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Measuring the ROI of Management Development: An Application of the Stochastic Rewards Valuation Model

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ABSTRACT

There is growing recognition that the core economic resources of the current era are human and intellectual capital, rather than physical assets such as inventories, plant, and equipment. Given the increasing importance of human capital and intellectual property as determinants of economic success at both the macroeconomic and enterprise levels, it is clear that the nature of investments made by firms need to shift to reflect the new economic realities. Specifically, if human capital is a key determinant of organizational success, then investments in training and development of people also become critical. In turn, there is a need to develop concepts and tools for monitoring and evaluating management development programs in terms of their impact, results, and value or return on investment. The specific objective of this article is to draw upon the concepts and measurement approaches of the field that has come to be known as "human resource accounting" and show how they, specifically the stochastic rewards valuation model, can be used as tools for the measurement of the value of investments in training programs designed to increase the value of human capital.

INTRODUCTION

Over the past few decades, most of the world's advanced economies have made a gradual yet fundamental transformation. They have shifted from industrial economies in which plant and equipment are the core assets to "post-industrial economies" in which human capital and intellectual property are the core assets. This transformation is evident not only in the economy as a whole, but in the very organizations of which it is comprised. The shifting fortunes of specific organizations are concrete manifestations of the general and broad trend toward a human capital intensive economy. While most firms in the industrial era, by definition, relied on manufacturing capabilities, companies in the post-industrial era now rely almost completely on knowledge and information (or intellectual capital) for survival and profit. While long dominant companies such as U. S. Steel, General Motors, and International Harvester have gone into decline, companies such as Microsoft, Intel Corporation, and Amgen have emerged as the hallmark of the new era. In the former era, the basis of competition was investments in inventories, plant and equipment, while the core economic resource of the new era companies is clearly human capital and intellectual property (which is created by and ultimately a manifestation of human capital). In this era, the potential success of an organization lies in its intellectual capabilities rather than in its physical assets. Accordingly, organizations must pay particular attention to the development and deployment of intellectual capital (Belasco and Stayer, 1994; Pfeffer, 1996). Intellectual capital, as defined here, is the sum of human capital and intellectual property. Unfortunately, accounting (both financial and managerial) has not responded to this change in circumstances. The accounting paradigm and related measurement technology have not been re-conceptualized to account for this economic transformation.

MEASURING THE RETURN ON INVESTMENT OF MANAGEMENT DEVELOPMENT

Management development programs are intended to help personnel gain the skills necessary to be successful managers. Development of managerial skills increases the potential of employees to provide services to the organization and, in turn, increases their value to the organization by increasing their productivity, promotability, and transferability.

Management development is an expensive process. It involves both outlay costs and opportunity costs made as investments. Currently investments in management development are made based upon faith of the potential payoff, because there is no measurement of the value derived or the return on investment.

The technology known as Human Resource Accounting ("HRA") provides a way to assess the increased value contributed by management development. It provides a method of calculating whether the change in value results in a positive return on investment in management development.

The purpose of this article is to describe how HRA can be used as a tool to measure the value and return on investment of management development programs. Specifically, it shows how a model for human resource valuation, known as the "stochastic rewards valuation model," can be used to assess return on investment in management development. First, we will present the theoretical background on the nature of human resource value, and then present the stochastic model of human resource valuation. Next we will describe how the model can be applied in organizations and then illustrate its application to measure the return on investment in management development programs.

THEORETICAL BACKGROUND

Unlike other resources, human beings are not owned by organizations, and hence they are relatively free to supply or withhold their services. From an organization's viewpoint, this means that the probability of realizing an individual's services is typically less than certainty. Accordingly, there is a legitimate debate as to whether human capital qualifies as an organizational asset in terms of conventionally defined "assets" (i.e., things of value "owned"). However, if we were to view "assets" as things of value "controlled" by an enterprise (with ownership being the strongest form of control), then our perception might shift. Although it is arguable whether human resources are assets in the technical sense as the term had been defined in the previous era, there ought to be no doubt that they are indeed economic resources and a form of capital - human capital. Human capital, in essence, is as important to a firm's success as is financial and physical capital. Accordingly, whether or not human capital is reported in external financial statements, it is a critical economic resource, and as such, it needs to be managed. In turn, since measurement helps to facilitate management, human capital needs to be measured.

THE STOCHASTIC PROCESS AND EMPLOYEE VALUE

The possibility that people can leave organizations does not eliminate them as capital, it merely creates a dual aspect to an individual's value as an organizational resource. Specifically, we can conceptualize a person's value to an organization under two different conditions: 1) remaining as an economic resource for the full period of the potential economic benefit or "service life," and 2) remaining as an economic resource for less than the full period of economic benefit or service life. Drawing on this distinction, *expected conditional value* refers to the amount the organization could potentially realize from the employee's services during the period of his or her productive service life. Secondly, expected realizable value is the amount actually expected to be derived, taking into account the person's likelihood of turnover. The ultimate measure of a person's value is more commonly considered to be *expected realizable value* because this concept is equivalent to the general notion of a resource's *economic value* - the present value of its expected future services.

One method that has been developed to measure the value of individuals, groups, and the human side of the organization in general is the *stochastic rewards valuation model* (Flamholtz, 1971, 1985, 1999). This model combines the notion of a stochastic process (which itself refers to any system that functions in accordance with probabilistic laws) and the rewards model (which integrates rewards, or values derived, into the stochastic process.)

A *stochastic process* refers to any natural system that operates in accordance with probabilistic laws. For example, the weather is a stochastic process. On a given day, there is a certain probability that it will be clear, that there will be rain, that there will be snow, and so forth. Similarly, the movement of people through an organizational hierarchy is a stochastic process. In time, people move through the organizational hierarchy from one service state to another. These movements from state to state are termed *state transitions* or, more simply, *transitions*.

