Simulating the Latent Effect of Attrition on Project Management

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Abstract

Staff attrition is a problem often faced by software development organizations. We used process modeling and simulation to estimate the effect of different staffing policies on the project cost. A simulation technique has been used for analyzing the effect of the policies pertaining to replacement for engineers who leave the project, and also overstaffing in the beginning of the project .This paper presents the simulation technique for optimizing the cost of staffing by analyzing replenishment level and replenishment strength with respect to attrition.

Key words: Attrition, Risk management, Replenishment strength

Introduction

Along with growing interest in human resource management there are however, some serious concerns. Personnel costs are skyrocketing relative to hardware costs [2][3].In the 1970s & early '90s, people still talked about "Lifetime Employment" and a career within one company. Starting in late 90s, the pendulum started swinging. The unspoken employee & employer contract was broken, as companies across industries restructured operations and reduced headcount. People then started talking about "owning their own careers," collecting experiences and skills in various jobs at various companies to enhance their ongoing employability [6][8].

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The most immediate concern facing the industry is the increasing levels of attrition.

IT/ITES companies, for instance, have an attrition rate of 30-35 percent. Other than the natural rate of the attrition, "poaching of employees", "burn out" and high stress environments are causing an increasing churn rate. Managing attrition is becoming increasingly important [5].

Also, staffing costs are one of the largest expenses regularly charged to the budget of a company, for instance, the IT/ITES sector. When one counts salaries, benefits, bonuses, training and other personnel costs, companies invest a great deal of resources in their employees. Thus, attrition becomes a two-fold issue, one, which is cost related and the second, retaining much needed and often, experienced talent.

We used process modeling and simulation for estimating the effect on the project cost of different staffing policies. Assessment of such managerial decisions could also be done by other methods like formal experiments, pilot projects, case studies, and experts' opinions and surveys. Modeling and simulation is preferred because it does not have the disadvantages of the other methods (like possible irrelevance in the case of formal experiments or pilot projects, interfering with the real process and taking a long time for case studies or subjectivity for experts opinions and surveys)

Attrition

Attrition is defined as the reduction in the number of employees through retirement, resignation or death. Attrition rate is the rate of shrinkage in size or number [1].

In the cut throat competition, it is the HR's real challenge for retaining the employees. Attrition is considered to be a business cost but it is actually a loss when it comes in terms of revenue. New motivational theories need to be established as a part of the Retention Strategy.

The Management style is seen as detached, as it is the more stretching on the productivity issues and ignoring the human related issues. The culture of staying for a short span of ,say, 1- 2 years at a stretch with an organization is the result of the changed mindset.

As the challenges due to attrition are growing, the threats of loosing business are increasing. Without proper, effective and efficient workforce, no organization can achieve its mission. Every organization needs more innovative approach and creative thinking which is framed on courage. Hence, it is said that

"If you are going to have ideas ahead of the times (i.e., "creative"), you will have to get used to living with the fact that most people are going to believe you are in the wrong." - Bruce Lloyd

The cost advantage in developing countries like India is getting the challenge on account of high cost of attrition. HR is, hence, the mirror of the company's both industrial & business perspective.

Attrition is calculated as:

Attrition = 100 * (Total resigns per month)/ (Total No. + New Joiners– Total Resigns)

It is also visible that the companies who are the highest paymaster are not the best employer through the employee satisfaction survey.

Few Attrition Prevention Parameters

1.Review of Recruitment process.
2. Remuneration Benchmarking.
3. Highly visible communication and implementation plan.
4. Flexibility to shift to any locations on requests, if possible.
5. Understanding the social needs of individuals and trusting their maturity.
6. Besides Induction & Project Training not much investment has been done to evolve a "Continuous Training Programs'.
7. Implementation of golden banana Concept.
8. Giving the true picture of the organization well before recruiting.
9. Properly handling the growth aspirations of the employees.
10. Keeping Very lively and energetic work environment, supporting with good infrastructure.

