ADV MATH SCI JOURNAL
Advances in Mathematics: Scientific Journal **9** (2020), no.10, 8349–8356
ISSN: 1857-8365 (printed); 1857-8438 (electronic)
https://doi.org/10.37418/amsj.9.10.64

MARKOV ANALYSIS OF MANPOWER AND BUSINESS OF TWO UNITS FUNCTIONING UNDER SINGLE MANAGEMENT IN CHENNAI CITY

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ABSTRACT. This research considers a business concern having two units but management is one. Separate budgets are prepared for each unit though both of them carry out the same type of business or not. For example a management may have two educational institutions but budgets for the two units are different. Business in one cannot be taken over by the other or transferred though at times of need the staff can be shared, as the working knowledge required in both units may be the same. So it is reasonable to assume that when shortage of manpower comes in one unit, as a temporary measure the manpower from the other unit in case of exigencies can be transferred whereas such a facility is not there for business and each unit should have its own business and therefore if shortage comes it has to be dealt in itself and improved. Analysis is done when units get manpower shortage and business shortage. So far no one has dealt this type of model and it is unique.

1. INTRODUCTION

In the midst of stochastic analysis research more generally accepted that steady state probability which plays satisfactory measure for the system which operated continuously as manpower and money management planning system. Vajda [26] (1947) has made a systematic approach to manpower system and also in Bartholomew [5], Grinold and Marshall [6]. Lesson [12] has given

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2020 *Mathematics Subject Classification.* 90B05.

Key words and phrases. Markov, two units, single management, steady state, rate of crisis.

model for wastages and promotion in desired man power structures gives suitable planning proposals. Vassiliou [27] and V.Subramanian [23] are given stochastic markovian models are for wastage and promotion in manpower system. For detail manpower models any one can refer K.Setlhare [19]. We find that the requirement of manpower skilled or unskilled is viewed in a different angle by any business concern, the work culture is different, salary and wages are different, training them for their requirement is different and therefore a totally a different approach has been given to manpower models. Recruitment and retrenchment are frequent. Recruitment is done in different phases after a close observation of manpower in stock, wastages and requirement. Inspections are conducted and a thorough review is done before going for recruitment. So the approach to manpower has completely changed, for such models of location, review and recruit one may refer to C.Mohan [14-18, 20-22]. For the model of location phase together with inspection and then recruitment one may refer to C. Mohan [18].

We consider a business concern having only two units functioning under one management in Chennai city [1, 2, 3, 4, 7, 8, 9, 10, 11, 13, 24, 25]. The two characteristics, Manpower and Business are considered for working out the model. We assume that, in both the units, Manpower and Business fluctuate between two levels Viz, 0 and 1, in both the characteristics. 0 stands for shortage and 1 stands for full. When shortage of manpower comes in one unit, as a temporary measure the manpower from the other unit can be used where as such a facility is not there for business and each unit should have its own business, and, therefore if shortage comes it has to be dealt in itself and improved. This is a unique model in its own respect.

We discuss the model in 6 different states. It is assumed that the manpower fails at a constant rate λ_O and business fails at a constant rate of λ. Recruitment or interchange of manpower between the units is done at a constant rate of β, and getting business is done at a constant rate of μ. A System is said to be failed if both the characteristics in both the units fail. In the case of manpower failure in one Unit and business failure in the other Unit, the manpower node is always set right first.

State 1, where manpower and business are full in both nodes. State 2, where failure in business has taken place in one of the nodes. State 3 where the business in the other node also fails. State 4 manpower has failed in one of the

nodes. State 5 is where manpower in the other also fails. State 6 is where One Unit has Manpower failed and in the other Unit business has failed.

2. System Analysis

Now $\{X(t) = (i, j)$ such that $i, j = 0, 1\}$ refers to manpower and business status at Unit$-I$, 1 means fully available and 0 means shortage and $\{Y(t) = (i', j')\, i', j' = 0, 1\}$ refers to manpower and business status in Unit$-II$, 1 means fully available and 0 means shortage.

