

# Human resource metrics and decision support: A classification framework

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## ABSTRACT

Human resource information systems and analytics have transformed the delivery of HR services and the role of HR within organizations. In spite of the complexity of HR and the different roles HR plays, there has been limited research which helps inform the selection, application and use of HR metrics and analytics to the operational, managerial, and strategic levels that HR occupies. Therefore, the goal of this article is to provide a framework that describes the data needs, decision characteristics, and HR metrics to these different levels of HR activity and decision-making. We provide a number of research propositions and implications of the model. We finish the paper with a discussion of the implications that this framework has for how HR decisions are made, the types of data used in support of these decisions, and the metrics used.

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## 1. Introduction

It has been argued that human resource information systems fundamentally alter how the human resource (HR) function is managed, with changes to managerial roles, HR processes, and the relationship between HR and the broader organization (Gueutal & Falbe, 2005). This transformation in HR is occurring as technology becomes infused into HR processes. Nearly gone are the days of paper forms stored in physical filing cabinets that severely constrain broad data access and usage. Instead, an e-HR approach to the delivery of HR functionality is emerging where organizations are transforming HR functions with technology. Further, many organizations “don't simply utilize technology in the support of human resources but instead see technology as enabling the HR function to be done differently” (Kavanagh, Thite, & Johnson, 2011, p. 18).

Although the specific technological platforms underlying this e-HR approach will vary by organizations, the various technologies that allow organizations to capture, store, and utilize data in support of HR functions are considered to be human resource information systems (HRIS). An HRIS can take many forms; it can take the form of a small spreadsheet-based employee file in a small business, or it can take the form as part of a multi-million dollar enterprise resource planning (ERP) system that captures data on all employment related and HR functions and integrates this data with the broader organizational systems and processes as well as external data. HRIS provide managers and employees with access to data without geographic or time constraints.

Because of this vast increase in the availability and reach of HR data, human resource professionals have the opportunity to more effectively employ HR metrics to assess HR in terms of its efficiency, effectiveness, and impact and service. Increasingly managers and employees are utilizing decision support systems (DSS) or business intelligence (BI) capabilities available as part of HRIS that include metrics and analysis tools to help solve key HR problems. A DSS integrates data and models to assist employees and managers as they make decisions. BI tools are specific set of DSS capabilities which “combine data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision makers” (Negash, 2004 p. 178). Although these terms may appear to be similar and some researchers view them as overlapping (Bhargava, Power, & Sun, 2007; Negash, 2004), others view BI tools as a subset of DSS tools (Power, 2002). Therefore, in this

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manuscript, we focus on BI tools as those DSS tools which are more technically and analytically sophisticated and which often are geared at more strategic level organization decisions.

Still considered a leading edge e-HR innovation, such DSS hold out the potential for HR managers to communicate HR's value and further transform its image from a back office administrative oriented function to a full-fledged strategic and business partner. For example, companies are increasingly turning to these sophisticated DSS to identify, develop and retain key talent (Baker, 2009). As a result of change, HRIS are able to continue to support traditional administrative HR functions and data handling as well as assist managers in their decision-making. The newer DSS capabilities, though, facilitate HR's progression and assumption of other roles related to becoming a valued partner with upper and line management. Although different classifications for HR activities exist, Lawler and Mohrman (2003) listed primary HR activities as: maintaining records; auditing controlling; being an HR service provider; development of HR systems and practices; and a strategic business partner role. Wright and Dyer (2000) also noted that HR activities focus on conducting basic HR transactions, completing traditional HR activities, and engaging in strategic or transformational activities. Essentially HR activities occur at the operational, managerial, and strategic levels of the organization.

The variety of roles, activities and organizational levels at which HR operates leads to questions regarding what types of data and DSS are needed to support HR. With respect to DSS tools, questions exist as to what tools, data, and expertise are needed to make a difference in managing an organization's human capital. Further, from a design, implementation, and security perspective, issues exist regarding what HR data different stakeholders in the organization should be provided with. Answering this question can impact organizational success. For example, in a recent field study, the Aberdeen Group identified having access to the appropriate HR data and HR analytics as a key characteristic of high performing organizations (Lombardi & White, 2009).

Despite the logic regarding the need for guidance into what DSS are needed to support different levels of HR activities, and the need to support HR and organizational decision-making, limited attention has been given to these issues. To identify appropriate HR metrics and DSS tools it is important to consider the types or levels of HR activity and types of information that are needed to support the different roles HR plays. The purpose of this article is provide theoretical guidance and an integrative approach to HR data and the use of different HR metrics and decision support systems for the different HR roles and activities.

## 2. Background

Human resource information systems have evolved in several respects. First was an evolution from simple transaction processing systems (TPS) whose foci included efficiently completing routine transactions such as payroll processing. The earliest HRIS developed in the 1960s and 1970s only provided automation of employee records and transactions related to back office maintenance of data on an organization's employees. Subsequently, beginning in the 1980s there was the development of standalone software packages, such as those that could run on a PC or network that provided functionality related to automating separate HR functions such as applicant tracking, performance appraisal, and training and development. These systems also converted raw data from transaction processing into meaningful form for managers, creating early management information systems (MIS) support for HR managers.

The 1990s witnessed a growth in integrated HRIS that managed multiple HR functions and provided more sophisticated management and reporting features for managers. These systems were either standalone or part of enterprise resource planning (ERP) software suites that integrated HR data and broader organizational data within one, large-scale organization-wide system. That decade witnessed a migration to web-enabled systems, based on an Internet architecture, which allowed for the centralization of all HR and organizational data with any time/place data access through a web browser. Since the turn of the century, there has been a growing emphasis on DSS and BI tools within HRIS that provide managers with the ability to integrate HR data with other organizational data, provide sophisticated analytic capabilities, and facilitate intelligent human capital management to enable better business management and decision-making with respect to a firm's human resources.

Despite the growing use of DSS and BI tools within human resources, there has been limited HR research focus. To our knowledge, currently there is only one scholarly article on the use of DSS tools by HR professionals (Beckers & Bsat, 2002). This article specifically focused on defining and outlining what a DSS is, the different financial considerations to consider, and competitive advantage opportunities which may accrue to organizations when implementing a DSS. Although the article offers practical advice to managers in identifying the type of system implemented, it is not really effective in helping researchers and practitioners apply a DSS in supporting HR. Specifically there are no practical recommendations or advice regarding what decision support is needed at different levels to support different HR activities or how to utilize DSS in conjunction with HR metrics to make HR more effective.