In certain stochastic processes, *rewards* are derived as the system's elements make transitions from one state to another. The rewards are, in other words, the benefits derived by the system. This type of stochastic profess is termed a stochastic process with rewards.

In an organizational hierarchy, people move from one role to another in a probabilistic manner. As people occupy specified organizational roles, they render services (rewards) to an organization. Thus the movement of people from one role to another in an organization is an example of a stochastic process with rewards.

According to the stochastic rewards valuation model, people are valuable to an organization precisely because of the fact that they are capable of rendering future services. The services that people render to a company depend on the set of present and potential roles they may occupy in an organization's structural hierarchy as well as the likelihood that they will actually occupy those roles. The following example illustrates how individual value to an organization can be viewed as a stochastic process with service rewards.

Assume, for example, that a person is currently a staff accountant for a CPA firm. Based on the firm's experience, we have determined that this person has a specified probability of doing one of four possible things during the coming year: (1) remaining in his or her present position (which is termed "productivity"), (2) being promoted to the next higher position (which is termed "promotability"), (3) being transferred to a different position (which is termed "transferability"), and (4) leaving the firm, either voluntarily or by request (which is termed "exit"). The services that people are expected to render to an organization are determined by their productivity, promotability, transferability, and probability of retention.

The value of the person to the firm depends on the value of each of the four possible things the person might do during the coming year. Each possibility (i.e., productivity, promotability, transferability, and exit) represents what we shall call a "service state". Service states are different conditions an individual might occupy in a firm, thus performing different levels of service. For example, assume that an individual is a staff accountant in a CPA firm. If the person is promoted to the next job classification (associate), that is a second level or state of services. If the person leaves the firm, we also view that as a service state (the state of exit). If the person remains a staff accountant, the firm might, for example, derive a value of $40,000 for the coming year, while if the person became an associate the firm might derive a value of $55,000. If the person left the firm at the beginning of the next year, however, the firm would derive a value of zero, while if he or she left sometime during the year, the firm would derive some value from the services that the person performed while still a member of the firm.

As seen in the foregoing illustration, the value of an individual to a firm depends on the value of the service states the person will occupy in an organizational hierarchy (present position, next higher position, exit, and so on) as well as the probabilities that the person will occupy each possible service state. This means that the value of human resources to a firm is based on a stochastic, or probabilistic, process.

The mathematical statement of these concepts described above, in algebraic terms, is as follows:

(1) $ERV = ECV \times P(R)$
(2) $P(R) = 1 - P(T)$
(3) $OCT = ECV - ERV$

Where: ERV = expected realizable value
ECV = expected conditional value
P(R) = probability of maintaining organizational membership
P(T) = probability of turnover
OCT = opportunity cost of turnover

THE STOCHASTIC REWARDS VALUATION MODEL

Based on the preceding concepts, one method that has been proposed for measuring a person's value to an organization is termed the *stochastic rewards model* for human resource valuation. This section describes the formal model and explains how it can be used to measure an individual's expected conditional and realizable values to an organization.

ELEMENTS OF THE MODEL

We can measure an individual's expected conditional and realizable value to an organization by means of a stochastic rewards valuation model. To do this, the following steps must be taken:

Step 1: Define the mutually exclusive set of states, or service states, an individual may occupy in the organizational system, or organization.
Step 2: Determine the value of each state to the organization, or the service state values.
Step 3: Estimate a person's expected tenure, or service life, in the organization.
Step 4: Find the probability that a person will occupy each possible state at specified future times.
Step 5: Discount the expected future cash flows to determine their present value.

The first step is to define the various states of the "system" or organization. The states should be defined to include the various organizational roles and the state of exit, as shown in Table 1. Because we are dealing with a stochastic process with rewards, we call each of these states *service states*. This implies that we expect to derive a specified quantity of services when an individual occupies a particular service state for a given time period. The service states of "exit" means a person has left the organization and the services to be derived in the state are zero.

Table 1. Organizational service state matrix.

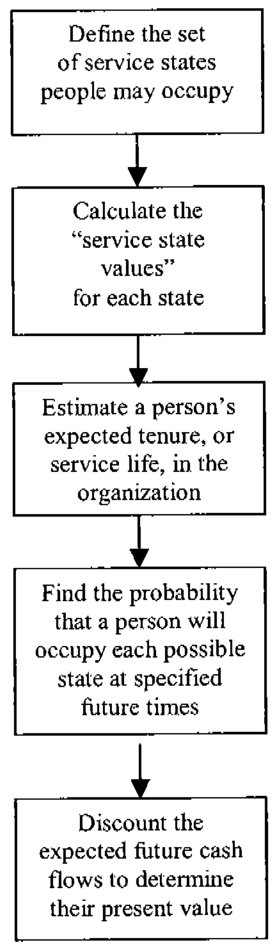
	Organizational Groups		
Organizational Levels	Marketing	Manufacturing	Finance
Top management			
Middle management			
First-line supervisors			
Operating personnel			
	Exit		

The second step is to determine the value the organization derives when an individual occupies each service state for a specified time period. We call these values *service state values*.

The third step is to estimate a person's future tenure in the organization - this is the valuation period or service life. The fourth step is to estimate the probability that a person will occupy each possible state at specified future times. For example: what is the probability that a person who is presently a first-line supervisor in marketing will still be a first-line supervisor in marketing at the end of one year? What is the probability that this person will be a first-line supervisor in manufacturing? What is the probability this person will be a middle manager? What is the probability that this person will have left the firm? Finally, we must determine the present value of the expected future benefits by discounting the expected future cash flows in order to determine their present value. Figure 1 below is a flow diagram, which illustrates the various steps involved in the stochastic rewards valuation model.