$\{X(t), Y(t)\}$ denote the state space system is in continuous time Markov Chain and $X(t), Y(t)$ are independent. The State Space is given by:

$$S = \{[(i, j), (i', j')] \;\; i, i' = 1, 0 \;\; j, j' = 1, 0\}$$

$$S = \{[(1,1),(1,1)], [(1,1),(1,0)], [(1,0),(1,0)], [(0,1),(1,1)], [(0,1),(0,1)], [(0,1),(1,0)]\}$$

That is $S = \{[1], [2], [3], [4], [5], [6]\}$, where number in the square bracket refers to the states in the order given as above. Then the six different states given by matrix A: where $\epsilon_1 = -(2\lambda+2\lambda_0)$, $\epsilon_2 = -(\lambda_0+\lambda+\mu)$, $\epsilon_3 = -\mu$, $\epsilon_4 = -(\lambda+\beta+\lambda_0)$,

States	[1]	[2]	[3]	[4]	[5]	[6]
[1]	ϵ_1	2λ	0	$2\lambda_0$	0	0
[2]	μ	ϵ_2	λ	0	0	λ_0
[3]	0	μ	ϵ_3	0	0	0
[4]	β	0	0	ϵ_4	λ_0	λ
[5]	0	0	0	2β	ϵ_5	0
[6]	0	β	0	0	0	ϵ_6

$\epsilon_5 = -2\beta$, $\epsilon_6 = -\beta$.

Therefore, state space is irreducible is clear from Matrix A . If ?? denotes the limiting probability distribution, then

$$\begin{aligned} \pi &= \lim_{t\to\infty} \Pr\left[\{X(t), Y(t)\} = \{(i, j), (i', j')\, i, j, i' \text{and } j' \in S\}\right] \\ \text{So } \pi &= \left[\pi_1, \pi_2, \pi_3, \pi_4, \pi_5, \pi_6\right]. \end{aligned}$$

The above probability exists and satisfies the equations: $\pi Q = 0, \Sigma_1^6 \pi_i = 1$. Solving, we get

(2.1)

$$\pi_1 z = \frac{\lambda+\beta}{K}, \quad \pi_2 = 2 \cdot \frac{\lambda}{\mu} \cdot \frac{(\lambda+\beta+\lambda_0)}{K}, \quad \pi_3 = 2 \cdot \frac{\lambda^2}{\mu^2} \cdot \frac{(\lambda+\beta+\lambda 0)}{K},$$

(2.2)$$\pi_4 = \frac{2\lambda 0}{K}, \quad \pi_5 = \frac{\frac{\lambda_0^2}{\beta}}{K'}, \quad \pi_6 = 2 \cdot \frac{\lambda_0}{\beta} \cdot \frac{\left(\lambda + \frac{\lambda}{\mu}(\lambda+\beta+\lambda 0)\right.}{K},$$

where

$$K = \lambda + \beta + 2\lambda_O \left[1 + \frac{\lambda_0}{2\beta} + \frac{\lambda}{\beta}\right] + 2\frac{\lambda}{\mu}\left[\lambda+\beta+\lambda_O\right]\left[1 + \frac{\lambda}{\mu} + \frac{\lambda_0}{\beta}\right].$$

Probability of Crisis sets is when units have manpower in full and business in shortage and vice versa in the time interval between t and $t+\Delta t$, and is defined by

$$\begin{aligned} P[Crisis(t,t+\Delta t)] &= P[X(t,t+\Delta t) = (1,0) Y(t,t+\Delta t) = (1,0)/ \\ &\quad X(t) = (1,0) Y(t) = (1,1)] \\ P[X(t) &= (1,0) Y(t) = (1,1)] + P[X(t,t+\Delta t) = (1,0)/ \\ &\quad X(t) = (0,1), Y(t) = (1,1)] \\ P[X(t) &= (0,1), Y(t) = (1,1)]. \end{aligned}$$