In spite of limited HR research, information systems researchers have developed several helpful models or frameworks that focus on how to apply DSS to support decision-making most effectively. This paper will briefly review these frameworks before going more in-depth on a classic framework that classifies DSS based upon two dimensions: degree of decision-making structure and the level of managerial activity. In each category we will describe the types of decisions supported, the types of metrics that can be used, and considerations to consider when assessing HR effectiveness at each of these levels. Following we briefly discuss the types of HR metrics and where they fit with respect to levels of HR activity.

## 3. Decision support system frameworks

One of the major impetuses for the original development of HRIS was to help HR staff and managers capture data to support auditing, to support government reporting, and to communicate HR effectiveness (Kavanagh et al., 2011). Over time, more sophisticated and complex tools have become available to support HR decision-making. Whether a small, self-developed, spreadsheet-based employee scheduling program or a large scale, organizational salary planning and forecasting tool, organizations

are increasingly using such DSS tools to support decision-making. As noted earlier, in the HR context, DSS tools are those tools available in an HRIS that support decision-making related to human resource management.

Although HR has long used metrics and technology to support decision-making, decisions regarding how to implement a DSS in HR have not been researched in detail. The challenge is that no single, global approach to DSS implementation can work for all organizations. DSS design needs to be different and appropriate for the context in which the decision is being made (Goodhue & Thompson, 1995). Some decisions are fairly simple and straightforward, such as determining the number of employees to be hired this month because of employee transitions. Other decisions though are much more complex such as determining the most effective way to manage the HR function (e.g. what combination of shared services, outsourcing, technology, etc. should be leveraged?).

Thus, designing the most effective DSS will depend on multiple factors. Because of this, information systems researchers have developed several frameworks to classify the types of DSS and provide guidance regarding where to deploy them in the organization. For example, Donovan and Madnick (1977) categorized decision-support systems into two classes, those which focused on on-going recurring decisions and those which were more ad-hoc in nature which focused on decisions which may or may not occur again (i.e., programmed or routine decisions versus non-programmed). They argued that the type of decision and the routine nature of the decision to be made should affect how a DSS is designed. In addition, Hackathorn and Keen (1981) identified the importance of whether the DSS would be used by an individual for decision-making or whether the decision would be used by a group of individuals in an interdependent fashion.

Another early taxonomy of decision support systems (Alter, 1977) reviewed fifty-six implemented DSS and categorized them based upon the types of operations the DSS undertaken, rather than the type of problem solved or functional area of focus. Specifically he broadly classified systems as being data oriented or model oriented. *Data oriented DSS* are mainly focused on the retrieval of data used to support decision-making. For example, a system which provides utilization data to managers who are completing affirmative action plan forms would be using a data oriented system. Conversely, a *model oriented DSS* focuses on providing simulations or suggestions based upon internal mathematical models. An example of a model based DSS, in the context of HR, would be a DSS focused on forecasting labor needs over the next six months to a year.

Power (2002) expanded on Alter's work, arguing that advances in DSS technology had created a greater diversity of systems supporting decision-making. He argued that DSS can be categorized based upon three characteristics: the intended users, their purpose, and the enabling technology. To the original two types of DSS identified by Alter, he added five additional types. *Knowledge driven DSS* utilize sophisticated algorithms and human expertise to provide suggestions to managers. *Document-driven DSS* assist managers in organizing, classifying and managing documents such as corporate records, meeting minutes, etc. *Communication based DSS* (or Group DSS) help managers coordinate and manage the collaboration and decision processes of multiple individuals. Next, *inter-organizational DSS* support decisions that span organizations such as product design and supply chain management. In addition, general purpose DSS are often made available to support functional areas, or within larger enterprise resource planning (ERP) packages, to support general decision-making. The final category of DSS that Power outlined was *web-based DSS*.

The framework Power provided is illustrative of the way much of the research on developing frameworks and categorizing DSS has been conducted. These frameworks have tended to focus on either the function (or purpose) of the DSS, who is using the DSS, or the technology supporting the DSS. Although this can provide useful insight for developers of DSS, Power's framework is of limited value for understanding the context in which the decision is being made. In addition, it is of limited value in helping HR professionals ask questions or determine how to best use technology to support their decision-making. Because of this, we feel that another framework that focuses on the structure of the decision process as well as the organizational level at which the decision is made can better inform HR researchers. Prior to turning to the framework, it is helpful to discuss the types of metrics and DSS tools in human resource management.

#### 4. HR metrics

Over the past three decades, scholars and practitioners have given attention to the need for HR metrics. Metrics are used by all core business functions and since HR represents a core function, a need exists for metrics. A metric is an accountability tool that enables the assessment of a function's results. With respect to HR, a primary idea has been that through metrics, HR units could build a business case for their work and this could contribute to an increased partnership between HR and the broader business functions. Scholars and practitioners have defined multiple levels of HR metrics.

The first level is efficiency metrics. Metrics at this level measure how well HR performs basic administrative tasks. The focus of these metrics is on productivity and cost. The majority of HR metrics developed to date have been efficiency measures. Examples include:

- Cost per hire
- Employer-sponsored health plan cost per employee
- HR expense per employee
- Yield ratios (e.g., number of applicants per recruiting source)

Often these efficiency metrics are compared to benchmarks provided by multi-company databases. The purpose of these metrics is to evaluate HR efficiency and inform how resources should be allocated within HR to maximize the operation of the HR function. They essentially are operational in nature and don't measure HR effectiveness and quality or HR's impact on the

organization. Although efficiency data are important, additional metrics are needed for a more complete picture regarding the effectiveness of HR.