Stated symbolically, the stochastic rewards valuation model requires that we define the set of i possible service states, where $i = 1, 2, \ldots, m$, and m is the state of exit. Second, we must determine

Figure 1. Steps in the application of the stochastic rewards valuation model to the evaluation of management development programs.



the value to the organization of each of the *i* service states, where R_i denotes the set of *i* possible service state values: R_1, R_2 + . . . + R_m. Since, by definition, R_m denotes the state of exit, the service state value of R_m will be zero-a person who occupies the state of exit is of no value to an organization. Third, we must estimate a person's expected service life (tenure) in the organization, where *t* denotes expected tenure. Next we must find the probability that a person will occupy each of the *i* possible positions at a specified future time. This is the probability that the organization will derive the rewards associated with different service states. It is denoted $P(R_i)$, which includes $P(R_1) + P(R_2) + \ldots + P(R_m)$. Finally, we must discount the expected future cash flows derived from service state values to their present worth (discounted value).

MEASUREMENT OF EXPECTED CONDITIONAL VALUE

Drawing upon this model, we can now symbolically define a person's expected conditional value as:

Expression (1)
where E(CV) is the expected conditional value; R_i is the value *R* to be derived by the
is $1,110 ($11,270 -$10,160). This is, of course, attributable to a probability of turnover of 0.10.

$$E(CV)=\sum_{t=1}^{n}\left[\frac{\sum_{i=1}^{m-1} R_i \bullet P(R_i)}{(1+r)^t}\right]$$

organization in each possible service state i; $P(R_i)$ is the probability that the organization will derive R_i (the probability that a person will occupy state i); t is time; m is the state of exit; and $(1 + r)^t$ is the discount factor for money. In words, this expression simply means that an individual's expected conditional value is the discounted mathematical expectation of the monetary worth of the future rewards (services) the person is expected to render to an organization in the future roles (positions) expected to be occupied, when we ignore (by holding constant) the probability of turnover.

Expression (1) tells us how to measure conditional value. It literally says: For each time period (t = 1 to n), calculate the discounted mathematical expectation (expected value) of the rewards a person will generate for an organization $[\Sigma R_i \bullet P(R_i)/(1 + r)^t]$, assuming that the person will not leave the organization. Recall that by definition the variable expected conditional value is the present worth of the potential services that are expected to be rendered to the organization if the individual maintains organizational membership throughout his or her expected service life.

MEASUREMENT OF EXPECTED REALIZABLE VALUE

Drawing on the model, we can symbolically define a person's expected realizable value as

Expression (2)

$$E(RV)=\sum_{t=1}^{n}\left[\frac{\sum_{i=1}^{m} R_i \bullet P(R_i)}{(1+r)^t}\right]$$

where all symbols have the same meaning as in Expression (1). The difference between these two expressions is that the service states include the state of exit ($i = m$) in the latter expression but not in the former. Recall that by definition the variable expected realizable value is the present worth of the services an organization actually expects to derive from an individual during the person's anticipated tenure in the organization. Conceptually, it is the product of conditional value and the probability that the person will maintain organizational membership.

RELATION BETWEEN THE VARIABLES

A person's expected conditional and realizable values can be equal if, and only if, the person is certain to remain in the organization throughout his or her expected service life. If the probability of turnover exceeds zero, expected conditional value must exceed realizable value, as shown Table 2. This table illustrates the calculation of these measures for an individual in an insurance company, assuming an expected service life of one year. As the table shows, the probability of exit is 0.10. To calculate expected conditional value, the probabilities of occupying each position must be transformed, so that their sum is 1.00. The transformation simply involves dividing each individual probability by the sum of the probabilities of occupying the three positions (0.10 + 0.50 + 0.30 = 0.90). For example, the conditional probability of occupying the position of office adjuster is 0.11 (0.10/0.90). Thus, the difference between the person's expected conditional value and expected realizable value in the example

Table 2. Illustration of calculation of expected conditional and realizable value.

I. Expected Conditional Value (1) Service States	(2) Expected Service State Values	(3) Conditional Probabilities of Occupying Each State	(4) Product [(2)x(3)]
Office adjuster	$ 7,800	.11	$ 860
Claims examiner	9,700	.56	5,430
Senior examiner	15,100	.33	4,980
Expected Conditional Value			$11,270
*II. Expected Realizable Value** (1) Service States	(2) Expected Service State Values	(3) Realizable Probabilities of Occupying Each State	(4) Product [(2)x(3)]
Office adjuster	$ 7,800	.10	$ 780
Claims examiner	9,700	.50	4,850
Senior examiner	15,100	.30	4,530
Exit	0	.10	0
Expected Realizable Value			$10,160

*Probability of exit = .10.

Given that the stochastic rewards model serves as a reliable method of valuing individuals, it is also important to understand the value of people as members of groups. In organizations, unlike geometry, the whole does not always equal the sum of its parts (hence the concept *synergism,* which holds that the cooperative action of discrete agencies creates a total effect which is greater than the sum of the effects of the agencies acting independently.)

APPLICATION OF THE STOCHASTIC REWARDS VALUATION MODEL

This section discusses the issues involved with applying this model in a practical way to an actual organization. To do this, it is necessary to define a set of service states, derive a measure of the value of each state, and estimate an individual's expected service life and the probabilities that the individual will occupy each service state at each point during his or her expected service life. The basic practical problem involved in applying this model in real world organizations is the difficulty of obtaining valid and reliable data inputs of the value of a service state, a person's expected service life, and the probabilities of occupying states at specified times. The problems of measuring each of these elements of the model are discussed below.