Proposed Model

Attrition is clearly detrimental to a software development project. When an experienced developer leaves a project prior to its completion, then a project manager faces the question of whether to replace the departing individual or to forego the expense of replacement and make other adjustments, such dropping functionality, slipping the schedule, and rearranging assignments. The answer to the question of replacement may turn on factors such as the experience of the developer, the percent completion of the project, the number of engineers on the project, the time required for hiring or transfer, and the attrition rate of the organization. Replacement is costly, but may be required to keep a project on schedule. It leads one to wonder, can the dilemma presented by attrition be resolved by yet another alternative, that of staffing a project with more than the necessary number of development engineers? Are there project situations in which it is economically feasible, or even desirable, to mitigate the risk of attrition by overstaffing? The experiment described here was motivated by these questions and the results offer an indication of the desirability of staffing policies which include the overstaffing option.

Notations

RPT =replenishment time
X=No of attrition
f(x)=distribution of attrition
Y=attrition during replenishment process time

P(Y=y)=h(y)=distribution of attrition during replenishment process time
H(y)=Cumulative distribution of Y
RL= replenishment level
RS=recruitment strength
A=expected annual attrition
RPC=recruitment process cost
ASHC=Annual staff holding cost per head
CPH=cost per head
SSC=staff shortage cost per head

Algorithm for Simulation of the distribution of the attrition during replenishment process time Y

Step 1

Select the sample value of RPT,say t.

Step 2

Select t sample values of X ,say X1,x2,x3….xt.

Step 3

Let $y = \sum_{i=1}^{t} xi$ be a sample value of the attrition during replenishment process time.

Step 4

Increase by one the no of times the value of Y has occurred.

Step 5

If the process has simulated a large no of Y values, say 25,000 values go to step 6; otherwise, return to step 1.

Step 6

The proportion of the time each value of Y occurs is taken as the probability distribution of the attrition during replenishment process time.

Stop

Algorithm for Optimal Replenishment level (RL) and (RS) Recruitment strength to minimize the expected total annual Staff holding cost

Step 1

Use above algorithm to determine h(y) by simulation, then go to step 2;

Step 2

Calculate the expected attrition during replenishment process time

$$E(Y) = \sum_{y=0}^{M} yh(y) = \sum_{y=0}^{M} yP(Y=y)$$

where M is the maximum attrition during replenishment process time.

Step 3

Calculate the expected number of stock out for RL =1,2,3.. ….M

$$ENR(RL) = \sum_{Y=RL}^{M} (y-RL)h(y) = \sum_{y=RL}^{M} (y-L)P(Y=y)$$

tep 4

Calculate the probability that the attrition during replenishment process time will exceed the replenishment level for RL = 1,2,…M. That is, calculate P(Y>RL) for RL =1,2,…M

Step 5

Let RL =M, then the expected number of reserve outs ENR (RL) will be zero.

Step 6

Calculate

$RS = \sqrt{2} * A \{RPC + SSC [ENR (RL)] \} / ASHC$

Let RS* be the largest integer less than equal to RS.

Step 7

Calculate c=ASHC (RS*)/SSC*A

Step 8

Let RL* be the smallest integer value of Z such that
$P(Y>Z) \leq c$

Step 9

If RL* is equal to RL, goto step 10; otherwise, set RL=RL* and return to step 6.
Step 10

The integers RL* and RS* are only approximations of the continuous optimal values so calculate expected total annual cost ETAC(RL<RS)for RL=RL*-1, RL* , RL*+1 And RS=RS*-1, RS*, RS*+1.This will assure that the minimum ETAC is attained.
Step 11
Print the minimum ETAC with the corresponding optimal RL and RS from step 10.
Stop

Table 1
Probability distribution, cumulative distribution, and one minus the cumulative distribution of attrition during replenishment process time

y	h(y)	H(y)	P(Y>y)
0	0.04420	0.04420	0.95580
1	.13000	.17420	.82580
2	.17436	.34856	.65144
3	.17568	.52424	0.47576
4	.16212	.68636	31364
5	.13048	.81684	.18316
6	.08172	.89856	.10144
7	.04932	.94788	.05212
8	.02876	.97664	.02336
9	.01244	.98908	.01092
10	.00620	.99528	.00472
11	.00264	.99792	.00208
12	.00128	.99920	.00080
13	.00048	.99968	.00032
14	.00028	.99996	.00004
15	.00004	1.0000	.00000
16	0.0000	1.0000	.00000