A second level of HR metrics is human capital metrics that attempt to measure the value of human capital. Measures of human capital are problematic however because companies don't own their employees. Consequently, unlike other capital assets there is no documented purchase price or market value. Furthermore the amount and type of human capital changes as people develop new skills and in their areas of expertise. However as a firm's human capital becomes more important to the value of a firm, organizations may attempt to measure it so that they can show in quantifiable terms how employees create value. Examples of human capital metrics include:

- Expense factor:  $(\text{Operating Expense} / \text{Total Full-time Equivalent (FTE)})$
- Profit per employee:  $(\text{Revenue} - \text{Operating Expense} / \text{Total FTE})$
- Labor cost factor:  $(\text{Compensation} + \text{Benefit Costs}) / \text{FTE}$
- Human capital value added revenue:  $(\text{Operating Expenses} - (\text{Compensation} + \text{Benefit Costs}) / \text{FTE})$ .

In addition to measuring costs and value of human capital, metrics also focus on the value of HR practices or programs. The third level of HR metrics is HR effectiveness or HR cost benefit metrics and these measure whether HR programs and practices have the intended effect on the people or talent pools that they are directed toward. These metrics provide data on issues such as what attributes distinguish effective from ineffective policies and practices. Typical metrics in this area include measures of the strategic skills and core competencies embodied in the work force. In addition, these metrics classify how well pivotal jobs are filled and the type of development activities that are taking place for critical talent (Lawler, Levenson, & Boudreau, 2004). Examples include:

- Firm salary/competitor salary ratio
- Number and quality of cross-functional teams
- Progression of employees through development plans
- Percentage of total salary at risk

The fourth and highest level of HR metrics is impact or strategic HR metrics. This group of metrics measure HR's impact on business outcomes. Specifically, they demonstrate in measureable terms what HR's impact is on financial, customer, process, and people outcomes. As such they answer questions related to where to direct and how to manage human capital resources in order to obtain sustainable competitive advantage. These metrics go beyond simple ratios but involve the integration of HR data with other organizational data. Data integration provides the basis for answering questions such as which talent pools are most critical for competitive advantage and how could improving human capital increase value and where should those human capital improvements take place (Boudreau & Ramsted, 2007). For example, HR's impact on business operational effectiveness involves demonstrating a relationship between a particular HR metric and other metrics in the organization. The objective is to ascertain and understand the impact of HR practices and policies on organizational performance. Statistical techniques and experimental approaches can be used to tease out the causal relationship between particular HR practices and performance metrics such as customer satisfaction or sales per employee (Marler & Dulebohn, 2006).

General agreement exists regarding the importance of HR metrics in transforming HR into a strategic business partner. Not surprisingly though, there has been a focus on some metrics to the exclusion of others. This was the general conclusion of a recent survey by i4cp that found that most companies only utilize efficiency metrics. In describing their findings, Jamrog and Downey (2009) wrote:

While almost three-quarters of the respondents said that they had HR measurements in place, most were measuring only the efficiency of various HR functions and programs. Less than a quarter were attempting to develop effectiveness metrics, and very few were measuring the impact on the organization (unless you believe that engagement and satisfaction surveys are providing a reliable gauge for measuring the impact that HR is having on the organization) (p. 1).

Companies that devote resources to collecting data necessary to measure efficiency, effectiveness, impact, and relevant external data are able to develop predictive models that will contribute to sustained competitive advantage in managing and deploying their talent.

## 5. HR metrics and decision support systems

Essential to use of all four levels of metrics, especially HR effectiveness and impact are DSS and BI tools. As discussed earlier in this paper, these tools allow organizations to improve business performance by leveraging data about customers, suppliers, human resources, and internal business operations. BI, as a type of DSS, refers to data driven DSS that provides capabilities with the primary focus on analyzing internal, structured data and business processes. BI applications include the activities of DSS, query and reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining.

With respect to HR, BI systems allow organizations to improve business performance by leveraging data about human resources and internal business operations. BI systems enable the extraction and integration of data from multiple sources to provide users with insight into different areas within the organization. They centralize, organize and standardize data in repositories, such as multi-dimensional data warehouses, and they provide analytical tools that allow a broad range of business and technical specialists to run queries against the data to uncover patterns and diagnose problems. An important criterion of DSS and BI systems is a standard and

agreed upon set of metrics (at the different levels such as described earlier) that provide the basis for the use of HR data for decision-making. To best determine how to link these metrics to decision-making, it is important to understand the decision-making process and how technology is used to support different types of decisions.

### 6. The Gorry and Scott Morton framework

A current need that exists with respect to metrics in HR is a framework to guide the application of metrics and DSS to different HR activities. Although excellent discussions exist on the types of metrics available, such as those provided by i4cp, limited help exists regarding where, and at what level of HR functioning, to employ specific types of metrics. Regarding this, early researchers in information systems noted that technology could be used to support decision-making at a variety of organizational levels and for a variety of purposes. Gorry and Scott Morton (1971) presented such a framework based upon Anthony's (1965) categorization of management activity and Simon's (1960) classification of decision structure. Specifically, in their seminal article, Gorry and Scott Morton argued that MIS primarily focus on structured decisions; they suggested that information systems also should provide managers with support for semi-structured and unstructured decisions and that these systems should be called decision support systems. Specifically they referred to DSS as interactive computer systems that integrate data and models to assist or support, rather than replace, decision-makers in making decisions for semi-structured and unstructured problems.

Gorry and Scott Morton's framework for DSS classified decisions along two dimensions (levels of management activity and degree of structure inherent in the decision) in order to inform the application of decision support tools and metrics to different decision-making situations or contexts. The cells in the framework represent general boundaries rather than precise categories. As such, to best understand how DSS can support human resource decision-making, a discussion and application of their model is appropriate. The framework is presented in Fig. 1.

#### 6.1. Level of organizational functioning

The classical model of what managers do lists five primary activities: planning, organizing, coordinating, decision-making, and controlling. Mintzberg (1990) organized managerial roles into three categories: interpersonal, information processing and decision-making. Information systems can contribute to the information processing and decision-making roles. With respect to the decision-making role, decisions made can be categorized into three broad levels of management activity: strategic planning, management control and operational control (Anthony, 1965). Anthony argued that there is sufficient difference in functioning at each level to suggest that different types of information systems are needed to support each. A more precise way of stating this, in light of the advances in technology, is that organizational systems supporting these levels require different types of data, need to support different types of processes, and will require different metrics to evaluate their effectiveness. We briefly summarize each level of organizational functioning below.

