS.

Finally, managers must be educated as to the availability and utilization of HRDSS capabilities. Managers only recently introduced to the DSS concept and technology may hesitate to utilize the formalized decision tool, HRDSS.

Conclusion

An integration of Human Resource Information System (HRIS) with Decision Support Systems (DSS) technology will support decision makers throughout an organization. The development of Human Resource Decision Support Systems (HRDSS) will complement the capabilities of existing HRIS, and provide a means for a more complete utilization of the massive amounts of information available.

HRDSS will extend the capabilities of the HRIS from its present task of recordkeeping and generating routine reports. Through the Model Base and sophisticated Interactive User Interface of the HRDSS, along with the database of the HRIS, managers will be able to gain support in making their human resource decisions, thereby providing gains in organizational productivity, competitive advantage, and managerial effectiveness.

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