

## **A Generalized Cost-Benefit Analysis Model for Switching to AppliTrack from a standard Paper-Based Application Process**

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### **Outline of Model**

The model divided up the cost of the paper application process into nine categories:

- Cost of Sorting Applications by office staff (includes unsealing applications, filing, recording applications, etc.)
- Cost of time spent by administrator searching paper applications for necessary credentials (scanning through all filed applications)
- Associated expenses (storage, document transportation, admin travel time to Central Office, shredding, etc.)
- Postage cost to send documents to semifinalists for the position
- Cost of photocopying copies of application file for the interview committee
- Cost of time spent copying and distributing materials to hiring managers and interview committee
- Cost of Advertising for the open position
- Cost of time spent maintaining EEO data for state and federal reporting
- Cost of time spent entering new hire data into HRMS, payroll, or SMS software

We assumed that there were no residual or "holistic" costs or benefits associated with paper application. We assumed that the entirety of AppliTrack's absolute cost would be the quoted rate presented (i.e. that the use of AppliTrack's software and processes would make all of the costs associated with paper application negligible).

From here, a supplemental model would calculate the "Present Value" of the cost savings over the course of ten years of operation, given the summed "Paper Application Cost" and the AppliTrack Cost.

### **Justification**

The assumption that these nine categories discussed entirely cover the cost of the paper application process is clearly flawed (one can easily think of costs not encapsulated by this model). However, the intent of the model is to provide a conservative estimate of cost savings (i.e. a strict lower bound in the vast majority of cases) for the benefit of our potential consumers and to provide transparency in their decision making process. This is augmented by the ability of the consumers to adjust parameters (both "input" and "output") at will. The usage of the AppliTrack process, in providing an automated electronic database (which is maintained by our organization), with automatic and easy-to-use search technology, in addition to an electronic information-transmission network between applicant and potential employer, would tend to entirely eliminate (e.g. postage cost, advertising) or reduce *almost* entirely (e.g. searching applications for credentials) the vast majority of costs associated with job application and applicant consideration. The parameters used in the model (as parameters) were derived from AppliTrack user data.

### **Parameters derived Initially from the End-User**

- Average HR administrator's annual salary
- Average clerical staff member's annual salary
- Number of employees/students (depending on organization type)
- Annual Number of Job Applicants

### **Assumed Parameters (Paper Application Process)**

- The average worker (administrator and office staff member) works for 2000 hours per annum.
- All work over a given period of time (after distinguishing between administrative and office staff) is homogeneous in cost.
- It takes five minutes for the average office staff member to sort applications.
- It takes 11 administrative man-hours to check and verify the credentials of a block of 250 applicants.
- \$450 of associated expenses (storage, document transportation, etc.) will correspond to each block of \$500 applicants.
- 15% of applicants will reach semifinalist status.
- All semifinalists are mailed three documents at postage of \$0.42 per document.
- 10% of applicants will reach the finalist (interview) status.
- The Interview Committee will have 5 members, each of whom will receive a copy of a ten-page application file for each applicant who reaches the finalist status for the position.
- Copying one page costs \$0.02, taking into account the cost of ink, the cost of paper, and the time necessary to make the copy.
- It takes 8 man-hours (\$12 per man-hour) to distribute materials to hiring managers for the finalists from each block of 500 applicants.
- The cost of advertising for a position that draws 500 applicants is \$250.
- It takes 10 clerical man-hours to enter in Equal Employment Opportunity data for state and federal reporting corresponding to a block of 500 applicants.



- It takes 4 clerical man-hours to enter in HRMS, Payroll, or SMS data for the new hire corresponding to a block of 500 applicants.
- The average annual inflation rate in wages, advertising, and other associated costs (i.e. in the Paper Application Process's cost) is 3%.
- The average annual inflation rate in AppliTrack's cost is 2% (based on the increase over the past ten years, rounding up by 0.5%).
- The average annualized interest rate (cash-flow discount rate) is 6%.

### Mathematical Structure of Model

We assumed that all expenses varied linearly and continuously (i.e. no discrete expenses and no economies or diseconomies of scale) with the number of applicants to the job (increasing the number of applicants by  $\Delta x$  would increase the local expense by  $dy/dx * \Delta x$ , for all  $\Delta x$ , with  $dy/dx$  representing the expense per applicant for the given cost category). The "man-hourly" cost of administrative and clerical labor was simply calculated through the division of the annual salary of the average administrator/clerical laborer by the 2000 hours per annum that each worker was assumed to work. From this point, we simply applied the assumptions named above to calculate each category of expense given the parameters entered by the user under our fundamental assumptions of linearity. From this point, we simply summed the expenses by category to achieve a global "Annual Cost for the Paper Application Process." After the calculation of the cost of AppliTrack using the discrete price-point generation algorithm, the cost savings was calculated by taking the difference between the Paper Application Cost and the AppliTrack Cost.

The present value of the cost savings over ten years was calculated by taking the difference between the present value of Paper Application Process's cost over ten years and the present value of AppliTrack's cost over ten years. We assumed that the initial term of the series would be the values generated by the calculator itself, and summed the discounted value of the cash flow for each over the course of ten years (assuming a net annual discount rate in the value of cash-flow of  $1 - (1 + \text{Inflation}) / (1 + \text{Interest rate})$  for each). For ease of calculation, we calculated the difference between the value of the geometric series at  $t = 0$  and at  $t = 11$ , utilizing the similarity of all terms in the series (noting the one-to-one correspondence between all terms), down to a factor of  $(1 - \text{Discount rate})^{10}$ .

Defining:

$$a_n(\text{initial cashflow}) = (1 - \text{Discount rate})^{n-1} / (1 - \text{Discount rate})$$

, using the more elegant formula for the infinite geometric series and this property of similarity, we calculated\*

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\* Note to take into account the differing inflation rates when calculating the different discount rates for AppliTrack and the Paper Application Costs, respectively.



Net Present Value of Cost Savings =  
 $a_1(\text{Paper Cost}) + a_{10}(\text{AppliTrack Cost}) - a_1(\text{AppliTrack Cost}) - a_{10}(\text{Paper Cost})$ .

**Potential Errors:**

The assumption of uniform inflation and interest rates is flawed due to the obvious deviation in these rates, but over the course of these ten years, the deviations between most reasonable scenarios and the hypothetical results is likely to be negligible. All assumptions of linearity were necessary to make the model work elegantly and generally, but of course overtime issues would need to be taken into account if the employer were to work the employment staff beyond the "overtime threshold," increasing the man-hourly wage by up to a factor of 1.5. Furthermore, one would have to take into account the discrete nature of salary-based compensation (one does not linearly adjust salary for excess work), but this is intended to represent the longer-term effect of increasing the quantity of work (which will eventually, of course, reach equilibrium at this approximately linear level). Other than this, all other potential errors are entirely negligible or tending entirely toward producing conservative cost estimates.