The *strategic planning level* focuses on the choices, objectives, and strategic activities the organization will pursue. Strategic planning is externally and future oriented, with a focus on scanning the external environment and evaluating the organization's strengths and weaknesses. Strategic decisions involve complex and generally non-routine problem solving and require the integration of internal and external data. At the strategic level, HR can inform and assist organizational strategy and set HR priorities and objectives. Decisions at this level are normally made by a small number of executives and will most often change and evolve over time as an iterative process.

		Management Decision-Making Levels		
		Operational Control	Management Control	Strategic Planning
Degree of Problem Structure	Structured	Benefits Enrollment	Recruitment Efficiency	HR Supply Analysis
	Semi-Structured	Applicant Screening	Monitoring Succession Plan	Strategic Planning & Workforce Planning
	Unstructured	Managing Unexpected Absenteeism	Implementing an HRIS	Mergers & Acquisitions

Fig. 1. Framework for HR decision-making.

The *management control level* focuses more on ongoing decision-making by managers. Managers are informed and constrained by the policies and strategies outlined as part of strategic plans. Management control decisions focus on how well operational units are performing and the efficiency and effectiveness of resource utilization. Much of the decision-making at this level is related to issues regarding implementing the business strategy, and monitoring and evaluating the results. Decisions at this level are made by a larger number of individuals and will likely be made on an ongoing basis.

The *operational control level* is concerned with day-to-day tasks that represent the organizational activity that is necessary to transform inputs into outputs. Operational activity is based on the direction, planning and control exercised by management. The focus at the operational control level is on ensuring that specific tasks are carried out effectively and efficiently (Gorry & Scott Morton, 1971). Generally, a lower level of independent judgment and decision-making is needed at the operational level because typically the procedures, tasks, and resources have been clearly pre-specified or predetermined by management. For HR, operational control often deals with the most efficient management and use of a firm's human capital.

## 6.2. Structure of the decision

The second dimension of the Gorry and Scott Morton framework is the structure of the decision. This dimension was based on Simon (1960) who stated that there are three broad phases in the decision-making process: intelligence, design, and choice. These should not be seen as distinct and discrete processes, but rather more of a broad categorization of the different activities that make up a decision. In the intelligence phase, decision-makers scan their environment looking for problems or opportunities for which a decision can be made. In the design phase, courses of action are evaluated and considered. Choice is the portion of the decision-making process in which a decision is made and an action is determined. Depending upon the type of decision being made, each of the phases can vary in the amount of structure associated with it. The structure of the decision refers to the level of routinization involved, automation possible, and the amount of judgment required in the decision.

Decision problems can be classified as structured, semi-structured, or unstructured (Simon, 1960). A *structured decision* is one that is amenable to mathematical models such as linear programming or statistical approaches. Standard solutions exist for structured problems and the approaches for obtaining solutions are known (Niu, Ju, & Zhang, 2009). For example, simple decisions, such as how to enroll a new employee into a corporate benefit program would be considered a very structured decision. In contrast, *unstructured decision* problems are not straightforward, do not have standard solutions, and require human judgment to solve. For example, HR decisions regarding which healthcare provider to utilize for an employer-sponsored health plan, what the fee arrangements should be, and what level of benefits to offer represents an unstructured decision.

*Semi-structured decision* problems fall in between and require a combination of standard solutions and judgment. Although an HRIS contains capabilities supporting data capture, storage, and retrieval that can be used to effectively and consistently solve structured decisions, this is less the case for semi- and unstructured decisions. For these latter decisions, where the purpose of an information system is to contribute to the decision-making process by increasing quality of the data, improving the integration of data from different sources, and providing the means to examine a variety of alternative scenarios, additional HRIS capabilities are needed. Specifically, the HRIS also needs to incorporate DSS and BI capabilities to most effectively support this type of decision-making.

## 7. A framework for HR decision-making

Using these two dimensions (management level and decision-making structure), Gorry and Scott Morton (1971) provided a matrix that classifies decisions on a structured to unstructured dimension and on an operational to strategic dimension. Their premise was that understanding and characterizing organizational decisions in a systematic way provides the basis for designing and implementing effective DSS. Their framework highlights that information requirements differ among the three areas of managerial activity and the structure of the decisions to be made. Rather than containing firm boundaries, the cells and boundaries of their framework are not fixed and sometimes overlap. HR decision-makers can apply this framework (as presented in Fig. 1) to categorize HR activities and decisions as well as to consider what metrics and DSS tools are needed.

For example, a majority of HR activities are operational, involving routine transaction processes that do not require independent judgment. Examples of operational activities are employee record keeping, wage and salary administration, and benefit enrollment. The application of information technology (IT) to these routine activities has been to improve data efficiency and accuracy and to reduce costs; there is much less judgment exercised in operational control activities, compared to the two other areas. Thus, the tasks, goals, resources and decision processes can be carefully structured and automated through the HRIS. Other activities, though, are non-routine, requiring substantial judgment. For example, managerial processes, such as evaluating the efficiency and effectiveness of the recruiting function, involve independent judgment that can be supported by appropriate data, metrics, and analytics provided by DSS tools rather than simply being automated through an HRIS. In the following we describe each level and cell and apply their framework to the HR context as presented in Fig. 1.

### 7.1. Structured and operational control

Recall that operational control refers to day-to-day HR activities. As such, this level is relevant to the application of HRIS to the automation of structured activities as well as the standardization of semi-structured activities. HRIS and e-HR enable the management of all employee information, and involve data entry, data storage, data tracking, the institutionalization of standardized practices and

workflow, and the distribution, reporting and analysis of HR information. It is through HRIS and e-HR that administrative tasks, that at one time dominated HR, are distributed to HR staff, line managers and employees. The use of HR metrics and analysis tools are generally not widespread at this level because the focus is on daily operations, standardization of routine tasks, and effective operation of HR functional tasks.

In the upper left cell of Fig. 1 are decisions that are structured and which focus on daily operations. Decisions in this cell are predictable and repetitious; employees do not have leeway to make ad-hoc judgments. For the organization, the goal is to structure and automate processes as much as possible; this leads to process standardization and the use of an HRIS to support these standardized processes. The system captures the data as end-users walk through transaction processes in which the processes, rules, and choices are pre-programmed and fixed. An example would be an online self-service benefit enrollment process or a process for updating personal information. The organization has determined the most efficient benefit enrollment process and by routinizing, sequencing, and automating the processes has eliminated the need for each employee to make a decision as to how they wish to complete their benefit enrollment. The program guides them through the pre-determined enrollment process, captures the response data for the organization, and stores the transaction data.

