

# Economic Benefit of a Quality Selection System: an Operational Model

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## Abstract

This paper presents an operative approach to the calculation of economic benefit in the application of a valid selection system in employees recruitment and promotion. The paper focuses on the issue of computation of the added marginal value of quality workers and proposes a comprehensive model for estimating the cost / benefit ratio of investment in the recruitment of more suitable personnel. In a simulation based on data from the selection of junior bank managers a return on investment of 21 (!) times was found. Procedures and formulae for calculating estimated feasibility of quality selection systems are detailed.

The development and implementation of reliable and valid personnel selection systems is a process demanding a high level of professionalism, persistence and the allocation of considerable organizational resources. In addition, the processes of selection and absorption are of marked significance from the standpoint of personnel mix, organizational culture, etc. The economic and organizational implications of implementing selection processes are often discussed at the highest organizational levels. The problem faced by personnel managers, and industrial / organizational psychologists is the need to translate added value of advanced selection systems into direct economic significance. The economic considerations, when deciding on application of selection systems, are, for example, direct and indirect cost, added value in monetary terms, and return on investment.

In the past, a number of attempts have been to develop computational formulae for demonstration the economic benefit of valid selection systems (Schmidt, Hunter & Pearlman, 1982; Boudreau & Berger, 1985; Janz & Etherington, 1985). From amongst such approaches, the pioneering work of Taylor and Russell (1939) should be singled out. They developed conversion tables for evaluation resultant success rates as a function of the naive success rate on the job, selection ratio, and the predictive validity of the selection system.

Brogden (1946, 1949) and Cronbach & Gleser (1965) proposed a different approach to evaluating the economic value of selection systems. Their model for computing economic benefit of selection systems, henceforth the B-C-G Utility Model - is based on the following variables for calculation selection benefit:

- U - Economic benefit of the selection system per worker.
- SDy - Added value in monetary values of one standard deviation in worker quality
- r(x,y) - Validity of selection system
- Zx - Standardized value of score obtained at cut off point
- C - Financial cost of assessing one candidate
- SR - Selection ratio

According to the B-C-G model, the formula for calculating benefit is:

Formula 1:

$$U=(SDy)(r(x,y))(Zx)-C/SR$$

(Boudreau, 1993)

According to the formula the economic benefit value of one standard deviation in worker quality is multiplied by the prediction validity and the cut-off point level. From the economic benefit of selection we then subtract the selection cost of producing one worker chosen from among the candidates.

Estimation of the overall economic benefit of the selection process to the organization takes into account the number of candidates screened and the number accepted, and is computed by a simple algebraic development of the above formula.

Two issues may be raised regarding the B-C-G model of calculation of economic benefit of personnel selection:

1. Selection ratio is not represented in the first part of the formula estimating the economic benefit of a good employee. In a situation where the selection ratio is 1.0, there should be no economic benefit, as a result of selection, to the organization. Nevertheless, according to the existent formula, the contribution value is maximized, as selection cost per worker is minimal. The impact of including the Zx value is limited to those cases where the whole population on which the cut-off point is calculated is included in the computation.
2. Many organizations experience some difficulty in obtaining an SDy value (Boudreau, 1993). In many cases the organization has no direct economic estimate of the added marginal benefit of the better worker.

Procedures and formulae for dealing with the above mentioned issues are proposed below.

## Selection Ratio and its place in the calculation of economic benefit in selection systems

Dealing with the issues of the contribution of the selection ratio in the calculation of marginal benefit can apparently be simplified by inclusion of the selection ratio in computing economic benefit value. However, with such a solution, the selection ratio is expressed twice: once in the definition of the cut-off point, and again in the multiplication of the economic benefit value of selection in the selection ratio. While alternative mathematical and economic solutions to the problem may be suggested, the author recommends an orthodox approach, which takes into account the significance of the selection ratio in calculating the economic benefit of selection.

In accordance, the following formula is offered, for estimation of the overall economic value of the selection process ( $\Sigma U$ ) in choosing a number of potentially good workers ( $N_s$ ) from within a group of applicants ( $N_{app}$ ):

Formula 2:

$$\Sigma U = ((N_s)(SD_y)(r(x,y))(Z_x)(1-SR)) - ((C)(N_{app}))$$

## Estimation of Economic Benefit of One Standard Deviation in Worker Quality

Many organizations require assistance in the calculation of  $SD_y$  values. One must consider that such difficulties may arise from the situational characteristics of the worker's contribution to the organization and changes in the organization's expectations from the workers. Nevertheless it appears that guidelines may be drawn for constructing the organizational estimate translated into economic significance of employing superior workers.

