A Case Study of R K M Industries Jodhpur on the Profit Analysis and Mathematical Modeling of a Four-Unit System with Preventive Maintenance

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Abstract

A Profit Analysis of a Four Unit System with Preventive Maintenance is covered in this paper: Regenerative Point Graphical Technique (RPGT) case study of R K M Industries Jodhpur, where preventative maintenance was implemented prior to complete failure and degeneration in one unit after failure. All four units—A, B, C, and D—are initially running at full capacity. While units B, C, and D might have a direct failure, unit A might have a partial failure mode. While units B, C, and D might have a direct failure, unit A might have a partial failure mode. A system with four units is subjected to preventive maintenance, and the principal unit degrades. Lastly, using a multivariate system with priority in repair and RPGT analysis, the differences in profitability ratios are explained by a number of variables (such as the capital output ratio, inflation rate, index number of physical production, etc.). To compare and make conclusions, graphs are generated.

Keywords: Four-Unit System, RPGT, Preventive Maintenance, MTSF, Availability, Profit Analysis

1. Introduction:

Due to the significant contributions made by numerous reliability and operation researchers, studies on redundant systems are becoming more and more important. This is because the goal of studying redundant systems is to increase system use and optimize structure parametric ethics for various system types by various revamp policies. There are many real-world uses for these systems, particularly in industries. Studying system resilience through redundant components and enhanced preventative maintenance of operational and standby units is the aim of this chapter. The system's standby units have three modes: degraded, failed, and operable. The main units have two modes: operable and failed. Both units are inspected subsequent to a failure in order to make out type of disappointment and select best repair strategy. While it comes to the planning, designing, and manufacturing of mechanical components, reliability is a major concern. The consequences of component failure become increasingly significant as the number of organizations and the size of mining equipment continue to grow. The sensitivity analysis and deep learning of a four-unit system with preventive maintenance are covered in this paper. The case study of R K M Industries Jodhpur uses the Regenerative Point Graphical Technique (RPGT). One unit has preventive maintenance performed prior to complete failure, and the other unit has degeneration after failure. All four units—A, B, C, and D—are initially running at full capacity. While units B, C, and D might have a direct failure, unit A might have a partial failure mode. While units B, C, and D might have a direct failure, unit A might have a partial failure mode. A system with four units is subjected to preventive maintenance, and the principal unit degrades. Several parts are put together to create various systems. Four unit systems are used in numerous process sectors, including the textile and utensil industries. The system as a whole fails if one component fails. The articulations for system metrics, such as server availability, MTSF, and expected fractional number of repairman inspections, have been constructed using RPGT for each of these models. The models have also been evaluated and assessed. Plotting several diagrams and tables for different standards of the strictures allows us to analyze the models' dependability, availability, and cost-benefits. Kumar (2022) used RPGT to study the performance analysis of a rice plant. The Jayfe Cylinder Manufacturing Plant Redundancy Allocation Problem was resolved by Rajbala et al. (2022). Mathematical modeling and profit analysis of an edible oil refinery industry were investigated by Kumar et al. (2017). In their 2019 article, Kumar and Garg discussed the reliability technology and its uses. The study conducted by Kumar et al. (2018) looked at a framework for producing bread. A sensitivity study of a cold standby architecture with priority for preventative maintenance that consists of two identical units with server failure using RPGT was conducted by Kumar et al. (2019). A poly tube plant's stochastics analysis was examined by Kumar et al. in 2022. Behavior analysis in the urea fertilizer sector has been researched by Kumar et al. (2017). In their 2017 study, Kumar et al. examined the behavior analysis system in urea fertilizer. The modeling and benefit analysis of the edible oil refinery sector have been examined by Kumar et al. (2017). The sociological analysis and numerical display of a paper industry washing unit were studied by Kumar et al. (2019). In their 2018 article, Kumar et al. examined the sensitivity analysis of 3:4:: A good framework plant is constructed with a single worker and four non-distinguishable units, some of which may be in a reduced state due to fractional disappointment. The profit analysis and mathematical modeling of an edible oil refinery plant have been studied by Kumar et al. (2017). Kumar et al. (2019) investigated the behavioral analysis and mathematical modeling of a paper mill washing unit. Applications of the dependability technology theory have been covered by Kumar and Garg (2019). A bread-making system's behavior analysis was examined by Kumar et al. (2018). 3:4:: excellent system plant sensitivity analysis was examined in a paper by Kumar et al. (2018). An article on the use of RPGT-A for system reliability and availability analysis was written by Kumar and Rajbala in 2021. Kumar et al. (2019) used RPGT to examine the sensitivity analysis of a cold standby framework that requires preventive support and consists of two identical units with worker dissatisfaction. The system's transition diagrams are analyzed using the Markov process in a variety of scenarios. Additional instances of multi-standby systems include data centers, research labs, telecommunication systems, satellite systems, space probes, and hypothetical cardiac assist devices, which are utilized to accomplish non-repairable systems with multiple standbys in case of mechanical or electrical heart failure. This can be done for a number of reasons, such as keeping one of the backup databases current to satisfy Recovery Point Objective requirements, using the second standby through a lag to remain it at the rear for a predetermined amount of time so it can be old for treatment, or guarding alongside logical corruption in the event that changes are made that could affect the first standby (for instance, accidentally removing a table or piece of data). It can recover the second standby database up to the point at which the undesirable operation (logical corruption) took place. If there is a delay in applying logs (for instance, only apply logs every 12 or 24 hours), it can then either activate it and utilize it as the new primary database or open it read-only to extract the required data. Furthermore, in this chapter, RPGT is used to model the system parameters. A single, always-available repairman replaces the problematic unit and switches in the standby unit when a breakdown occurs. It is anticipated that the repairman will be available at all times. The repaired item should function as well as a brand-new one. In the event that another unit fails while the server is fixing a downed unit, it joins the back of the queue of failed units. A single, always-available repairman replaces the problematic unit and switches in the standby unit when a breakdown occurs. It is anticipated that the repairman will be available at all times. Various people are constantly looking for strategies to find the extra effort, even if the organization of little and huge diverse sub-units is very complex. For example, it would cost more to increase the sub-unit repair rates. Tables for rising failure/repair rates and graphs are used to discuss different path probabilities, mean sojourn time, and system profit.