**Proposition 1a.** *Structured operational HR control activities represent human resource management tasks that are transactional, structured, and routine and can be fully automated through an HRIS.*

### 7.2. Semi-structured and operational control

The next level reflects operational control and semi-structured decisions and processes. Although at this level the organization has identified and institutionalized a formal decision process through pre-programmed steps or pre-set routines, there is an added dimension of some required discretion on the part of HR personnel. One purpose of a semi-structured, operational control decision is that the organization wants to implement the same basic process and criteria to be used in the decision process, but they also want employees to have limited leeway in making adjustments to the decision process. In support of these decisions, the DSS provides detailed, accurate, and timely data in a form that can be rapidly processed. This type of data is often the most basic data captured by the organization in transaction processing.

For example, consider the applicant screening process, one of the critical, initial stages in the staffing process. The screening process may be part of a multiple hurdle approach administered through an online web application system beginning with the collection of applicant data, followed by a screening interview. The applicant data would be captured through an online interface accessed through a web-browser or onsite kiosk. The organization would first incorporate job analysis to generate knowledge, skills, abilities and other characteristics (KSAOs) required for the job to use as preliminary screening criteria for their e-recruiting systems. Next, the system would use automatic decision rules to eliminate applicants who do not meet the minimum cut-off scores on criteria, such as certifications, years of prior experience, educational attainment, on-line testing scores, etc. The criteria are set at the operational level; the goal is to structure the process for initial applicant screening as efficiently and accurately as possible. From a decision-making standpoint, the goal becomes to minimize the effort it takes to process applicants and to uniformly apply the criteria to each applicant.

Following data capture and initial screening, applicants who meet the minimum criteria may undergo additional screening such as through a structured interview. In support of this interview, staff may have the results for each applicant from the system to refer to, but in the end staff have to subjectively rate the applicant in terms of the applicant's person–job and person–organization fit based on the pre-determined screening criteria, interview results, and their personal knowledge of the organization. Thus, some discretion or judgment is required in this screening process. Although the front-end screening process is very structured and automated through the HRIS, part of the process is somewhat less structured and requires some decision-making discretion. In this cell, the HRIS supports semi-structured decisions through both automation of parts of the decision process as well as through the capturing and processing data that is used by HR staff in the support of their decisions.

**Proposition 1b.** *Semi-structured operational HR activities can be largely automated through HRIS modules, such as e-HR applicant tracking, and decision criteria are embedded into system processes but may also include information not captured by the HRIS as well as a certain level of human judgment in decision-making.*

### 7.3. Unstructured and operational control

Activities that occur at the operational control level and that are unstructured require a large amount of managerial discretion but typically occur less frequently. An example of an unstructured and operational control activity would be dealing with a situation where suddenly there is a large amount absenteeism in an organization. For example, due to unanticipated events a hospital finds itself with a large number of nurses absent at a particular time. The routine operational schedule therefore has to be modified and gaps in nursing coverage have to be immediately filled. Hospital administrators would have to quickly scramble to identify which nurses and caregivers are currently available and the specific skills they have. They would then need to match these skills to the staffing needs of the day, balance them with unit needs, hospital requirements, and relevant legal and labor requirements. Although the system can provide some of the data (e.g. nursing skills and hours worked during the current period), much of the decision process and identification of the appropriate personnel would involve judgment on the part of managers with typically no prescriptive process to follow.

**Proposition 1c.** *Unstructured operational control HR activities are typically unanticipated and therefore cannot be automated or programmed through the HRIS. The HRIS may provide data in support of these decisions, but the type of data needed may not be clear before the situation arises and therefore the DSS tools should allow for flexibility in data display and access to best support these decisions, which are dependent on human judgment for their resolution.*

#### 7.4. Structured and management control

As applied to HR, management control is the level of HR functioning at which managers ensure that resources are used effectively and efficiently in the accomplishment of HR objectives. At this level, these structured management control decisions are focused on decisions that are unambiguous and do not require independent judgment. HRIS contributes to management control by providing data or routine feedback on the use of resources and measures related to the accomplishment of HR objectives. The metrics available through the HRIS provide managers with feedback data, and decisions based upon that data would be amenable to standard decision process steps and algorithmic programming.

Activities in this cell are supported by metrics which measure the efficiency of the different HR functions (i.e., efficiency metrics). Specifically, each of the primary HR functions can be evaluated through the use of metrics that can be programmed into the DSS. Lists of the appropriate efficiency metrics are available for areas such as staffing, compensation, performance management, training and development, labor relations (e.g., grievances), and safety and health. Scholars have described the use of metrics at the structured management control level as enabling HR to play an administrative expert role (Jamrog & Downey, 2009) where little discretion is needed. For example, evaluating compensation in terms of payroll as a percentage of total operating costs enables HR to benchmark its compensation against peer competitors. Similar comparisons can be done for other HR functions such as staffing (e.g., comparing turnover rates, cost per hire, number of applicants per recruiting source, time to complete recruiting process), benefit costs (e.g., medical costs per participant), and equal employment compliance (e.g., progress on affirmative action goals). Such efficiency metrics provide measures of how well HR is performing. These metrics are programmed into the system and available through HRIS query and reporting features.

**Proposition 2a.** *Structured management control decisions will use HRIS capabilities to allow managers employ efficiency metrics that will provide feedback on the use of resources in HR activities toward the accomplishment of objectives.*

#### 7.5. Semi-structured and management control

Semi-structured decisions at the management control level involve those that can be programmed to some extent but also involve significant manager judgment. It is at this level the HRIS provides analytic tools, data and HR metrics from different sources to support managerial decision-making that requires discretion and judgment. These can include both efficiency measures that were applied at the structured level, but also effectiveness metrics which answer questions regarding whether HR programs have their intended effect. The DSS tools for this level contain the metrics, data, and analysis capabilities that are “useful because the manager is able to explore the implications by using the computer output of the analysis of data; he can then apply his own judgment for the resolution of problems” (Dubey, 1985, p. 135). These decisions go beyond simply using standard efficiency metrics and involve combining these with effectiveness metrics and analytic tools to ascertain HR’s performance in meeting organizational goals and objectives. They enable HR to articulate how effectively HR activities align with the business strategy and how HR adds value to the organization.