MEASUREMENT OF SERVICE STATE VALUES

Ideally, the appropriate measure of the value derived when an individual occupies a specific service state for a time period is the discounted future earnings contributed to the firm (or *economic value*). In principle, this can be measured by either what may be termed the *price-quantity* method or the income method. The *price-quantity method* involves determining the product of the price per unit of human services and the quantity of expected services. For example, in a CPA firm, we can obtain measurements of the product of a person's "net chargeable hours" to clients and his or her applicable billing rate. This is a measure of the gross contribution to profit that the individual makes. (We must, of course, deduct payments to the individual for salary to derive a measure of his or her net contribution.) The *income method* involves forecasting the expected earnings of a firm and allocating them between human and other resources and further allocating them among specified people.

In human capital intensive organizations (including service organizations such as legal, engineering, CPA, and advertising firms), the problems of measuring service state values are *relatively* small. However, there are many organizations in which it is very difficult, if not impossible, to obtain a measure of a service state's value by either the price-quantity or the income methods. In these companies, we may be able use a surrogate or proxy measure of a service state's value such as compensation. As an alternative approach, we may use transfer pricing as a means of developing the service state values. A *transfer price* is an internally designated price for the exchange of goods or services within an organization. These are, however, issues that must be solved on a case by case basis.

MEASUREMENT OF EXPECTED SERVICE LIFE

The stochastic rewards valuation model uses a valuation period equal to a person's expected service life. Service life is influenced by many factors, including the individual's natural life expectancy, his or her health and emotional state, the organization's retirement policies, and the person's inter-organizational mobility. Since these factors cannot be known with certainty, we must measure the individual's service life probabilistically. We refer, therefore, to *expected service life*, meaning the mathematical expectation of service life. There are two ways to measure a person's expected service life: by using historical experience to develop actuarial predictions and by subjective forecasts of future probabilities.

MEASUREMENT OF MOBILITY PROBABILITIES

A critical input required to apply the stochastic rewards valuation model is the human resource mobility probabilities or transition probabilities. These probabilities can be measured or derived by two methods: actuarial prediction and subjective prediction.

The actuarial method (based on the use of Markovian transition matrices) is described here. A Markovian transition matrix assumes that the probability of the "system" (in this case an individual) being state "j" in a period depends only on the probability of the system having been in state "i" during the prior period (Howard, 1960).

There are three steps involved in the calculations of the mobility probabilities, each of which is explained in greater detail in the section that follows:

Step 1: The firm must compile a data base of personnel hires, transfers, promotions, and exits for all employees.
Step 2: The data must be aggregated to determine the transitions from one side to another.
Step 3: The mobility or transition probabilities can then be derived from the frequency count of the state-to-state transitions.

The organization must first compile a historical database dealing with the movement of people in the firm. This database must indicate the person's positions in the firm during each year since he or she was hired. As shown in Table 3, for example, Mr. Abel was hired during 1998 as an assistant accountant. In 1999 he was still an assistant. In 2000 he became a "associate," and he left the firm in 2001.

From this historical database, the number and types of state-to-state transitions made during each year must be counted. Counting may be done manually or, preferably, with a computerized database program. Table 4 shows a state transition matrix.

The matrix shows that there are four possible service states: assistant, associate, senior, and exit. The matrix has the same set of rows and columns. It should be interpreted as follows: How many people who were in a given state in year T will be in any of the four service states in the next year (T + 1)? For example, there were fifty seniors in year T; of those fifty, thirty will still be seniors and twenty will exit by year (T + 1). Similarly, there were forty assistants in year T; of these, ten will still be assistants, twenty will be associates, none will be seniors, and ten will exit by year (T + 1). Thus the transition matrix shows the frequency of state-to-state transitions during a time period (in this example, one year).

Table 3. Historical database for human resources.

PERSON	*1998 JOB LEVEL*	*1999 JOB LEVEL*	*2000 JOB LEVEL*	*2001JOB LEVEL*
Abel	Assistant	Assistant	Associate	Exit
Barry	Senior	Senior	Exit	Exit
Cando	Associate	Senior	Senior	Senior
Donenow		Assistant	Assistant	Exit

Table 4. Frequency count of transitions.

	Year T +1				
Year T	Senior	Associate	Assistant	Exit	Total
Senior	30	0	0	20	50
Associate	20	20	0	20	60
Assistant	0	20	10	10	40
Exit	0	0	0	40	40

The mobility probabilities can be directly derived from the frequency count of the transitions. Suppose the frequency count is as in Table 4. (Note that this count represents totals from several years of historical data.) These frequencies are transformed into probabilities, as shown in Table 5. For example, the probability that a staff assistant will make the transition to an associate in the following year would be 20/40 or 50 percent. Similarly, there is a 25 percent (10/40) chance that the person will remain a staff assistant and a 25 percent (10/40) chance of exit (or turnover) from the firm. The transition matrix in this example is shown in Exhibit 7.

Table 5. Transition matrix.

	Year T + 1			
Year T	Senior	Associate	Assistant	Exit
Senior	60%	0	0	40%
Associate	33%	33%	0	33%
Assistant	0	50%	25%	25%
Exit	0	0	0	100%

SUMMARY OF THE MODEL'S APPLICATION

As described above, the application of the stochastic rewards valuation model is a five-step process:

Step 1: Define the mutually exclusive set of states, or service states, an individual may occupy in the organizational system, or organization.
Step 2: Determine the value of each state to the organization, or the service state values.
Step 3: Estimate a person's expected tenure, or service life, in the organization.
Step 4: Find the probability that a person will occupy each possible state at specified future times.
Step 5: Discount the expected future cash flows to determine their present value.