2. **Assumptions and Notations**

- The failures rates of units are unspoken to be exponentially disseminated.
- The system is examined under steady state circumstances.
- When a unit fails, it moves to the back of the queue if the repairman is busy and the backup unit also nosedives. The switch-over mechanism is flawless.
- In the event that the main unit malfunctions, the organization is considered degraded, and the malfunctioning unit is promptly repaired.
- Repair rates are general, independent, and diverse for working units.
- Units are of unlike aptitude. In the event that the system fails, nothing more can go wrong. When one of the primary components malfunctions, the entire system goes down.
- The redundant unit and mainstreams unit have priority policy.
- The facility never damages the units; that is, the repairs are flawless.
- Failure and repair rates of units are independent. There is a on its own repairman who is 24x7 hours available, who joins classification after the failure of the classification.

A,B,C,D/a,b,c,d: Working State/ failed state.

w_i/λ_i – respective mean constant repair/failure rates.; I = 0 to 6

3. **System Description:**

➢ **Forged steel ball (A):** Selecting the steel ball base, blanking, heating, die forging, precooling, quenching, and tempering are all steps in the process of creating forged steel balls. The steel ball goes through two quenching processes, raising the skin temperature to 360–420 °C the first time and then to 170–220 °C the second time. This is what makes it unique.

➢ **Forged bearing races (B)**: Forged bearing races are made from a forged blank or pipe/tube stock, which are subsequently machined and ground to precise measurements. They are commonly made from 52100 steel, a chrome steel valued for its strength, hardness, and wear resistance.

➢ **Bushes (C):** Bushes are cylindrical components that reduce wear and friction in mechanical applications. They are made of high-quality steel alloys. They are available in a number of varieties, each with special properties and uses, including alloy steel, carbon steel, and stainless steel.

➢ **Forged auto components D):** Metal components used in forged autos are formed by compressive force. They are found in many cars since they are strong, light, and long-lasting. Forged parts are used in many different systems and are essential to the effectiveness and security of cars.

4. **Model Description**

Considering the various possibilities and following the assumptions and notations the transition diagram of the system is drawn as under in Figure 1

