Scrum Project Optimization Model

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Contents

1 Sets (Entities)

- $\mathcal{P}$: Set of Projects
- $\mathcal{T}$: Set of Teams
- $\mathcal{W}$: Set of Workers
- $\mathcal{F}$: Set of Features
- $\mathcal{S}$: Set of Skills
- $\mathcal{R}$: Set of Roles
- $\mathcal{PO}$: Set of Product Owners
- $\mathcal{SM}$: Set of Scrum Masters
- $\mathcal{PB}$: Set of Product Backlogs
- $\mathcal{SP}$: Set of Sprints
- $\mathcal{SPP}$: Set of Sprint Plannings
- $\mathcal{DS}$: Set of Daily Scrums
- $\mathcal{SR}$: Set of Sprint Reviews

- $\mathcal{SRE}$: Set of Sprint Retrospectives
- $\mathcal{SBL}$: Set of Sprint Backlogs
- $\mathcal{SG}$: Set of Sprint Goals
- $\mathcal{E}$: Set of Epics
- $\mathcal{US}$: Set of User Stories
- $\mathcal{TSK}$: Set of Tasks
- $\mathcal{DEV}$: Set of Development Snapshots
- $\mathcal{BL}$: Set of Blockers
- $\mathcal{SH}$: Set of Stakeholders
- $\mathcal{VEL}$: Set of Velocities
- $\mathcal{REP}$: Set of Release Plans
- $\mathcal{RM}$: Set of Roadmaps
- $\mathcal{SCB}$: Set of Scrum Boards
- $\mathcal{FED}$: Set of Feature Documentations

2 Indices

- $p \in \mathcal{P}$
- $t \in \mathcal{T}$
- $w \in \mathcal{W}$
- $f \in \mathcal{F}$
- $s \in \mathcal{S}$
- $r \in \mathcal{R}$
- $po \in \mathcal{PO}$
- $sm \in \mathcal{SM}$
- $pb \in \mathcal{PB}$
- $sp \in \mathcal{SP}$
- $spp \in \mathcal{SPP}$
- $ds \in \mathcal{DS}$

- $sr \in \mathcal{SR}$
- $sre \in \mathcal{SRE}$
- $sbl \in \mathcal{SBL}$
- $sg \in \mathcal{SG}$
- $e \in \mathcal{E}$
- $us \in \mathcal{US}$
- $tsk \in \mathcal{TSK}$
- $dev \in \mathcal{DEV}$
- $bl \in \mathcal{BL}$
- $sh \in \mathcal{SH}$
- $vel \in \mathcal{VEL}$
- $rep \in \mathcal{REP}$
- $rm \in \mathcal{RM}$
- $scb \in \mathcal{SCB}$
- $fed \in \mathcal{FED}$

3 Goals

- **G0 (maximize_team_productivity):**

$$\text{Maximize} \sum_{t \in \mathcal{T}} \text{team\_size}_t \times \text{weight}_{G0}$$

- **G1 (maximize_sprint_velocity):**

$$\text{Maximize} \sum_{vel \in \mathcal{VEL}} \text{avg.\_story\_points}_{vel} \times \text{weight}_{G1}$$

- **G2 (minimize_blocker_severity):**

$$\text{Minimize} \sum_{bl \in \mathcal{BL}} \text{severity}_{bl} \times \text{weight}_{G2}$$

- **G3 (maximize_feature_completion):**

$$\text{Maximize} \sum_{f \in \mathcal{F}} \mathbb{I}(\text{status}_f = \text{completed}) \times \text{weight}_{G3}$$

- **G4 (maximize_team_satisfaction):**

$$\text{Maximize} \sum_{sre \in \mathcal{SRE}} \text{team\_satisfaction}_{sre} \times \text{weight}_{G4}$$

- **G5 (minimize_project_budget_overrun):**

$$\text{Minimize} \sum_{p \in \mathcal{P}} \max(0, \text{actual\_budget}_p - \text{planned\_budget}_p) \times \text{weight}_{G5}$$

- **G6 (maximize_stakeholder_satisfaction):**

$$\text{Maximize} \sum_{sh \in \mathcal{SH}} \text{relevance\_to\_feature}_{sh} \times \text{weight}_{G6}$$

- **G7 (maximize_sprint_goal_achievement):**

$$\text{Maximize} \sum_{sg \in \mathcal{SG}} \text{achievement\_status}_{sg} \times \text{weight}_{G7}$$

- **G8 (minimize_task_effort):**

$$\text{Minimize} \sum_{tsk \in \mathcal{TSK}} \text{effort}_{tsk} \times \text{weight}_{G8}$$