The main factors to be considered in calculating the contribution value of superior workers are costs of employment, cost of training, errors and mistakes and special contributions. These factors seem to be the main variables associated with the worker's contribution to the organization. Formula 3 below details the respective contribution of the factors to the  $SD_y$  value. The differential weight of the variables in the model may be expected to change in accordance with different circumstances, jobs, and organizations. Thus weights of different values were excluded from the formula, but their differential value is expected to be expressed in the different cost-benefit relations of each variable.

The added value of a better worker in one standard deviation is based on the following variables:

- AVEC - Estimate of Added Value of a better employee based on Employment Cost
- AVTC - Estimate of Added Value of a better employee regarding reduced Training Cost.
- AVCM - Estimate of Added Value of a better employee with regard to reduced Cost of Mistakes
- AVSC - Estimate of Added Value of a better employee with regard to addition in Special Contribution

The calculated value of SDy based on the above components is:

### Formula 3

$$SDy=(AVEC)+(AVTC)+(AVCM)+(AVSC)$$

The rationale underlying the computational method of added economic value of one standard deviation in worker quality is based on the following arguments:

1. Many organizations are able to discriminate between their best and worst workers. While finer discrimination may be difficult, most managers can single out those workers who distinguish themselves, both positively and negatively. This distinction identifies those workers performing one standard deviation above and one standard deviation below the norm.
2. Cost of employment is the minimal economic benefit that the worker brings to the organization. This estimate is based on the assumption that a business organization cannot continue to exist if its workers' output is of lower economic value than their overall cost to the organization.
3. Using the critical incidents method (Flanagan, 1954), it is possible to identify elements of special contribution and of damage attributable to worker error. From this viewpoint, negative critical incidents are errors and mistakes, whereas positive critical incidents are special contributions by the employee at work.
4. Success rate in training provides an estimate of the job's level of demands vis-a-vis applicant potential and of the new workers' level of success in meeting these demands. The underlying assumption is that those who fail training fall one standard deviation below the workers' average. Despite the limitations on inference from functioning on training to job performance, the difference between successes and failures in training is expected to reflect an estimate of the difference between those who are better or poorer on the job.

According to these arguments, calculating the frequency of special contributions (such as manufacturing improvement suggestions, marketing initiatives, etc.) for good workers as compared with their frequency for poor workers, provides a qualitative indication of the size of the good worker's contribution. Similarly, a calculation based on the frequency of errors, and on success and failure rates in training, provides a qualitative estimate of the size of the added cost of poor workers.

Below are the computational formulae for the different variables included in the calculation of SDy:

### AVEC - Added Value of better worker in one standard deviation - the factor of Employment Cost

The cost of employment provides a minimal estimate of the worker's contribution to the organization. According to this principle, the good worker's added marginal value will be based on the following variables:

- EC - Average annual cost of one worker on the job.
- T - Average tenure of worker on the job.
- QD - Proportion of quality difference between a good worker (operationally defined as one standard deviation above average) and a poor worker (one standard deviation below average).

The formula for calculating the marginal benefit estimate of a good worker, based on employment cost, is: -

#### Formula 4

$$AVEC = ((EC)(T)(QD))/2$$

The QD value represents the difference between good employees, operationally defined as one standard deviation above average, and poor employees, operationally defined as one standard deviation below average, e.g., a difference of two standard deviations. Therefore the formula needs to be divided by two to represent the added value of better worker in one standard deviation.

Organizations often encounter difficulty in computing the QD value. In such cases, the QD estimate will be calculated on the basis of data collected from the following components of the benefit function. The function for computing the QD value will be presented in formula 10, later on.

### AVTC - Added Value of better worker in one standard deviation - the factor of Training Cost

Job training is the initial meeting point between a new worker and his place of employment, and frequently serves as an additional selection stage where a not inconsiderable number of those accepted for the job, actually fail,. This is so especially job and critical professions, like pilots. The ratio of training success to success on the job provides the minimal estimate of the differences between new good and poor workers. The estimate is minimal as the situation being dealt with is one where reduction of variability in

instruction is one of the primary targets in selection. The variables included in calculation are:

- CT - Average training cost
- LT - Average duration of training in years
- SRT - Average success rate in training.

The formula for calculating the training component (AVTC) is:

Formula 5

$$AVTC=(EC)(LT)(1-SRT)+(CT)(1-SRT)$$

A basic assumption implicit in Formula 5 above is that those who fail training are one standard deviation inferior in quality to the worker average. It is to be expected that in some professions especially critical ones (such as pilots) or those with a low level of demands (unskilled workers) exceptions to the above assumption will be found.