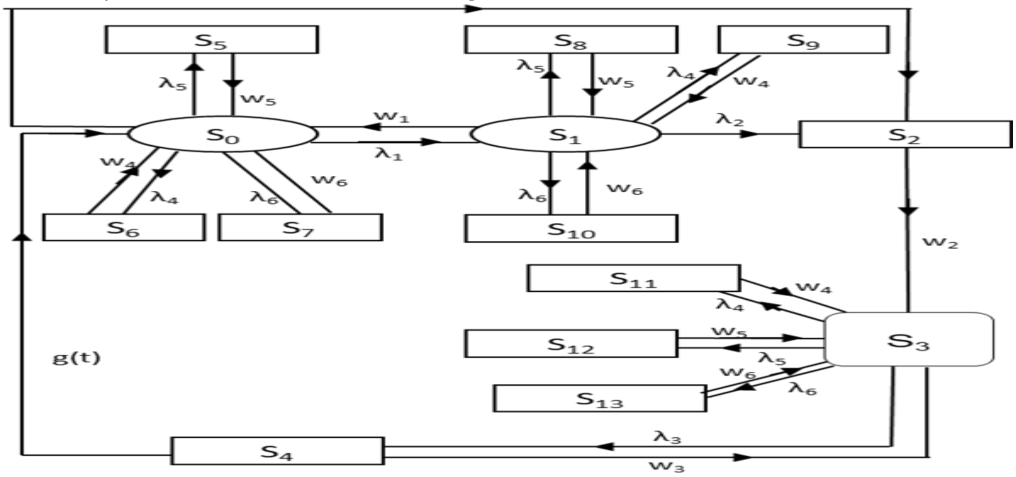

Figure 1: Transition Diagram

The system can be in any of the following states with respect to the above symbols.

S_0	=	ABcD	S_1	=	$\bar{A}$BCD	S_2	=	aBCD
S_3	=	$\bar{A}_1$BCD	S_4	=	a_1BcD	S_5	=	ABcD
S_6	=	AbCD	S_7	=	ABCd	S_8	=	$\bar{A}$BcD
S_9	=	$\bar{A}$bCD	S_{10}	=	$\bar{A}$BCd	S_{11}	=	$\bar{A}_1$bCD
S_{12}	=	$\bar{A}_1$BcD	S_{13}	=	$\bar{A}_1$BCd			

5. Transition Probability and the Mean sojourn times.

Table 1: Transition Probabilities

$q_{i,j}^{(t)}$	$P_{ij} = q^*_{i,j}{}^{(t)}$
$q_{4,0} = g(t)e^{-w_3(t)}$ $q_{4,3} = w_3 e^{-w_3 t}\overline{g(t)}$	$p_{4,0} = g^*(w_3)$ $p_{4,3} = 1-g^*(w_3)$
$q_{5,0} = w_5 e^{-w_3 t}$	$P_{5,0} = w_5/w_5 = 1$
$q_{6,0} = w_4 e^{-w_4 t}$	$P_{6,0} = w_4/w_4 = 1$
$q_{7,0} = w_6 e^{-w_6 t}$	$P_{7,0} = w_6/w_6 = 1$
$q_{8,1} = w_5 e^{-w_5 t}$	$P_{8,1} = w_5/w_5 = 1$
$q_{9,1} = w_4 e^{-w_4 t}$	$P_{9,1} = w_4/w_4 = 1$
$q_{10,1} = w_6 e^{-w_6 t}$	$P_{10,1} = w_6/w_6 = 1$
$q_{11,3} = w_4 e^{-w_4 t}$	$P_{11,3} = w_4/w_4 = 1$
$q_{12,3} = w_5 e^{-w_5 t}$	$P_{12,3} = w_5/w_5 = 1$
$q_{13,3} = w_6 e^{-w_6 t}$	$P_{13,3} = w_6/w_6 = 1$

Table 2: Mean Sojourn Times

$R_i(t)$	$\mu_i = R_i^*(0)$
$R_0^{(t)} = e^{-(\lambda_1+\lambda_4+\lambda_5+\lambda_6+\lambda)t}$	$\mu_0 = 1/(\lambda_1+\lambda_4+\lambda_5+\lambda_6+\lambda)$
$R_1^{(t)} = e^{-(w_1+\lambda_5+\lambda_4+\lambda_6+\lambda_2)t}$	$\mu_1 = 1/(w_1+\lambda_5+\lambda_4+\lambda_6+\lambda_2)$
$R_2^{(t)} = e^{-w_2 t}$	$\mu_2 = 1/w_2$
$R_3^{(t)} = e^{-(\lambda_3+\lambda_4+\lambda_5+\lambda_6)t}$	$\mu_3 = 1/(\lambda_3+\lambda_4+\lambda_5+\lambda_6)$
$R_4^{(t)} = e^{-w_3 t}\overline{g(t)}$	$\mu_4 = (1-g^*\ w_3)/w_3$
$R_5^{(t)} = e^{-w_5 t}$	$\mu_5 = 1/w_5$
$R_6^{(t)} = e^{-w_4 t}$	$\mu_6 = 1/w_4$
$R_7^{(t)} = e^{-w_6 t}$	$\mu_7 = 1/w_6$
$R_8^{(t)} = e^{-w_5 t}$	$\mu_8 = 1/w_5$
$R_9^{(t)} = e^{-w_4 t}$	$\mu_9 = 1/w_4$
$R_{10}^{(t)} = e^{-w_6 t}$	$\mu_{10} = 1/w_6$
$R_{11}^{(t)} = e^{-w_4 t}$	$\mu_{11} = 1/w_4$
$R_{12}^{(t)} = e^{-w_5 t}$	$\mu_{12} = 1/w_5$
$R_{13}^{(t)} = e^{-w_6 t}$	$\mu_{13} = 1/w_6$