For example, if HR has developed a succession planning program, in response to and with the purpose of meeting the strategic objective of developing leaders to assume higher level roles, HR will want to evaluate the effectiveness of the program. Decisions regarding this will be supported by data from HRIS and multiple metrics such as competency development expense per employee, percentage of employees with development plans, progression of employees through development plans, retention of high potential employees, performance management and training data, collected by the HRIS system. This would provide data for on-going evaluation of the succession planning program that would be used to make changes in the program, based on its effectiveness in meeting business objectives.

Another example would be if the business strategy has directed HR to implement change efforts to adopt team-based work structures, then efficiency metrics could be utilized to evaluate the performance of the teams. Team assessment could be based on gathering multi-source data (from team members, leaders, managers, objective performance criteria, and customers) to assess the quality of the teams and their outcomes. HR managers could use effectiveness and efficiency metrics to identify low performing teams (e.g., the number of teams that have within team communication and coordination problems leading to poor performance), and then plan and conduct interventions to rectify performance issues. This assessment example would be one that demonstrates whether the team deployment has had its intended effect and whether the teams are adding value to the business by achieving performance objectives. The DSS and metrics used allow HR managers to augment their individual judgment on the evaluation of the teams and inform them on interventions that may be necessary.

**Proposition 2b.** *Decisions at the semi-structured and management control level will utilize efficiency and effectiveness metrics and data from multiple sources to evaluate the effectiveness of HR activities in meeting business objectives. The judgmental evaluation of HR managers will be supported by DSS tools and metrics.*



### 7.6. Unstructured and management control

Decisions in this cell of the framework are unanticipated, complex, and unprogrammed. An example of such would be HR responding to a business strategy decision to adopt a new ERP and HRIS. Moving from a legacy system, to an HRIS, would involve a high level of judgment, planning, and coordination. In addition, the move to a new HRIS is not conducted very often. This change initiative involves subjective judgment for a number of decisions such as forming the project committee and moving the project through the steps in the systems development lifecycle. A key difference between decisions at this level and semi-structured decisions is the relative absence of DSS or tools to make the decisions related to the novel situation. Following the actual decisions related to moving forward (e.g., what HRIS system to implement, what vendor if any to use, what modules to include, etc.), decision support tools (e.g., project management software to enable collaboration, facilitate communication, schedule activities, track progress and milestones for the project group) would be used to support the implementation. These tools can provide managers with regular information to assist them in navigating this unstructured process. Suffice it to say, implementing large-scale organizational change effort are typically supported by project management tools.

**Proposition 2c.** *Unstructured management control decisions are largely a judgmental process in response to novel situations. The use of DSS tools to support this type of decision-making will focus on supporting the structuring and execution of decision choices during this process.*

### 7.7. Strategic planning and HR decision-making

While the managerial control level focuses on assessing the efficiency and effectiveness of HR activities, the strategic planning level focuses on strategic planning, people and organizational issues. Strategic level planning represents the highest level of decision-making in organizations. Although the strategic level is typically characterized as unstructured overall, involving a high level of uncertainty and judgment, structured strategic planning involves decisions that are primarily dominated by economic considerations. Although the subjective judgment of the manager plays a key role, much of the information utilized is generated by simulations and models that are provided by DSS.

HR can play several roles with respect to organizational strategy: no role, implementation only, input and implementation, and full partnership role (Lawler & Mohrman, 2003). The implementation only role is totally reactive to the business strategy where what is done in HR is driven by the business strategy; the objective of HR is to align its functions to be consistent with, supportive of, and carry out the strategy. The input and implementation and full partnership roles are interactive with HR contributing, at some level to strategy formulation and planning. With respect to HR functions, the highest-level function that is closest to the strategic planning process, is HR planning. As such, a primary strategic role played by HR is to inform and direct the planning, acquisition, development, and allocation of the organization's talent or human capital.

It is at the strategic planning level that HR helps top management formulate business strategy and position itself to implement the strategy, by developing the HR strategy to align its activities to execute the strategy. Key considerations at this level of planning are the relationship of the organization to the environment, planning for the future, and the use of aggregate information. Strategic planning is the process of deciding on an organization's strategic objectives and on the planning required to achieve the objectives and making decisions on resource allocation to pursue the strategy including capital and people. With respect to formulating the business strategy, HR supplies competitive intelligence, information on the strengths and weakness of the company's human capital, and on identifying human resource issues that are vital to business strategy. Specifically, HR needs to identify and communicate the human capital issues that are required to support various strategy scenarios and strategic initiatives by providing alternative insights. The strategy implementation will involve HR functional activity at the managerial control level associated with developing the necessary human capital capabilities and HR activities needed to implement the strategy.

### 7.8. Structured strategic planning

Metrics at the structured strategic planning level measure and provide routine internal and external data related to strategic people and organizational issues. An HRIS with DSS and BI capabilities allow managers to capture and analyze external data, (e.g., labor market projections, cost data on expected benefit increases, and market compensation data) and internal data (e.g., internal workforce transitions, direct and indirect labor costs, leadership capability, talent retention) that involves little independent judgment, but which are based on effectiveness and efficiency metrics. An example of this would be mathematical approaches to HR planning's supply analysis. Historical data on employee movement between jobs and exiting the organization is captured by the HRIS. This information is then analyzed by BI tools through statistical approaches such as Markov analysis that estimate transition probability matrices and this provides the HR decision-maker with expected probability of future internal labor supply. In this example, it is the programmed analysis that alerts the HR manager of the probable gaps between incumbents presently in a position and what is expected at a future date and therefore the need to rectify the anticipated gap.

In addition, it is at the structured strategic planning level where metrics are generated to assess or estimate the value added by HR to the organization. Researchers point out the need for organizations to adopt an agreed-upon set of metrics that link HR activities (e.g., direct labor costs; reduction in defects or scrap) to organizational outcomes (e.g., net revenue) (Lombardi & White, 2009). Once a set of metrics has been decided upon, these can be automatically generated through the BI tools.

