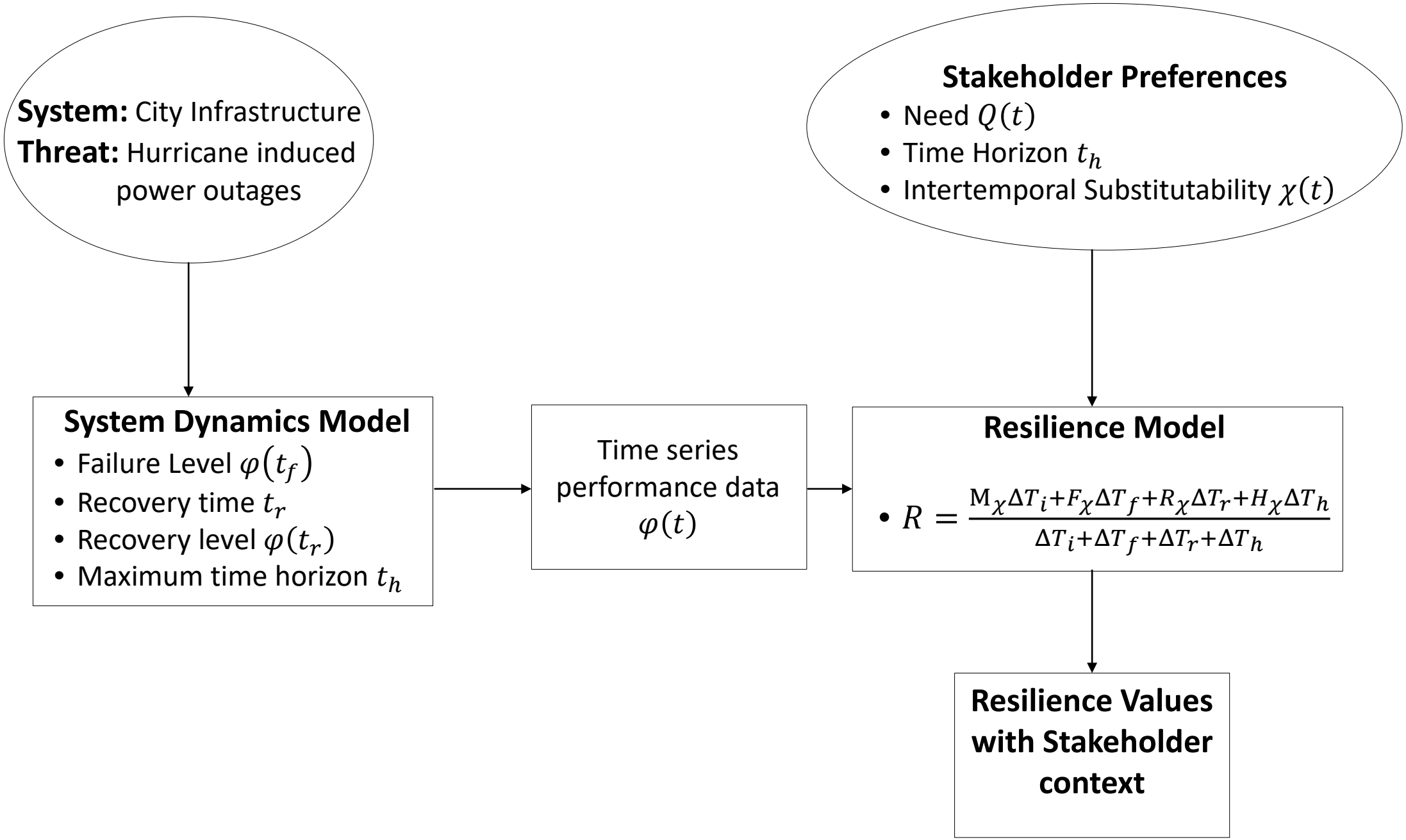

System: City Infrastructure
Threat: Hurricane induced power outages
Stakeholder Preferences
• Need $Q(t)$
• Time Horizon t_h
• Intertemporal Substitutability $\chi(t)$
System Dynamics Model
• Failure Level $\varphi(t_f)$
• Recovery time t_r
• Recovery level $\varphi(t_r)$
• Maximum time horizon t_h
Time series performance data $\varphi(t)$
Resilience Model
• $R = \frac{M_\chi \Delta T_i + F_\chi \Delta T_f + R_\chi \Delta T_r + H_\chi \Delta T_h}{\Delta T_i + \Delta T_f + \Delta T_r + \Delta T_h}$
Resilience Values with Stakeholder context

System Description

System	Threat
Puerto Rico Electrical Grid	Hurricane Maria
City Infrastructure	Hurricane induced power outages

	Puerto Rico Electrical Grid	City Infrastructure
Data Sources	DOE Reports, 9/20/17 - 4/4/18	System Dynamics Model

Stakeholder Preferences

Stakeholder Preference	Puerto Rico Electrical Grid	City Infrastructure
Need: $Q(t)$	Status Quo	Infrastructure-dependent
Time Horizon: t_h	Recovery Complete	.5, 1, 2, 5, and 10 years

