ITC Infotech: Repairable spare parts management

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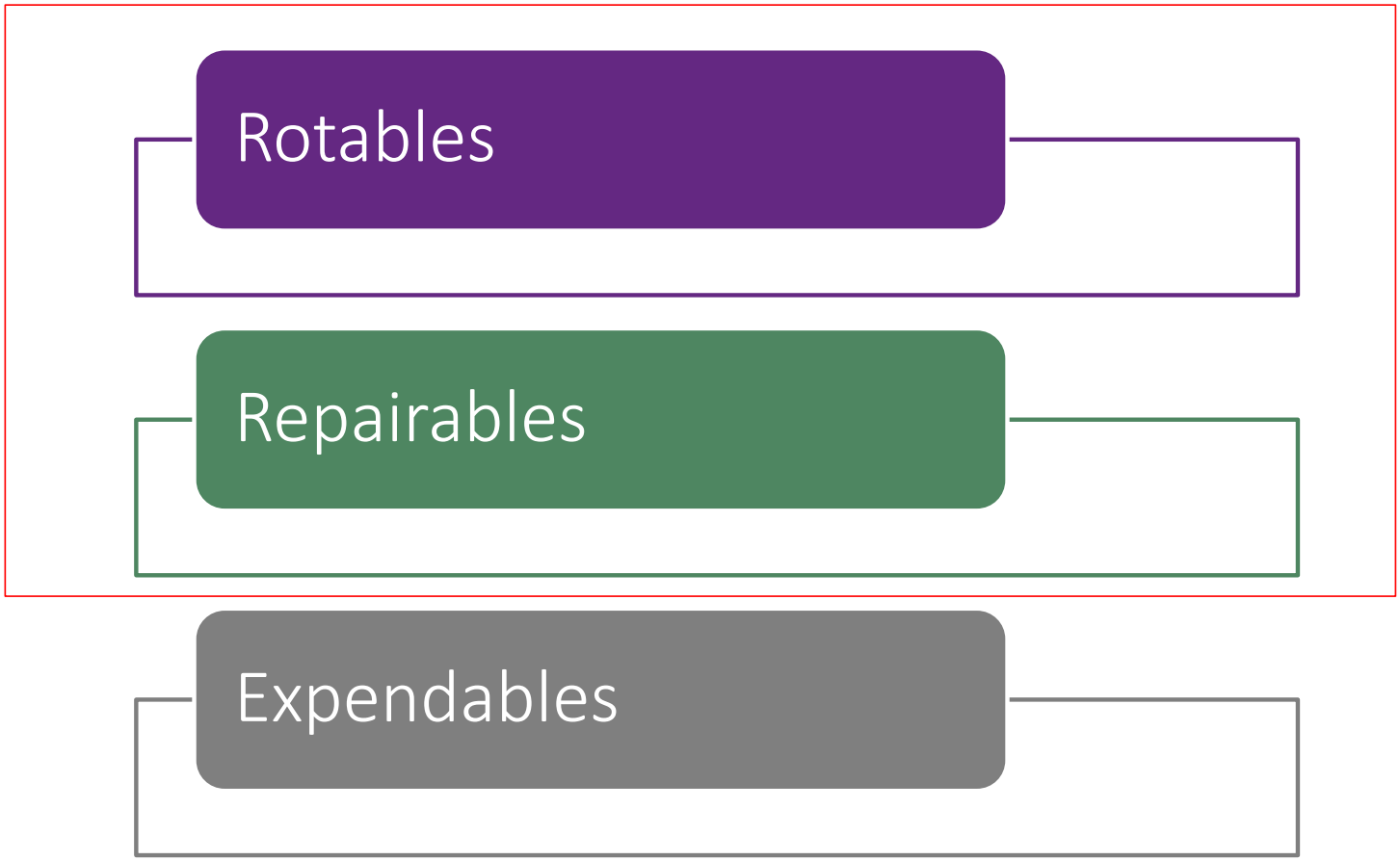
Business-friendly Solutions