6. Path Probability:

Using RPGT and taking 0' by means of the base-state of system, path likelihood factors of approachable states on or after base state ξ' = 0 and 3' are: Path likelihood as of state 6' to diverse vertices stand as under

$V_{0,0} = 1$

$V_{0,1} = p_{0,1} = \lambda_1/(\lambda_1+\lambda_4+\lambda_5+\lambda_6+\lambda)$

$V_{0,2}$ = …..Continuous

$V_{3,0} = \lambda_3 g^*(w_3)/(\lambda_3+\lambda_4+\lambda_5+\lambda_6) \div 1-\lambda_1 w_1/(\lambda+\lambda_1+\lambda_4+\lambda_5+\lambda_6)(w_1+\lambda_2+\lambda_4+\lambda_5+\lambda_6)(\lambda+\lambda_1+\lambda_4+\lambda_6)(\lambda+\lambda_1+\lambda_5+\lambda_6)(\lambda+\lambda_1+\lambda_4+\lambda_5)/(\lambda+\lambda_1+\lambda_4+\lambda_5+\lambda_6)^3$

$V_{3,1}$ = ……..Continuous

7. EVALUATION OF PARAMETERS OF THE SYSTEM:

MTSF (T_0): States to which the classification dismiss transit from regenerative earlier visiting any un-failed state, taking initial state as '0', before going to failed state are: 'i' = 0 to 4.

$$\text{MTSF } (T_0) = \left[\Sigma_{i,sr}\left\{\frac{\left\{pr\left(\xi \xrightarrow{sr(sff)} i\right)\right\}\mu i}{\Pi_{m_1\neq\xi}\left\{1\text{-}V_{\overline{m_1 m_1}}\right\}}\right\}\right] \div \left[1\text{-}\Sigma_{sr}\left\{\frac{\left\{pr\left(\xi \xrightarrow{sr(sff)} \xi\right)\right\}}{\Pi_{m_2\neq\xi}\left\{1\text{-}V_{\overline{m_2 m_2}}\right\}}\right\}\right]$$

$T_0 = (w_1+\lambda_2+\lambda_4+\lambda_5+\lambda_6)+\lambda_1 \div (w_1+\lambda_2+\lambda_4+\lambda_5+\lambda_6)(\lambda+\lambda_1+\lambda_4+\lambda_5+\lambda_6)-\lambda_1 w_1$

Availability of the System: The states (recreating) at which the coordination stands working partially/ fully are 'j' = 0 to 4 and the degenerative states stand 'i' = 0 to 10 taking base state as 'ξ' = '0' using RPGT is given as

$$A_0 = \left[\Sigma_{j,sr}\left\{\frac{\{pr(\xi^{sr\to}j)\}fj,\mu j}{\Pi_{m_1\neq\xi}\left\{1\text{-}V_{\overline{m_1 m_1}}\right\}}\right\}\right] \div \left[\Sigma_{i,s_r}\left\{\frac{\{pr(\xi^{sr\to}i)\}\mu_i^1}{\Pi_{m_2\neq\xi}\left\{1\text{-}V_{\overline{m_2 m_2}}\right\}}\right\}\right]$$

$A_0 = (V_{3,0}\mu_0+V_{3,1}\mu_1+V_{3,3}\mu_3) \div (V_{3,0}\mu_0+V_{3,1}\mu_1+V_{3,2}\mu_2+V_{3,3}\mu_3+V_{3,4}\mu_4+V_{3,5}\mu_5+V_{3,6}\mu_6+V_{3,7}\mu_7+V_{3,8}\mu_8+V_{3,9}\mu_9+V_{3,10}\mu_{10}+V_{3,11}\mu_{11}+V_{3,12}\mu_{12}+V_{3,13}\mu_{13})$