**Proposition 3a.** *Structured strategic planning is based on data that is programmable and captured by the HRIS and assessed with DSS and BI tools through algorithmic techniques and analytic tools, such as supply analysis through Markov analysis.*

### 7.9. Semi-structured strategic planning

The semi-structured planning level involves judgment and it is at this level where DSS and BI tools can facilitate strategic decision-making. With respect to HR, it is at the semi-structured planning level where HR contributes to the business strategy formulation process and also where HR develops the HR strategy in response to the business strategy. Both are judgment-based processes that use effectiveness and efficiency metrics. Activities as a strategic business partner including building a persuasive case for what direction the company should take, providing alternative insights on what is feasible and optimal based on the human capital of the organization, and the best way to utilize HR, in light of proposed strategy, to create value for the company. In addition, it is at the semi-structured level of decision-making that the results, or impact, of HR on the organization is assessed.

As noted in Fig. 1, workforce planning is listed as an example of an HR activity in this cell. Workforce planning involves integrating HR and other internal and external data to generate scenario planning. To accomplish this requires an agreed upon set of human capital metrics, the development of a process to aggregate employee data with other organizational data, benchmarking human capital data against external data, and tracking and reporting on human capital performance on a regular basis. Not surprisingly, this process may involve data from multiple sources, the use of sophisticated BI tools, and collaboration between HR, IT, and other core business functions to integrate the data. To function as a strategic business partner and use workforce analytics to enable better decision-making HR leaders need not only to possess a high level of business acumen, HR skills, and a knowledge of the business, but also skills in how to use DSS and BI analytic capabilities.

Uncertainty in the environment, disruptive technologies, changes in the workforce, and economic challenges, increase the challenge of workforce planning. Immediate planning involves aligning existing talent with organizational plans, identifying high potentials, retaining talent, and managing a robust succession planning and development program. Longer term workforce planning involves planning for future staffing requirements that can support the organization's strategic plans and goals. This represents a process that involves both workforce analytics and significant judgment on the part of HR and upper management. Specifically, workforce planning involves the integration of HR and talent data, other organizational data, and external data to perform gap analysis and what-if scenario analysis planning. Although workforce analytics and BI tools can provide decision support and data integration, this process also involves significant judgment by the by the decision-maker. The DSS and BI tools at this level serve to support the complex and strategic managerial decision processes rather than automating decision processes.

**Proposition 3b.** *Semi-structured strategic planning with respect to HR is dependent on DSS and BI that can integrate data from multiple internal and external sources to support complex analyses such as what-if scenarios, to provide support for strategic decision-making.*

### 7.10. Unstructured strategic planning

The final cell in Fig. 1, unstructured strategic planning reflects high level, strategic, and non-routine decisions that are primarily based on judgment and intuition. Examples of this level of decision-making are hiring an executive from outside of the organization, deciding to go into a new line of business, or undertaking a merger or acquisition. Mergers and acquisitions as change events are complex, chaotic, unpredictable, and situationally specific (Ralls & Webb, 1999). HR's role in this type of unstructured strategic planning includes identifying and addressing the human challenges of a particular merger or acquisition, identifying organizational cultural differences, risks, and key talent as well as determining what change management processes would be necessary. A plethora of other HR issues emerge with such planned transitions including establishing communication processes, executing change management, dealing with compensation and benefit issues, workforce reductions, job redesign, etc.

Although decisions at the unstructured strategic planning level will primarily be based on human judgment, some of the decision-making can be facilitated by DSS tools. These tools could include merger and acquisition management solutions such as project portfolio management software for the structural, legal, and financial as well as integration issues. In addition, similar to unstructured management control situations, DSS and BI tools would support the major decision-making process (e.g., to merger or acquire a company) and event. Actually, the implementation of a merger or acquisition is largely at the management control level and is dependent on DSS. Merger and acquisition integration DSS and BI tools provide the means to analyze and integrate data from the merging organizations' HR and financial systems and facilitate progression toward a combined company. Such tools enable HR to conduct what if scenarios, model new organizational structures, create new reporting relationship structures, match talent to positions in the combined organization and track and audit progress.

**Proposition 3c.** *Unstructured strategic planning is primarily a judgment process. DSS and BI tools will facilitate the planning and implementation of these unstructured and strategic decisions.*

## 8. Implications

The framework described above has several implications for both the use of HR metrics as well as for how HR professionals utilize DSS in support of decision-making. First, it illustrates how the information needs and reporting requirements differ

depending on the level of management activity and the degree of structure of the decision. As such, the framework should help HR professionals ask fundamental and informed questions regarding their deployment of HR metrics and DSS. The framework also provides HR managers with insight into what type of metrics they should use at different levels of managerial control and for different degrees of decision structure.

In addition, the framework also suggests that DSS capabilities available through an HRIS are not simply tools to provide metrics to the decision-maker. Instead, DSS can also help managers structure problems, provide them with key data, and support sophisticated analyses which help them make more effective decisions. For example, as noted with structured operational control, the processes can be automated to insure efficiency and compliance. The example used above, applicant tracking and selection, demonstrates that through programming (e.g., minimum cut-off scores for selection tools), the organization enforces standards and the HRIS actually applies the decision rules to assessing candidates.

Although operational data needs to be specific, timely, and accurate, and although decisions can often be automated through algorithms, for decisions which are more strategic, algorithms and mathematical models may become less viable. In fact, they can become counterproductive because they may provide a false sense of simplification. As *Gorry and Scott Morton (1971)* argued, there is a tendency to focus on optimization models, algorithms, and metrics because they are easy to obtain and use. Although this facilitates HR's ability to ask questions based on metrics that are programmed into the DSS, these algorithmic solutions actually may not make HR more effective because the easily derived metrics may not be those which are appropriate as decisions become more unstructured and strategic.

For managers, the data available through the HRIS may lead them to believe that they have everything needed to make effective decisions, yet the very data being collected may mask the inherent complexity of unstructured decisions. The structure of higher level decisions will often be lower than that at the operational level. Fewer managers will be making decisions which occur less regularly and which require greater managerial insight. Because of this, an important question is how HR data should be aggregated to support decisions at higher levels of organizational functioning and whether the types of questions asked at the different levels of organizational functioning change to such an extent that aggregated data is not appropriate. The framework suggests that although much of the underlying data may be drawn from the same sources, the organization and presentation of this data may need to be different based upon decision structure and level of organizational functioning.

