

## A Mathematical Model for Employee Replacement and Promotion Policies in Manpower Systems

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### Abstract

Reliability theory usually deals with replacing technical components that fail randomly, and their lifetimes can be modelled with hazard rates. A similar idea applies to employees in workforce systems who leave due to resignation, retirement, or promotions to higher roles. This paper presents a unified modelling framework that integrates workforce dynamics with ideas from replacement, renewal, and dependability theory. The goal is to develop both analytical and simulation-based tools for assessing how dependable, maintainable, and cost-effective an organization is. This is done by treating employee roles as random components that can experience failure-like events and renewal. The proposed method focuses on two main strategies: (i) preventive replacement, which represents planned promotions or retirements, and (ii) corrective replacement, which addresses unplanned exits like resignations. By linking these strategies with workforce transition processes, the framework allows for flexible policy development that improves long-term stability and operational continuity in manpower organizations.

### Keywords

Workforce dynamics, Employee roles, Preventive replacement, Hazard rate, Survival function, Breakdowns.