Proportional Busy Period of the Server: Recreating states where the unusual server is eventful is 'j' = 1 to 10 and recreating states stand 'i' = 0 to 10, enchanting ξ = '0',

$$B_0 = \left[\Sigma_{j,sr}\left\{\frac{\{pr(\xi^{sr\to}j)\},nj}{\Pi_{m_1\neq\xi}\left\{1\text{-}V_{\overline{m_1 m_1}}\right\}}\right\}\right] \div \left[\Sigma_{i,s_r}\left\{\frac{\{pr(\xi^{sr\to}i)\}\mu_i^1}{\Pi_{m_2\neq\xi}\left\{1\text{-}V_{\overline{m_2 m_2}}\right\}}\right\}\right]$$

$B_0 = (V_{3,1}\mu_1+V_{3,2}\mu_2+V_{3,4}\mu_4+V_{3,5}\mu_5+V_{3,6}\mu_6+V_{3,7}\mu_7+V_{3,8}\mu_8+V_{3,9}\mu_9+V_{3,10}\mu_{10}+V_{3,11}\mu_{11}+V_{3,12}\mu_{12}+V_{3,13}\mu_{13}) \div (V_{3,0}\mu_0+V_{3,1}\mu_1+V_{3,2}\mu_2+V_{3,3}\mu_3+V_{3,4}\mu_4+V_{3,5}\mu_5+V_{3,6}\mu_6+V_{3,7}\mu_7+V_{3,8}\mu_8+V_{3,9}\mu_9+V_{3,10}\mu_{10}+V_{3,11}\mu_{11}+V_{3,12}\mu_{12}+V_{3,13}\mu_{13})$

Expected Fractional Number of repairman's visits: Re-forming states where the overhaul man fixes this job j = 1 to 10 and i = 0 to 10 Captivating 'ξ' = '0',

$$V_0 = \left[\Sigma_{j,sr}\left\{\frac{\{pr(\xi^{sr\to}j)\}}{\Pi_{k_1\neq\xi}\left\{1\text{-}V_{\overline{k_1 k_1}}\right\}}\right\}\right] \div \left[\Sigma_{i,s_r}\left\{\frac{\{pr(\xi^{sr\to}i)\}\mu_i^1}{\Pi_{k_2\neq\xi}\left\{1\text{-}V_{\overline{k_2 k_2}}\right\}}\right\}\right]$$

$V_0 = (V_{3,1}+V_{3,2}+V_{3,4}+V_{3,5}+V_{3,6}+V_{3,7}+V_{3,8}+V_{3,9}+V_{3,10}+V_{3,11}+V_{3,11}+V_{3,12}+V_{3,13}) / (V_{3,0}\mu_0+V_{3,1}\mu_1+V_{3,2}\mu_2+V_{3,3}\mu_3+V_{3,4}\mu_4+V_{3,5}\mu_5+V_{3,6}\mu_6+V_{3,7}\mu_7+V_{3,8}\mu_8+V_{3,9}\mu_9+V_{3,10}\mu_{10}+V_{3,11}\mu_{11}+V_{3,12}\mu_{12}+V_{3,13}\mu_{13})$

8. Data Analysis

Behavior Analysis: Fix $\lambda_i = \lambda$, and $w_i = w$

Table 3: MTSF

T_0	w = 0.50	w = 0.55	w = 0.60	w = 0.65
λ = 0.10	9.702	9.702	9.702	9.702
λ = 0.15	7.659	7.659	7.659	7.659
λ = 0.20	5.491	5.491	5.491	5.491
λ = 0.25	3.852	3.852	3.852	3.852