Table 2

Expected no of reserve out at a given replenishment level

RL	ENR(RL)	Pygrop(RL)
0	3.60139	0.95580
1	2.64559	.82580
2	1.81980	.65144
3	1.16836	0.47576
4	69260	31364
5	.37896	.18316
6	.19580	.10144
7	.09436	.05212
8	.04224	.02336
9	.01888	.01092
10	.00796	.00472
11	.00324	.00208
12	.00116	.00080
13	.00036	.00032
14	.00004	.00004
15	0.0	.00000
16	0.0	.00000
17	0.0	.00000
18	0.0	000000
19	0.0	.00000
20	0.0	.0000

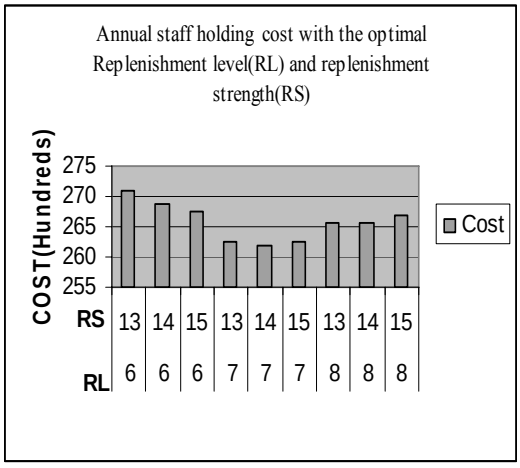

Figure 1

Conclusions

The minimum cost in the above figure occurs with replenishment level 7 and replenishment strength as 14 ,so one must start the

replenishment process at this level to minimize staff holding cost.

This experiment suggests several implications for software project staffing in response to attrition. In general, no action for attrition is the least expensive choice and overstaffing is the most expensive choice. Since there are cost associated with recruitment process, due to staff shortage, staff holding etc., the objective to determine when to recruit and how many to recruit to minimize the total annual staff holding cost. The managers can have expected no of staff shortage at a given replenishment level. This will help the managers to schedule their recruitment process and no of recruitments to be made in advance to reduce the impact of attrition in the company.

References

[1] Abdel-Hamid, Tarek, A study of staff turnover, acquisition, and a assimilation and their impact on software development cost and schedule", *Journal of Manager Information Systems*, Summer 1989, vol. 6, no. 1, pp. 21-40.

[2]Lorenzo, Cappellari , "Low-pay transitions and attrition bias in Italy: An analysis using simulation based estimation, Department of Economics, University of Warwick Coventry, CV4 7AL, UK, October 1999.

[3] Abdel-Hamid, Tarek and Stuart E. Madnick, *Software project dynamics An integrated approach*, Prentice-Hall, Englewood Cliffs, New Jersey, 1991.

[4] Abdel-Hamid, Tarek, "Thinking in circles", *AmericanProgrammer*, May 1993, pp. 3-9.

[4] Bevilaqua, Richard J. and D.E. Thornhill, "Process modeling", *American Programmer*, May 1992, pp. 3-9.

[5] Collofello, James S., J. Tvedt, Z. Yang, D. Merrill, and I. Rus, "Modeling software testing processes",*Proceedings of Computer Software and Applications Conference (CompSAC'95)*, 1995.

[6] Curtis, Bill, M. I. Kellner and J. Over, "Process mdeling", *Communications of the ACM*, 35(9), Sept.1992, pp. 75-90.

[7]*ithink Manual*, High prformance systems Inc.,Hanover, NH, 1994.

[8] Lin, Chi Y., "Walking on Battlefields: Tools for strategic software management", *American Programmer*, May, 1993, pp. 34-39.

[9] Madachy Raymond, "System dynamics modeling of an inspection-based Process", *Proceedings of the Eighteenth International Conference on Software Engineering*, Berlin, Germany, March 1996.

[10] Richardson, George P. and Alexander L. Pugh III, *Introduction to system dynamics modeling with DYNAMO,* The M.I.T. Press, Cambridge, MA, 1981.

[11] Richmond, Barry, "System Dynamics/Systems Thinking: Let's just get on with it", *International System Dynamics Conference*, Sterling, Scotland, 1994.