Broad classification of spares based on their life-cycle



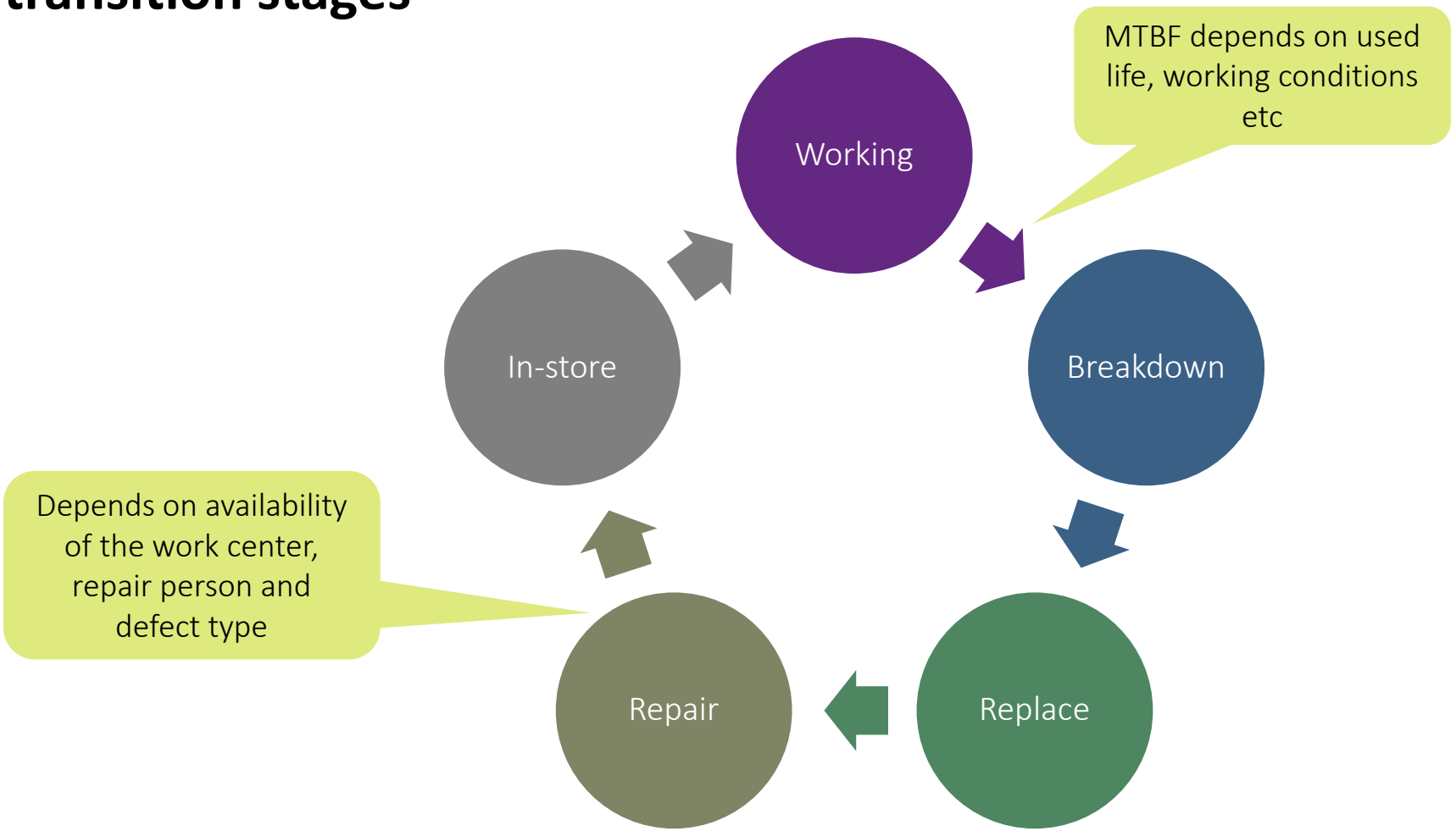
Focus of this demonstration is on this class of spares

A typical challenge in a complex asset intensive industry

The challenges in maintaining the right redundancy of repairable spares is high. Further the cost and service impact of these decisions are also very high

This model tells us how much of spares to stock. The model can also further suggest when a particular spare should be replaced or repaired

Typical cycle for repairable spare and variations in transition stages



Predicting the failure interval for the asset

Equipment failure analysis

Survival Function:

$S(t) = P(T \geq t)$

Probability that a particular component will survive atleast time 't' before it fails

T is the random variable denoting the failure of the component

t is time of interest

Lifetime Distribution Function

$F(t) = P(T \leq t) = 1 - S(t)$

The lifetime distribution function, conventionally denoted F, is defined as the complement of the survival function

If F is differentiable then the derivative, which is the density function of the lifetime distribution, is conventionally denoted f

$$f(t) = F'(t) = \frac{dF}{dt} = \frac{d(1 - S(t))}{dt} = -\frac{dS}{dt} = -S'(t)$$

The function f is sometimes called the event density; it is the rate of death or failure events per unit time.