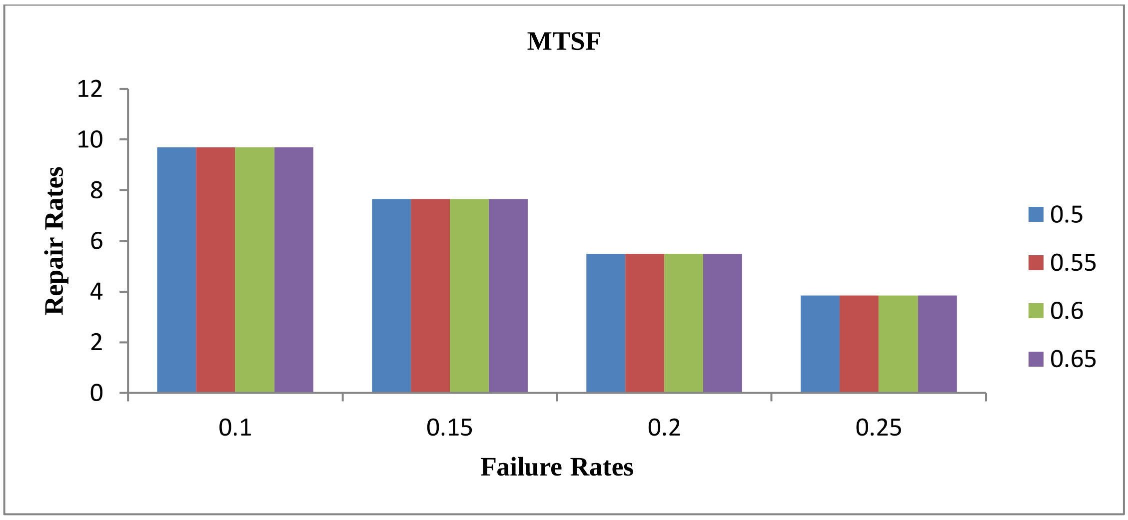

Fig. 2: MTSF

Table 3 and Fig. 2 demonstrate that (i) it remains constant as repair rate increases and (ii) decreases as stoppage rate increases. These findings follow the predicted trend and are consistent with real-world scenarios.

Table 4: Availability of System

A_0	$w = 0.50$	$w = 0.55$	$w = 0.60$	$w = 0.65$
$\lambda = 0.10$	0.514	0.518	0.522	0.526
$\lambda = 0.15$	0.488	0.492	0.496	0.500
$\lambda = 0.20$	0.415	0.419	0.423	0.427
$\lambda = 0.25$	0.352	0.356	0.360	0.364

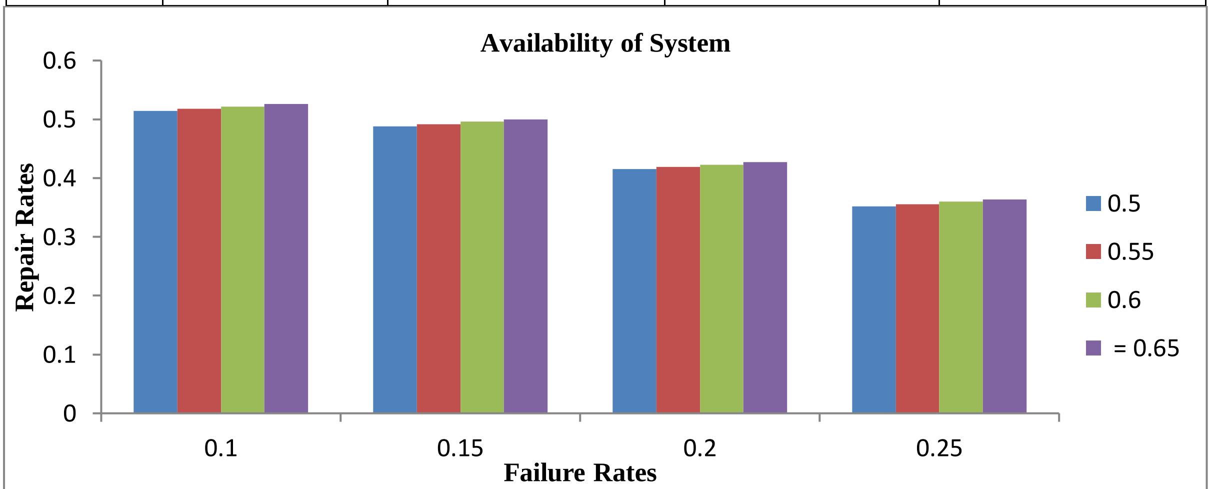

Fig. 3: Availability of System

Practically availability should increase with the (i) amplify in repair rates of units (ii) Decrease by amplify in efficiency i.e. stoppage rates, these same trends are depicted in Table 4 and fig. 3. So our derived results match the practical scenario graph below also depicts the same behavior.

Table 5: Busy Period of Server (B_0)

B_0	$w = 0.50$	$w = 0.55$	$w = 0.60$	$w = 0.65$
$\lambda = 0.10$	0.690	0.678	0.666	0.654
$\lambda = 0.15$	0.752	0.740	0.728	0.716
$\lambda = 0.20$	0.878	0.866	0.854	0.842
$\lambda = 0.25$	0.945	0.933	0.921	0.919

Fig. 4: Busy Period of Server (B_0)

The similar pattern can be seen in Table 5, where a rise in repair rates causes a drop in the busy period of server. If a repairman has a greater repair rate than anyone else, he will correct the problem or restore the failed unit in less time than the others. (ii) When units fail more frequently, the server must work harder to solve the issue, which means it will take longer to fix the units in Table 5 and Fig. 4. Looking at the columns as of top to bottom, which be a real drift in nearly every simulation below the graph and confirms the similar outcomes.