For example, research on the use of HR dashboards (as a BI tool) and executive information systems reiterates the complexity of developing DSS support for higher level managers. Because of the need to work closely with executives to provide them with a system which has flexibility in data presentation and multiple DSS capabilities, designers must customize these systems to fit with the way these managers process data and make decisions (*Galliers & Leidner, 2004; Lamont, 2007; Rainer & Watson, 1995*). Successful dashboards are not simply designed to provide managers with aggregated data, but instead need to be designed to provide a variety of internal and external data in a manner that supports their specific approaches to data gathering, simulations, and decision-making. The customization of these systems illustrates the challenges facing designers of dashboards specifically and DSS in general, because data and metrics at different levels of organizational functioning cannot simply reflect aggregations of lower and more precise operational data. In fact, developing metrics and using DSS capabilities, which simply aggregate data to higher levels, as decisions become more strategic and less structured may be problematic as they are less likely to support the needs of managers at these higher levels.

One of the goals of utilizing metrics and DSS tools is to make decision-making more efficient and effective. As the framework illustrates, moving from the top left to the bottom right in the framework, decisions increase the importance of effectiveness while reducing the importance of efficiency. Although the goal of efficiently processing thousands of applications for an open position and the measurement of successful hires are important goals, efficiency is not as important when a firm is considering how to deliver HR functionality (e.g. outsourcing, using technology, shared services, etc.). In this case, a myriad of key internal and external data and benchmarks are needed to inform HR managers as they seek to structure a decision and make the most effective decisions regarding the programs implemented.

The framework also suggests an interesting pattern regarding the development of metrics and the standardization of decision-making. Many decisions made by managers at the managerial and strategic level are not completely structured. Yet as time progresses and managers make certain decisions repeatedly, they become more structured and the process for solving the problem becomes more routine. As this occurs, HR managers can work to strengthen metrics associated with these decisions and linking HR decisions to organizational outcomes. It also suggests the need for HRIS vendors and software developers to work closely with HR professionals in the design of HRIS. By working closely, they can develop greater flexibility in the software which can allow the organization to incorporate new metrics and evolve the decision-making process as managers gain more experience with HR practices and the system.

The framework also suggests potential for risks with the use of metrics and DSS in the support of HR processes. When technology is institutionalized into operational processes and helps organizations optimize decisions, such as assigning workers to tasks, there is a tendency for managers to rely on the data provided by the system and to manage and evaluate employees exclusively by monitoring system data (*Zuboff, 1988*). In addition, although *Gorry and Scott Morton (1971)* argued that enterprise-wide, fully integrated organizational databases would be prohibitively expensive and basically infeasible to develop, today most large organizations have such systems, through their ERP and HRIS. The increased ability to aggregate data empowers HR professionals to be able to ask an ever greater number and type of questions. Despite this, we caution researchers and scholars to carefully examine their use of aggregated data and not simply assume that strategic data is simply the aggregate of operational data.

In addition, there are some issues associated with the use of these new, sophisticated DSS tools that are now available. One of the effects of the implementation of HRIS is the reduction of HR staffing (*Gueatal, Marler, & Falbe, 2007*), pushing more decision-

making authority out of the hands of HR and IT professionals and into the hands of employees or “end-users”. Employees and managers are now making decisions, which were once done by HR, and along with the growth in the use of these tools is that there is often a breakdown in the relationship between HR and end user decision-makers. With the implementation of HRIS the number of HR professionals is reduced and their expertise often becomes more specialized and less general (Bloom, 2001; Gueutal et al., 2007). This creates risks for employees and managers because they may have to make decisions with HR implications without the assistance of an HR professional to help them understand the broader implications of these decisions. Instead, they will need to rely on the capabilities of the system to provide them the data.

In addition, as employees gain experience with these tools they will continue to demand more access to data and greater capabilities of their DSS tools (Johnson & Gueutal, 2011). In response to this, software designers are increasingly incorporating flexibility and customization options in their offerings. No matter how well designed systems are, they “will still need to be customized to the needs of particular users” (Myers, Hudson, & Pausch, 2000, p. 21). Many of today's end-users desire the opportunity to adapt the DSS tools to their needs through techniques such as programming macros, writing queries, or developing simulations and scenarios within the system. The challenge is that not everyone will be able to do so effectively.

A final issue with the growth in capability of these systems and use is that ERPs and other large scale systems can be so complex and opaque to end users that they rely on them without necessarily understanding the underlying logic and assumptions designed into the models and metrics used (Perrow, 1999). End users can end up assuming that that certain assumptions were made or factors were accounted for, or that the computer is making the decision (even if it was not designed to do so) (Johnson, Marakas, & Palmer, 2008). Together each of these implications suggests that along with the benefits to be gained by applying metrics and DSS tools in HR, organizations must take care to ensure that employees and managers have access to appropriate HR expertise and that the design and implementation of these DSS tools is not done in such a way as to encourage inappropriate reliance on these tools. Future research which focuses on these design issues would be beneficial.

## 9. Conclusion

One of the central purposes of HRIS in organizations is to provide accurate, timely, and relevant data to support HR decision-making. As HRIS have evolved over time, they have provided HR managers with an ever increasing variety of data in support of HR metrics which help HR effectively contribute to the operational, managerial and strategic levels of the organization and communicate its value. As this study highlights, the challenge is that although HR professionals have developed a greater array of metrics, a lack of guidance has existed with respect to where to apply those metrics, and to incorporate them into DSS and BI tools in order to add value to HR. Therefore, in this study we have outlined a framework to provide some guidance to researchers and managers. As part of this framework, we outlined what type of metrics and DSS fit HR activities in terms of the level of organizational functioning and decision structure involved. In addition, we discussed the various implications of the framework for HR data capture and HR decision-making. Finally, the propositions we have listed provide suggestions for future research which in turn will lead to more refinement with respect to what metrics and DSS and BI capabilities can best support the wide range of HR activities in organizations today.

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