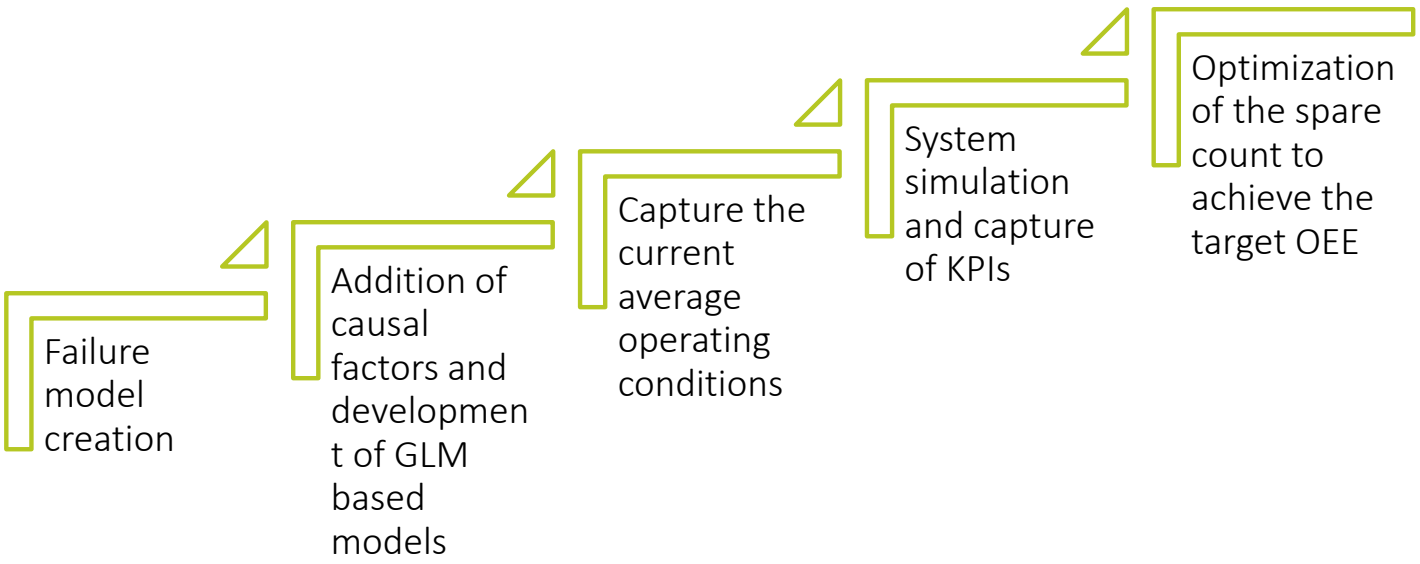
Hazard function

The hazard function, conventionally denoted by λ , is defined as the event rate at time t conditional on survival until time t or later (that is, T ≥ t).

Suppose that an item has survived for a time t and we desire the probability that it will not survive for an additional time dt:

$$\lambda(t) = \lim_{dt \to 0} \frac{\Pr(t \leq T < t + dt)}{dt \cdot S(t)} = \frac{f(t)}{S(t)} = -\frac{S'(t)}{S(t)}.$$

Solution approach



Demonstration scenario

An operation with two machines and has repairable component. The component life depends upon the following

- Total working hours
- Number of interventions/repairs carried out on the component
- Operating pressure

The components once out of running condition can be repaired on a particular workcenter.

The company intends to optimize the spare count and achieve an machine uptime of more than 95%.

This demonstration uses an agent based simulation model to first model the entire scenario. Then capture the current operating conditions. use the above factors to predict failure rate and then use Anylogic based optimization to design the number of spare parts to hold.

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Thank you

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