Applying limit as $\Delta t \to 0$ we get, $C_t = \lambda P_2(t) + \lambda_0 P_5(t)$, as $t \to \infty$, the rate of crisis follows steady state condition, C_∞ and $C_\infty = \lambda \pi_2 + \lambda_0 \pi_5$ with steady state probabilities, we can have:

$$C_\infty = 2\lambda \cdot \frac{\lambda}{\mu} \cdot \frac{(\lambda+\beta+\lambda_0)}{K} + \lambda_0 \frac{\frac{\lambda_0^2}{\beta}}{K},$$

where

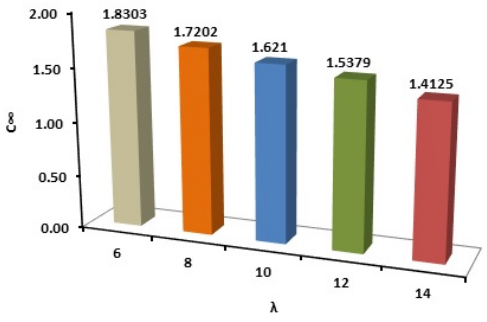
$$\mathrm{F}_K = \lambda + \beta + 2\lambda_O \left[1 + \frac{\lambda_0}{2\beta} + \frac{\lambda}{\beta}\right] + \frac{\lambda}{\mu}\left[\lambda+\beta+\lambda_O\right]\left[1 + \frac{\lambda}{\mu} + \frac{\lambda_0}{\beta}\right].$$

By using (2.1), take values $\lambda = 5, \lambda_0 = 3, \mu = 6$, $\beta = 2$; we get the table of following steady state probabilities (P).

s.no. and λ and $\mathbf{C}_\infty$
1 and 5 and 1.2531
2 and 7 and 1.5581
3 and 9 and 1.8707
4 and 11 and 2.1638
5 and 13 and 2.4294

S.No and Steady States and (P)
1 and π_1 and 0.0795
2 and π_2 and 0.1893
3 and π_3 and 0.1577
4 and π_4 and 0.0681
5 and π_5 and 0.0511
6 and π_6 and 0.4543
and Total and **1.0000**

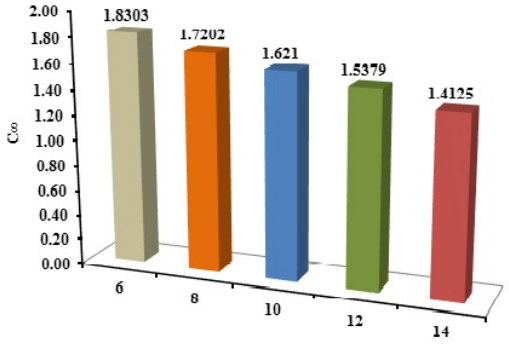
Values of C_∞ is calculated using (2.2) and the graph of C_∞ against the changes in λ is given below:



The graph of C_∞ against the changes in β is given below:

Let the average earning at state 1 when both units are fully available be 100, at state 2 it is 60 and at state 3 it is 20, at state 4 it is 85, at state 5 it is 40 and at state 6 it is 50, then expected earnings of the company, having the two units

S.No. and $\boldsymbol{\beta}$ and $\mathbf{C}_\infty$
1 and 6 and 1.8303
2 and 8 and 1.7202
3 and 10 and 1.6210
4 and 12 and 1.5379
5 and 14 and 1.4125



when $\lambda = 5, \lambda_0 = 3, \mu = 6, \beta = 2$ is given by:

$$\begin{aligned}
\text{Expected Earning} &= \sum_{1}^{6} \pi_i E_i \\
&= 0.0795 \times 100 + 0.1893 \times 60 + 0.1577 \times 20 + \\
&\quad +0.0681 \times 85 + 0.0511 \times 40 + 0.4543 \times 35 \\
&= 7.95 + 11.358 + 3.154 + 5.7885 + 2.044 + 15.855 = 46.1495.
\end{aligned}$$

3. Consclusion

We observe from the graph that when rate of failure of business λ increases the rate of crisis increases and when rate of recruitment of manpower increases the rate of crisis decreases.

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