AVCM - Added Value of better worker in one standard deviation - the factor of Cost of Mistakes

A central variable in the marginal benefit of good workers is the low level of error as compared with other workers. The estimate of marginal value in error reduction is based on the following variables:

- CM - Average Cost of Mistake
- NM - Annual Average Number of Errors per Worker
- P (q-1,m) - Proportion of Errors executed by poor workers in percentages
- P(q+1,m) - Proportion of Errors executed by good workers in percentages
- PC1 - The intermediate value calculated for the purpose of standardizing the above proportions to the based of 100% according to the calculation presented in Formula 6 below (Proportion Coefficient)

Formula 6

$$PC1=1/(P(q-1,m)+P(q+1,m))$$

The computational formula for the component of Error Cost (AVCM) is:

Formula 7

$$AVCM= (((P(q-1,m)(PC1)-((P(q+1,m))(PC1))))/2)(CM)(NM)(T)$$

## AVSC - Added Value of better worker in one standard deviation - the factor of Special Contribution

Another central variable in the marginal benefit from good workers is the higher level of special contributions, such as manufacturing suggestions and marketing initiatives relative to other workers. The estimate of marginal benefit of special contributions is based on the following variables:

- VSC - Average monetary value for special contributions
- NSC - Average number of special contributions per worker per year
- $P(q-1,a)$  - Proportion of contributions made by poor workers in percentages
- $P(q+1,a)$  - Proportion of contributions made by good workers in percentages
- PC2 - Intermediate value calculated for the purpose of standardizing the above proportions  $P(q+1,a)$  and  $P(q-1,a)$  to the based of 100% according to the calculation detailed in Formula 8 (Proportion Coefficient 2).

### Formula 8

$$PC2=1/(P(q-1,a)+P(q+1,a))$$

The formula for calculating the special contribution factor (AVSC) is:

### Formula 9

$$AVSC=(((P(q+1,a)(PC2))-((P(q-1,a))(PC2))))/2)(VSC)(NSC)(T)$$

## QD - Estimate in percentages of Quality Difference between better workers (SD+1) and poorer workers (SD-1)

The estimate of QD in calculating AVEC on the basis of estimates of personnel quality included in other components in the formula, is based on the formula below:

### Formula 10

$$QD=(((P(q-1,m))(PC1))-((P(q+1,m))(PC1))+(((P(q+1,a))(PC2))-((P(q-1,a))(PC2))))/2$$

Averaging the values of the size of difference between good workers (one standard deviation above the norm) and poor workers (one standard deviation below the norm) relative to the error rate and the special contribution, provides an approximation to the size of difference in percentages between good and poor workers.

## Empirical Example

An example of calculating the economic benefit of selection of junior managers in a large bank is detailed below. The organization is interested in taking 60 new trainees to junior managers course from among the ranks of the bank employees. To this end 240 candidates are screened by the selection system developed and adapted for the job and the organization. The values included in the example are based on the bank's H.R. manager's knowledge and reflect a realistic situation

$r(x,y)$	-Validity of selection system	.30
$Z_x$	-Standard value of score at cut off point	1.00
$C$	-Cost of assessment of one candidate	\$ 300
$N_s$	-Number of workers accepted out of total number of candidates	60
$N_{app}$	-Number of candidates to be assessed	240
$EC$	-Average annual cost of employment	\$ 50,000
$T$	-Average tenure of workers on job in years	12
$CTN$	-Average cost of training	\$ 2,000
$TMTN$	-Average duration of training in years	0.5
$SRTN$	-Success rate in training	80%
$CM$	-Average cost of error or mistake	\$ 1,000
$NM$	-Average number of errors per worker per year	2
$P(q-1,m)$	-Proportion of errors made by poor workers in percentages	40%
$P(q+1,m)$	-Proportion of errors made by good workers in percentages	20%
$VSC$	-Average value of special contributions	\$ 1,000
$NSC$	-Average number of special contributions per worker per year	1
$P(q-1,a)$	-Proportion of special contributions made by poor workers per year	20%
$P(q+1,a)$	-Proportion of special contributions made by good workers per year	40%

The overall economic value of implementing a selection system in accordance with the stringent approach proposed in this paper, is \$ 1,431,900.00. In terms of return on investment we have a yield of 21 (!) times on investment in selection. These values are conservative compared with results of similar calculations cited in the literature, in which values of return on investment run as high as 95 times (Janz, 1993).

Another important piece of data is the measured of feasibility of investment in the improvement of existing selection systems. In a calculation based on the same data, and assuming the validity of the selection system to be  $r=.20$ . The economic value of improving the selection value of improving the selection system to a predictability level of  $r=.30$  is \$501,300.

Psychologist, personnel managers and behavioral science professionals are only infrequently aware of the grave economic implications of valid selection processes. Business managers, entrusted with company profitability, must have some control on their investment in personnel as the most valuable and important resource of most companies. The conservative model presented here proposes an operational approach to the estimate of feasibility of investment in improving selection processes. In many simulations, as in that presented above, it appears that the cost of developing and refining selection systems is a negligible part of the overall economic significance in identifying quality personnel. However, it is recommended that financial assessment elements be incorporated in the planning of selection and placement processes.

This financial assessment provides business guidelines in decision-making concerning issues such as selection ratio and further investment in advanced selection tools.



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