ILLUSTRATION OF THE STOCHASTIC REWARDS MODEL

This section illustrates the application of the stochastic rewards valuation model described above. The illustration continues our example of the value of a staff member in a CPA firm. A CPA firm is being used as the context for illustration for three primary reasons: (1) it is an example of a human capital intensive firm, (2) it provides an example of how this type of firm can be generalized to other human capital intensive firms including all professional organizations (law firms, engineering firms, and the like), and (3) because such firms typically have most of the data available to apply the model in a relatively straightforward manner. The model can also be applied to other types of firms, but additional procedures must first be developed to facilitate the application. We shall use the audit department of a CPA firm for this illustration. The firm has seven service states. As shown in Table 6, these states include the state of exit as well as six other job classifications an individual may occupy.

Table 6. Service states.

State Number	*State Name*
7	Exit
6	Partner
5	Manager-heavy*
4	Manager-light*
3	Senior
2	Staff-heavy*
1	Staff-light*

*The labels "heavy" and light" refer to differences in levels of service potential.

Each of these states has a gross and net service state value, as depicted in Table 7. The *gross service state value* is the amount of the expected chargeable hours of services to be rendered by the staff member to clients multiplied by that person's billing rate. It is a measure of the gross revenue contribution of the individual to the firm and thus involves treating the individual as a revenue center. The *net service state* value is the difference between gross service state value and the cost of the individual to the firm. In principle, this difference is attributable to the process of having a person provide services to clients. Net service state value is, therefore, a measure of an individual as a profit center.

Table 7. Service state values.

State Number	*State Name*	*State Value: Gross*	*State Value: Net*
7	Exit	-0-	-0-
6	Partner	$60,000	$15,000
5	Manager-heavy	$45,000	$14,000
4	Manager-medium	$35,000	$13,000
3	Senior	$25,000	$12,000
2	Staff-heavy	$20,000	$11,000
1	Staff-light	$15,000	$10,000

To determine a person's value to a firm, it is necessary to calculate probabilities that the individual will occupy each possible service state at specified future times. This information is derived from the transition matrices previously described. The information concerning the expected mobility of Robert

Walker, one of the firm's staff members, is shown in Table 8. To calculate a person's value to a firm, we also need information about the cost of money or discount rate. For purposes of this illustration, assume that the firm's current cost of capital is 10 percent.

Table 8. Mobility probabilities for Robert Walker.

Individual #1	States						
Year	1	2	3	4	5	6	7
1	.5	.3	0	0	0	0	.2
2	.1	.7	0	0	0	0	.2
3	0	.7	.1	0	0	0	.2
4	0	.4	.4	0	0	0	.2
5	0	.1	.6	0	0	0	.3
6	0	0	.4	.3	0	0	.3
7	0	0	.1	.5	0	0	.4
8	0	0	0	.5	0	0	.5
9	0	0	0	.3	.2	0	.5
10	0	0	0	0	.2	0	.8
11	0	0	0	0	0	0	1.0

Given this information, it is feasible to calculate an individual's expected conditional value and expected realizable value. Using the logic in the formulas shown previously in Expressions (1) and (2), Tables 9 and 10 show the calculations of expected realizable value and expected conditional value, respectively. The tables are set up in a format that can easily be converted to an electronic spreadsheet such as Excel. Note that in Table 9 calculating expected realizable value, the probability of turnover is considered; thus the total of the realizable probabilities of being in expected service states is 1 less the probability of turnover. On the other hand, as shown in Table 10, the calculation of expected conditional value assumes that the probability of turnover is 0. Thus, as previously explained in this paper, the probabilities assumed in the conditional calculation are derived by dividing the equivalent realizable probability by the sum of the realizable probabilities of all expected service states, not including the exit state. This is shown in Table 10 simulating an Excel electronic spreadsheet. The results of the calculations show that expected realizable value is $49,130 and expected conditional value is $72,571; the difference of $22,532 between these two values is the expected opportunity cost of turnover.

USING THE STOCHASTIC REWARDS MODEL TO MEASURE THE VALUE AND RETURN ON INVESTMENT OF MANAGEMENT DEVELOPMENT PROGRAMS

Management development programs are intended to help personnel gain the skills necessary to be successful managers. Development of managerial skills increases the potential of employees to provide services to the organization and, in turn, increases their value to the organization by increasing their productivity, promotability, and transferability. HRA provides a way to assess the increased value contributed by management development. It also provides a method of calculating whether the change in value results in a positive return on investment in management development. In the stochastic rewards model for the valuation of human resources, the necessary steps include: identifying the service states of relevance, determining the values of these states, calculating the probability using a matrix method and, finally, calculating the expected realizable value of each.
The following example shows how HRA, and the stochastic rewards valuation model in particular, can be used to evaluate management development and training programs. It is based upon an actual organization, but details have been changed both for the privacy of the organization and for the simplicityof the illustration.

Table 9: Expected realizable value.

A	B	C	D	E	F	G	H	I
Year	Prob. of Turnover	Service State	Realizable Prob. of Service State	Service State	Realizable Prob. Of Service State	Sum Products [(CxD)+ (ExF)]	PV of Single Sum Factor 10%	Expected Realiz. Value (GxH)
1	.2	10,000	.5	11,000	.3	8,800	.90909	$8,000
2	.2	10,000	.1	11,000	.7	8,700	.82645	7,190
3	.2	11,000	.7	12,000	.1	8,900	.75132	6,687
4	.2	11,000	.4	12,000	.4	9,200	.68301	6,284
5	.3	11,000	.1	12,000	.6	8,300	.62092	5,154
6	.3	12,000	.4	13,000	.3	8,700	.56447	4,911
7	.4	12,000	.1	13,000	.5	7,700	.51316	3,951
8	.5	13,000	.5			6,500	.46651	3,032
9	.5	13,000	.3	14,000	.2	6,700	.42410	2,841
10	.8	14,000	.2			2,800	.38554	1,080
Total Expected Realizable Value								$49,130

Table 10: Expected conditional value.