Table 6: Expected Number of Server's Visits (V_0)

V_0	$w = 0.50$	$w = 0.55$	$w = 0.60$	$w = 0.65$
$\lambda = 0.10$	0.433	0.440	0.447	0.454
$\lambda = 0.15$	0.487	0.494	0.501	0.508
$\lambda = 0.20$	0.523	0.530	0.537	0.544
$\lambda = 0.25$	0.596	0.603	0.611	0.618

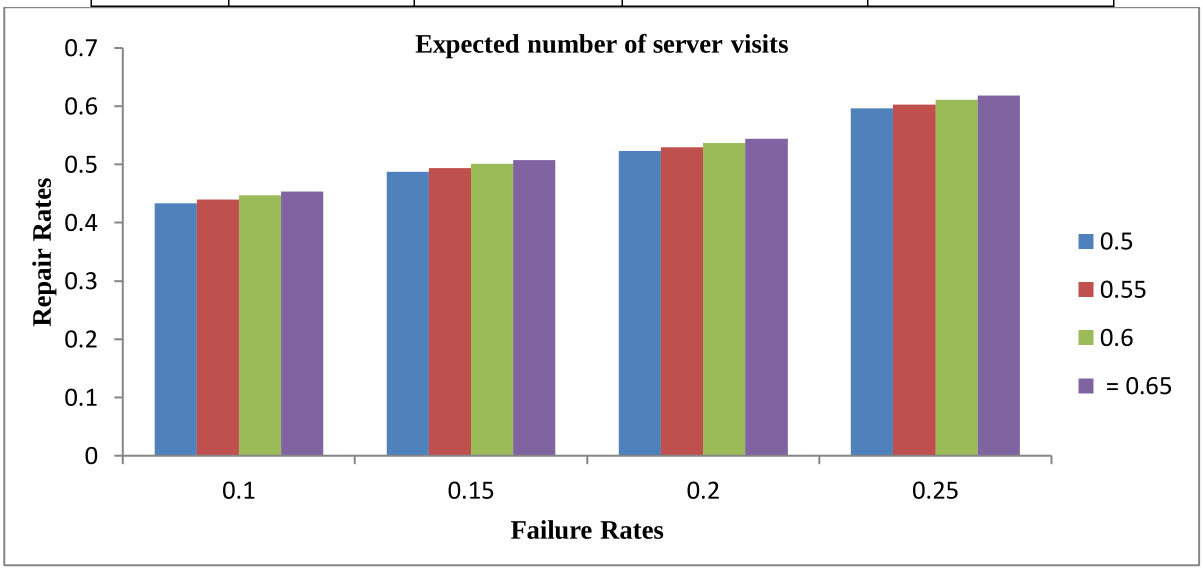

Fig. 5: Expected Number of Server's Visits

Expected fractional or proportional value of number of server visits over course of a system's life shows the design efficiency of system components that are major parts of the units/system are poor in design and quality will be higher. The graph 5 above and table 6, which are drawn in relation to failure and repair rates, also demonstrate trends.

Profit Function of the System: Profit function is given as

$P_0 = D_1A_0 – D_2B_0 - D_3V_0,$

Taking; $D_1 = 1200$; $D_2 = 100$; $D_3 = 200$

Table 7: Profit Function

P_0	$w = 0.50$	$w = 0.55$	$w = 0.60$	$w = 0.65$
$\lambda = 0.10$	461.2	465.8	470.4	475.0
$\lambda = 0.15$	413.0	417.6	422.2	426.8
$\lambda = 0.20$	305.6	310.2	314.8	319.4
$\lambda = 0.25$	208.7	213.3	217.7	221.3

Fig. 6: Profit Function

As demonstrated in Fig. 6 and Table 7, for instance, profit rises by advanced repair rates and falls by larger estimates of unit failure rates. Recessions occur when a system hits its limit and is unable to generate. A system is said to be in a degraded state when any of its constituent parts continuously carry out a function up to an appropriate but lower (lower) limit than indicated due to its essential functions. We call something that isn't functioning properly a degraded system or piece of equipment. It needs to be restored to its original condition if it can be fixed; if not, a replacement must be made. In this study, we proposed the availability search method, profitability analysis, behavioral analysis, and industrial performance optimization.