Time series performance data $\varphi(t)$

Resilience Model

$$R = \frac{\mathrm{M}_\chi \Delta T_i + F_\chi \Delta T_f + R_\chi \Delta T_r + H_\chi \Delta T_h}{\Delta T_i + \Delta T_f + \Delta T_r + \Delta T_h}$$

Resilience Values with Stakeholder context

System Description

System	Threat
Training Squadron: Aircraft Students Instructors	Delayed replacement aircraft Surge in graduate demand

	Commanding Officer	Program Manager
Functional Outputs	Graduates / Quarter	Graduates / Quarter
	Satisfaction / Quarter	Satisfaction / Quarter
		Aircraft / Day

Stakeholder Preferences

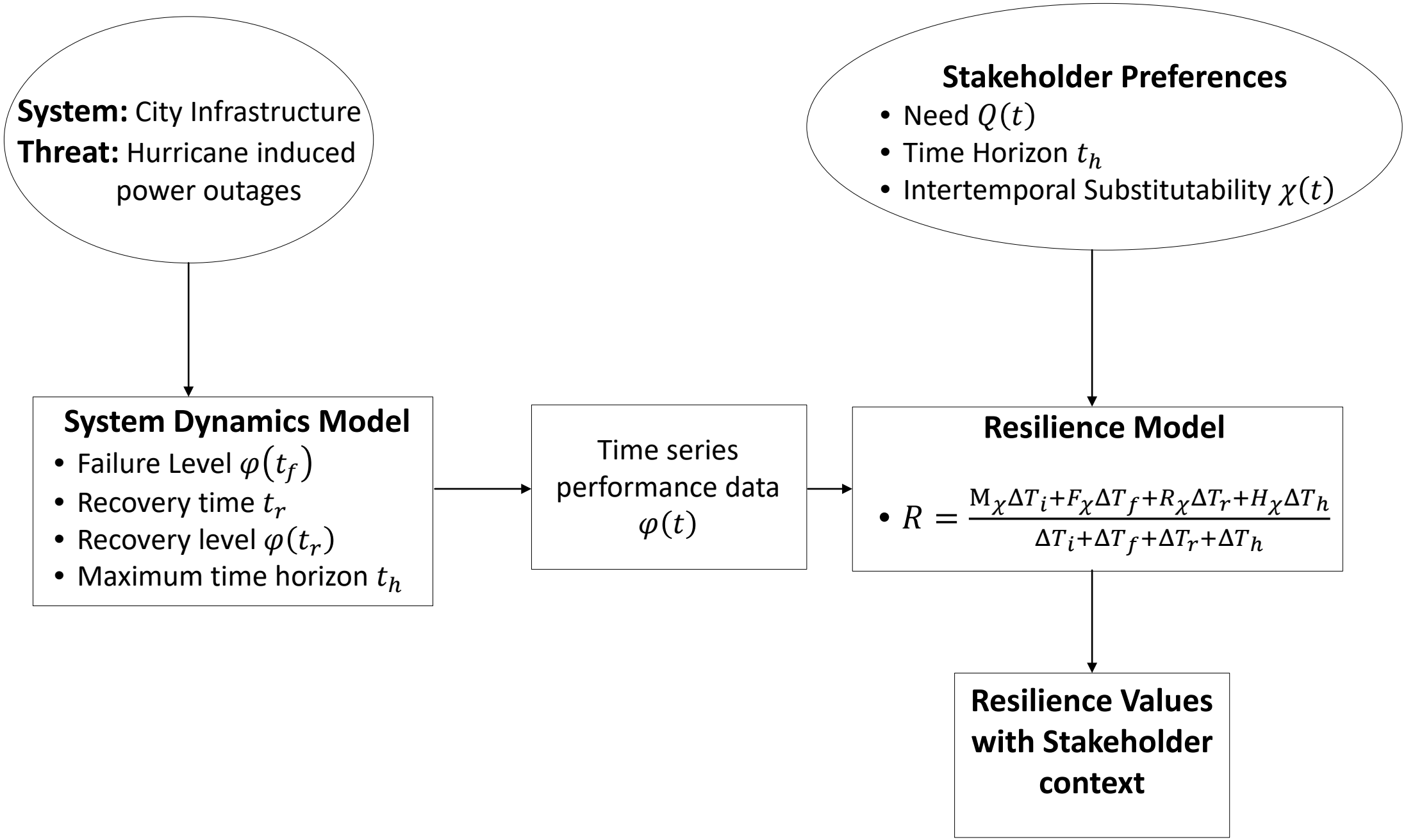
Stakeholder Preference	Functional Output	Commanding Officer	Program Manager
Need: $Q(t)$	Graduates	65 Normal, 90 Surge	65 Normal, 90 Surge
	Satisfaction	85%	85%
	Available Aircraft		85%
Time Horizon: t_h	All	3 Year Intervals	15, 20, 25, 30, 35 years
Intertemporal Substitutability: χ	Graduates	0, 1, & Event Dependent	0, 1, & Event Dependent

Time series performance data φ_t

Resilience Model

$$R = \frac{\mathrm{M}_\chi \Delta T_i + F_\chi \Delta T_f + R_\chi \Delta T_r + H_\chi \Delta T_h}{\Delta T_i + \Delta T_f + \Delta T_r + \Delta T_h}$$

Resilience Values with Stakeholder context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Resilience Values with Stakeholder context