A	B	C	D	E	F	G	H	I	J	K
Year	Prob. of Turn-over	Service State	Realiz-able Prob. of Service State	Cond. Prob. of Ser. State [D/ (D+G)]	Serv. State	Realiz able Prob. Of Serv. State	Cond. Prob. of Serv. State [G/ (D+G)]	Sum Products [(CxE)+(F xH)]	PV of Single Sum Factor 10%	Expect Cond. Value (IxJ)
1	.2	10,000	.5	.625	11,000	.3	.375	10,375	.90909	$9,432
2	.2	10,000	.1	.125	11,000	.7	.975	11,975	.82645	9,897
3	.2	11,000	.7	.875	12,000	.1	.125	11,125	.75132	8,358
4	.2	11,000	.4	.5	12,000	.4	.5	11,500	.68301	7,855
5	.3	11,000	.1	.143	12,000	.6	.857	11,857	.62092	7,362
6	.3	12,000	.4	.571	13,000	.3	.429	12,429	.56447	7,016
7	.4	12,000	.1	.167	13,000	.5	.833	12,833	.51316	6,585
8	.5	13,000	.5	1				13,000	.46651	6,065
9	.5	13,000	.3	.6	14,000	.2	.4	13,400	.42410	5,683
10	.8	14,000	.2	.8				11,200	.38554	4,318
Total Expected Conditional Value										$72,571

PROBLEM STATEMENT

Omicron, a medium-sized, high-tech firm, encourages present and potential managers to enroll in university-sponsored training programs. The company provides a small stipend for those who choose to attend, but the individual must schedule the courses so that they do not conflict with work hours. Although only about half of all managers have traditionally attended these programs, the company believes that those who attend are better prepared for the responsibilities of the managerial role. The company also believes that these programs increase the effectiveness of its managers and hence their productivity. These beliefs are based, in part, on the opinions of supervisors, peers, and instructors.

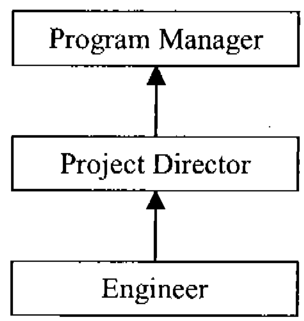
Recently the new president, Kevin Hartman, has begun to question the worth of these management development programs. Hartman has suggested that in terms of management potential, there is no difference between those who participate in these courses and those who do not. He has also suggested that if this is the case, the programs are costing the firm more than the benefits actually derived.

The corporate controller of human resources, John Lockwood, does not agree. He believes that the programs should continue, although he has experienced difficulty quantifying their value to the firm. Lockwood has heard about HRA and, in fact, has recently hired a consultant who is familiar with this field. He has asked the consultant to perform a study assessing the effects of participation in management development programs on the person's value to the firm. The analysis performed by this consultant is described in the following paragraphs.

IDENTIFICATION OF SERVICE STATES

The first step in using the model for valuation of human resources is to identify the service states of interest. The relevant portions of the career ladder are presented in Figure 2.

Figure 2. Career ladder of an engineer.



Based on this career ladder, the service states of interest were identified as:

1. Program Manager
2. Project Director
3. Engineer
4. Exit State

"Engineer" was identified as the primary position of interest-that is, the organization was interested in how participation in a management development program affected the value of a person currently occupying the position of engineer.

DETERMINATION OF SERVICE STATE VALUES

The consultant next needed to identify the values of each service state. Since the company billed its personnel on contracts, the consultant calculated the service state values by multiplying the billing rates and expected chargeable hours for each service state classification, less the compensation paid to the person occupying each service state. Accordingly, each service state value is the expected net profit contribution (before administrative charges or corporate overhead) for each position. The service state values derived from this procedure are presented in Table 11.

Table 11. Service state values for engineer career ladder.*

Service State	Value
Exit	$0
Engineer	$27,000
Project Director	$33,000
Program Manager	$40,000

*Service State Value: Billing Rate x Chargeable Hours = Compensation (i.e. Net profit contribution margin)

Unfortunately, it is not always feasible to obtain service state values directly, as shown above. In such circumstances it will be necessary to obtain proxy or surrogate measures of service state values. As noted previously, this can be done by means of transfer pricing. At present, the technology for using transfer pricing in this way has not been developed. This will require future research, but it remains a possibility. Another alternative is the use of non-monetary measures of human resource value.

CALCULATION OF TRANSITION MATRICES

The consultant was able to obtain information on the types of state-to-state transitions made by 200 employees for a period of 10 years. The consultant was also able to separate those individuals who had completed a management development program from those who had not, since this company made it a policy of noting such participation in its personnel files. One hundred employees in the sample had participated in such programs and one hundred employees had not.

From this information, the consultant was able to construct two transition matrices: one for those who did not participate in management development programs and one for those who did. These matrices are presented in Tables 12 and 13, respectively.

Table 12. Transition matrix for non-participants in management development program.

	Year T + 1			
Year T	*Program Manager*	*Project Director*	*Engineer*	*Exit*
Program Manager	60%	0	0	40%
Project Director	35%	35%	0	30%
Engineer	0	25%	50%	25%
Exit	0	0	0	100%

Table 13. Transition matrix for participants in management development program.