9. Conclusion

A theory can be thought of as a logical collection of presumptions or claims made to explain a phenomenon. It is an abstraction of truth. A manufacturing framework is described as coordination of activities and procedures used to produce a preferred product or element with suitable presentation. Reliability is a significant presentation extent on behalf of normal action of several modern technological systems. Consistency is distinct as the ability of an organization to do its proposed function deprived of disappointment, aimed at a period of time, under determined conditions. With the growing complexity of today's manufacturing framework, dependability optimization productions a significant part in manufacturing plan and has stood utilized successfully to raise organization presentation. One cannot overstate the importance of a concept in any field of study. Theory looks for, monitors, interprets, provides a cause for, and controls occurrences or phenomena. Purchasing a piece of machinery and requiring payment in exchange for labor contributions are commonplace amenities of interest. A methodical rationalization of production, on the other hand, falls outside the purview of the family's business members but is still within economics. The complete variety of rule-making governing the paintings vicinity is outdoor the scope of a monetary device however critical to a commercial members of the family device. It is based on these parameters. For each of these models, the articulations for system parameters, for example, server of busy, availability, MTSF, and expected the fractional number of inspections by repairman and so forth have been developed using RPGT for the models have also been assessed/evaluated. The models are dissected regarding their reliability, availability, and cost-benefits by plotting different diagrams and tables for various standards of the strictures. The Markov process is used to analyses the system's transition diagrams under various circumstances. An emphasis on reliability is challenging to improve Short-Interval Scheduling, also improving component performance. In the more extended term, the life of mine plans helps decide the amount and sort of component required to accomplish that arrangement and subsequently maximize the component availability.

10. References: -

1. Kumar, A., and Garg, D. (2019). Reliability technology theory and application. Lap Lambert Academic Publishing in Germany, ISBN 978-613-9-47665-7.
2. Kumar, A., Goel, P. and Garg, D. (2018). Behaviour analysis of a bread making system. International Journal of Statistics and Applied Mathematics, 3(6), 56-61.
3. Kumar, A., Garg, D., Goel, P., Ozer, O. (2018). Sensitivity analysis of 3:4:: good system. International Journal of Advance Research in Science and Engineering, 7(2), 851-862.
4. Kumar, A., Garg, D., and Goel, P. (2019). Mathematical modeling and behavioral analysis of a washing unit in paper mill. International Journal of System Assurance Engineering and Management, 1(6), 1639-1645.
5. Kumar, A., Goel, P., Garg, D., and Sahu, A. (2017). System behavior analysis in the urea fertilizer industry. Book: Data and Analysis [978-981-10-8526-0], Communications in computer and information Science (CCIS), Springer, 3-12.
6. Kumar, A., Garg, D., and Goel, P. (2019), "Mathematical modeling and behavioral analysis of a washing unit in paper mill", International Journal of System Assurance Engineering and Management, 1(6), 1639-1645.
7. Kumar, A. (2022). Performance anaysis of a Rice Plant using RPGT, SSRN, 1-8.
8. Kumar, A., Rajbala and Khurana, P. (2022) Stochastics analysis of a Poly tube plant. Journal of Mathematical Problems, Equations and Statistics, vol. 3(1), pp. 11-17.
9. Kumar, A., Garg, D., and Goel, P. (2019), "Sensitivity analysis of a cold standby system with priority for preventive maintenance", Journal of Advance and Scholarly Researches in Allied Education, 16(4), 253-258.
10. Kumar, A., Garg, D., and Goel, P. (2019). Sensitivity analysis of a cold standby system with priority for preventive maintenance. Journal of Advance and Scholarly Researches in Allied Education, 16(4), 253-258.
11. Kumar, A., Garg, D., and Goel, P. (2017). Mathematical modeling and profit analysis of an edible oil refinery industry. Airo International Research journal, XIII, 1-14.
12. Kumar, A., Goel, P., Garg, D., and Sahu, A. (2017)," System behavior analysis in the urea fertilizer industry", Book: Data and Analysis [978-981-10-8526-0], Communications in computer and information Science (CCIS), Springer, 3-12.
13. Kumar, A. and Rajbala (2021). Artical on the system reliability and availability analysis using RPGT-A general approach, galaxy international interdisciplinary research journal, 371-375.
14. Kumar, A., Goel, P. and Garg, D. (2018), "Behaviour analysis of a bread making system", International Journal of Statistics and Applied Mathematics, 3(6), 56-61.
15. Kumar, A., Garg, D., Goel, P., Ozer, O. (2018), "Sensitivity analysis of 3:4:: good system", International Journal of Advance Research in Science and Engineering, 7(2), 851-862.
16. Kumar, A., Garg, D., and Goel, P. (2017), "Mathematical modeling and profit analysis of an edible oil refinery industry", Airo International Research journal, XIII, 1-14.
17. Kumar, A., and Garg, D. (2019), "Reliability technology theory and application", Lap Lambert Academic Publishing in Germany, ISBN 978-613-9-47665-7.