	Year T + 1			
Year T	*Program Manager*	*Project Director*	*Engineer*	*Exit*
Program Manager	65%	0	0	35%
Project Director	45%	35%	0	20%
Engineer	0	40%	40%	20%
Exit	0	0	0	100%

A comparison of these two matrices suggests that participation in a management development program increases the likelihood of being promoted. An examination of the engineer and project director service states within the two matrices reveals that the probability of promotion to the next service state increases by approximately 10 to 15% with participation in a management development program. Moreover, probability of exit decreases by approximately 5% with participation. This finding suggests that participation in these programs may not only increase the probability of promotion but may also increase the probability of individuals remaining with the firm. Both changes in the matrix affect the value of individuals to the firm. In the absence of service state values, the difference between a participant of training and a non-participant of training is clear. Thus, given a situation where service state values are missing, the difference in value can still be detected. Furthermore, this non-monetary information is important to the organization in terms of its potential value as a measure of return on investment.

DETERMINATION OF A DISCOUNT RATE

The firm has determined that its relevant cost of capital is 10%. The consultant has decided to use this as the appropriate discount rate in the model. Since this is a technical finance/accounting issue that is well familiar to management accountants, it will not be treated in detail here.

CALCULATION OF EXPECTED REALIZABLE VALUE

Using the information obtained from steps 2 to 4 in the stochastic rewards valuation process, the consultant was able to calculate and compare the expected values of an engineer who participates in a management development program with the value of an engineer who does not participate. These figures, calculated using a 10-year valuation period, are as follows:

Participant:	$93,541
Non-participant:	$80,931
Increase:	$12,610

A comparison of these figures suggests that participation in a management development program actually increases the value of individuals to the firm. This increased value results from the increased probability of promotion combined with a decreasing probability of exit. Since management development programs are intended to give individuals the skills needed to be more productive, service state values would be expected to increase if the program is successful. In the present analysis, changes in service state values were not considered because it was difficult to use a measurement method that would allow the consultant to observe these changes. Thus, in the present analysis, service state values were held constant.

The calculations in the above example conclude that for one engineer the increase in expected realizable value over a ten year period from participating in a management program is $12,610, assuming a 10% discount rate. The following analysis takes a more overall approach and concludes in Table 18 that there is a $1,134,233 or 23% increase over a four-year period in the expected realizable value of 100 engineers who participated in the management development program over 100 engineers who did not participate. Using the transition matrices, service state values, and 10% discount rate assumed in the original example, Tables 14 through 18 demonstrate differences in service states, turnover, and expected realizable value between the 100 participants and 100 non-participants. Turnover rates are noticeably higher for the non-participants.

Tables 14 and 15 track for the non-participant and participant groups of 100 engineers respectively, the service states or state of exit the engineers either stayed in or moved to during each year over the four year period. As shown in the tables, some remained as engineers, some were promoted to project engineers, and some were promoted to project engineers and then to program managers. Others left the organization at various points. This analysis was done using the probabilities of remaining in present position, being promoted, and exiting the firm shown in the transition matrices in Tables 12 and 13.

Tables 16 and 17 use the data calculated in Tables 14 and 15, as well as the service state values in Table 11, to compute the undiscounted future cash flows of the service state values using numbers of employees based on assumed probabilities from the transition matrices. Next, expected realizable values are calculated by discounting to the present value (assuming a 10% cost of capital and discount rate) the undiscounted cash flows of the service state values. Table 18 emphasizes the increase in each of the four years, and the total overall four-year increase of $1,134,233 in expected realizable value between non-participants and participants in the management development program.

The tables have been prepared so that the reader can easily see how the data can be analyzed in an electronic spreadsheet such as Excel, and the HRA measures conveniently computed and re-computed as parameters and assumptions change. A four-year time horizon was considered sufficient to communicate the process and demonstrate calculation of the effect of participation in the management program on expected realizable value of an organization's employees. In order to complete the analysis, the organization would compute the present value of the cash outflows invested in the management programs. Then using the organization's desired time horizon and cost of capital as assumed discount rate, the net present value to the organization would be computed as the difference between expected realizable value and cash outlows for the management programs.

Table 14. Nonparticipants in management development program: Tracking of 100 engineers at beginning of four-year period to various service states and exit over four years based on probabilities in transition matrix in table 12.

Year	Service States Beg Yr.	No. in Service State Beg Yr.	Program Manager [C x Prob. inTable 12]	Project Director [Cx Prob. inTable12]	Engineer [Cx Prob. In Table 12]	Exit	No. Remain End Yr.
A	B	C	D	E	F	G	H
						[C-(D+E+F)]	[C-G or D+E+F]
One	Engineer	100	0	25	50	25	75
	Project Dir.	0	0	0	0	0	0
	Program Manager	0	0	0	0	0	0
	Totals	**100**	**0***	**25***	**50***	**25**	**75**
Two	Engineer	50	0	12.5	25	12.5	37.5
	Project Dir.	25	8.75	8.75	0	7.5	17.5
	Program Manager	0	0	0	0	0	0
	Totals	**75**	**8.75***	**21.25***	**25***	**20**	**55**
Three	Engineer	25	0	6.25	12.5	6.25	18.75
	Project Dir.	21.25	7.44	7.44	0	6.37	14.88
	Program Manager	8.75	5.25	0	0	3.5	5.25
	Totals	**55**	**12.69***	**13.69***	**12.5***	**16.12**	**38.88**
Four	Engineer	12.5	0	3.13	6.25	3.12	9.38
	Project Dir.	13.69	4.79	4.79	0	4.11	9.58
	Program Manager	12.69	7.61	0	0	5.08	7.61
	Totals	**38.88**	**12.40***	**7.92***	**6.25***	**12.31**	**26.57**

* Number of Service States Remaining End of Year; goes to Table 16.

In summary, these results suggest that the management development programs attended by individuals

Table 15. Participants in management development program: Tracking of 100 engineers at beginning of four-year period to various service states and exit over four years based on probabilities in transition matrix in table 13.

Year	Service States Beg Yr.	No. in Service State Beg Yr.	Program Manager	Project Director	Engineer	Exit	No. Remain End Yr.
A	B	C	D	E	F	G	H
						C-(D+E+F)	C-G or D+E+F
One	Engineer	100	0	40	40	20	80
	Project Dir.	0	0	0	0	0	0
	Program Manager	0	0	0	0	0	0
	Totals	**100**	**0***	**40***	**40***	**20**	**80**
Two	Engineer	40	0	16	16	8	32
	Project Dir.	40	18	14	0	8	32
	Program Manager	0	0	0	0	0	0
	Totals	**80**	**18***	**30***	**16***	**16**	**64**
Three	Engineer	16	0	6.4	6.4	3.2	12.8
	Project Dir.	30	13.5	10.5	0	6	24
	Program Manager	18	11.7	0	0	6.3	11.7
	Totals	**64**	**25.2***	**16.9***	**6.4***	**15.5**	**48.5**
Four	Engineer	16.9	0	6.76	6.76	3.38	13.52
	Project Dir.	19.9	8.96	6.97	0	3.97	15.93
	Program Manager	11.7	7.61	0	0	4.09	7.61
	Totals	**48.5**	**16.57***	**13.73***	**6.76***	**11.44**	**37.06**

* Number of Service States Remaining End of Year; goes to Table 17.

Table 16. Non-participants in management development program: Expected realizable value of 100 engineers over four-year period based on probable service state occupancy in table 14.

Year	Service State	Service State Value	*Number in Service State Remaining End Yr. from Table 14	Total Service State Cash Flows	PVof Single Sum Factor at 10%	**Discounted Cash flows: Expected Real.Value**
One	Program Manager	$40,000	**0***	0		
	Project Director	$33,000	**25***	$825,000		
	Engineer	$27,000	**50***	$1,350,000		
	Totals		**75**	$2,175,000	.90909	**$1,977,271**
Two	Program Manager	$40,000	**8.75***	$350,000		
	Project Director	$33,000	**21.25***	$701,250		
	Engineer	$27,000	**25***	$675,000		
	Totals		**55**	$1,726,250	.82645	**$1,426,659**
Three	Program Manager	$40,000	**12.69***	$507,600		
	Project Director	$33,000	**13.69***	$451,770		
	Engineer	$27,000	**12.5***	$337,500		
	Totals		**38.88**	$1,296,870	.75132	**$974,364**
Four	Program Manager	$40,000	**12.4***	$496,000		
	Project Director	$33,000	**7.92***	261,360		
	Engineer	$27,000	**6.25***	$168,750		
	Totals		**26.57**	$926,110	.68301	**$632,542**
	Expected Realizable Value: Total Discounted Cash Flows for Four-Year Period of Conditional Service States					**$5,010,836**

Table 17. Participants in management development program: Expected realizable value of 100 engineers over four-year period based on probable service state occupancy in table 15.

Year	Service State	Service State Value	*Number in Service State Remaining End Yr. From Table 15	Total Service State Cash Flows	PV of Single Sum Factor at 10%	**Discounted Cash flows: Expected Realizable Value**
One	Program Manager	$40,000	**0***	0		
	Project Director	$33,000	**40***	$1,320,000		
	Engineer	$27,000	**40***	$1,080,000		
	Totals		**80**	$2,400,000	.90909	**$2,181,816**
Two	Program Manager	$40,000	**18***	$720,000		
	Project Director	$33,000	**30***	$990,000		
	Engineer	$27,000	**16***	$432,000		
	Totals		**64**	$2,142,000	.82645	**$1,770,256**
Three	Program Manager	$40,000	**25.2***	$1,008,000		
	Project Director	$33,000	**16.9***	$557,700		
	Engineer	$27,000	**6.4***	$172,800		
	Totals		**48.5**	$1,738,500	.75132	**$1,306,170**
Four	Program Manager	$40,000	**16.57***	$662,800		
	Project Director	$33,000	**13.73***	453,090		
	Engineer	$27,000	**6.76***	$182,520		
	Totals		**37.06**	$1,298,410	.68301	**$886,827**
	Expected Realizable Value: Total Discounted Cash Flows for Four-Year Period of Conditional Service States					**$6,145,069**

Table 18. Difference in Expected Realizable Value Between Non-participants and Participants in Management Development Program Over Four-Year Period.

Year	Non-participants' Expected Realizable Value from Table 16	Participants' Expected Realizable Value From Table 17	Increase	Percent Increase
One	$1,977,271	$2,181,816	$ 204,545	10.3%
Two	$1,426,659	$1,770,256	$ 343,597	24.1%
Three	$ 974,364	$1,306,170	$ 331,806	34.05%
Four	$ 632,542	$ 886,827	$ 254,285	40.2%
Total	**$5,010,836**	**$6,145,069**	**$1,134,233**	**22.64%**

in this company were effective at increasing their value to the firm The firm can invest an amount up to the present value of the differential value expected to be derived from participants in the program and benefit. The company should therefore continue to promote these programs as a way of increasing the effectiveness of their managers. The results also suggest that HRA can make an important contribution to the evaluation of programs intended to increase the value of individuals to the firm.

CONCLUSION

HRA has a dual function in organizations. First, it is designed to create an increased emphasis on the human side of the organization. It attempts to increase the recognition that human resources are capital which are crucial to the organization's growth and development. Additionally, HRA provides upper level management with an alternative accounting system designed to measure the cost and value of people to an organization. In this sense, HRA represents both a paradigm (a way of viewing human resource decisions and issues) and a set of measures for quantifying the effects of human resource management strategies upon the cost and value of people as organizational resources.

The proposed use of HRA as a tool to measure the value of management development is in its early stages. However, if it is used in the way described above, HRA will enhance the value not only of human capital in organizations, but the value and relevance of management accounting as well.

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