- **G9 (maximize_skill_coverage):**

$$\text{Maximize} \sum_{w \in \mathcal{W}} \text{availability}_w \times \text{weight}_{G9}$$

- **G10 (minimize_sprint_duration):**

$$\text{Minimize} \sum_{sp \in \mathcal{SP}} \text{duration}_{sp} \times \text{weight}_{G10}$$

- **G11 (maximize_epic_priority):**

$$\text{Maximize} \sum_{e \in \mathcal{E}} \text{priority}_e \times \text{weight}_{G11}$$

- **G12 (maximize_user_story_completion):**

$$\text{Maximize} \sum_{us \in \mathcal{US}} \mathbb{I}(\text{status}_{us} = \text{completed}) \times \text{weight}_{G12}$$

- **G13 (minimize_team_location_distance):**

$$\text{Minimize} \sum_{t \in \mathcal{T}} \text{distance}(\text{location}_t) \times \text{weight}_{G13}$$

- **G14 (maximize_documentation_quality):**

$$\text{Maximize} \sum_{fed \in \mathcal{FED}} \text{change\_log}_{fed} \times \text{weight}_{G14}$$

4 Conditions

- **C0 (team_size_limit):**

$$\text{team\_size}_t \leq 9 \quad \forall t \in \mathcal{T}$$

- **C1 (sprint_duration_fixed):**

$$\text{duration}_{sp} = 14 \quad \forall sp \in \mathcal{SP}$$

- **C2 (blocker_resolution_time):**

$$\text{resolved\_on}_{bl} - \text{detected\_on}_{bl} \leq 2 \quad \forall bl \in \mathcal{BL}$$

- **C3 (budget_constraint):**

$$\text{actual\_budget}_p \leq \text{planned\_budget}_p \quad \forall p \in \mathcal{P}$$

- **C4 (skill_requirement):**

$$\sum_{w \in \mathcal{W}} \text{has\_skill}_{w,s} \times \text{assign\_worker\_to\_task}_{w,tsk} \geq 1 \quad \forall tsk \in \mathcal{TSK}, s \in \mathcal{S}$$

- **C5 (role_assignment):**

$$\sum_{sm \in \mathcal{SM}} \text{is\_supported\_by}_{t,sm} = 1 \quad \forall t \in \mathcal{T}$$

- **C6 (feature_priority_threshold):**

$$\text{priority}_f \geq 3 \quad \forall f \in \mathcal{F}, \text{select\_feature\_for\_release}_{f,rep} = 1$$

- **C7 (velocity_trend_positive):**

$$\text{trend}_{vel} \geq 0 \quad \forall vel \in \mathcal{VEL}$$

- **C8 (story_points_per_sprint):**

$$\sum_{us \in \mathcal{US}} \text{story\_points}_{us} \times \text{is\_in\_sprint\_backlog}_{us,sbl} \leq \text{avg.\_story\_points}_{vel} \quad \forall sbl \in \mathcal{SBL}, vel \in \mathcal{VEL}$$

- **C9 (release_date_deadline):**

$$\text{actual\_date}_{rep} \leq \text{planned\_date}_{rep} \quad \forall rep \in \mathcal{REP}$$

- **C10 (roadmap_milestone):**

$$\sum_{rep \in \mathcal{REP}} \text{is\_part\_of\_roadmap}_{rep,rm} \times \text{status}_{rep} = |\text{milestones}_{rm}| \quad \forall rm \in \mathcal{RM}$$

- **C11 (scrum_board_columns):**

$$|\text{columns}_{scb}| \geq 3 \quad \forall scb \in \mathcal{SCB}$$

- **C12 (worker_availability):**

$$\text{availability}_w = 1 \quad \forall w \in \mathcal{W}, \text{assign\_worker\_to\_task}_{w,tsk} = 1$$

- **C13 (acceptance_criteria_met):**

$$\text{status}_{us} = \text{completed} \implies \text{acceptance\_criteria\_met}_{us} = 1 \quad \forall us \in \mathcal{US}$$

- **C14 (retrospective_attendance):**

$$\text{attendees\_count}_{sre} = |\mathcal{T}| \quad \forall sre \in \mathcal{SRE}$$

5 Decision Variables

- $\text{assign\_worker\_to\_task}_{w,tsk} \in \{0, 1\}$
- $\text{select\_feature\_for\_release}_{f,rep} \in \{0, 1\}$
- $\text{set\_sprint\_duration}_{sp} \in \mathbb{Z}^+$
- $\text{allocate\_budget\_to\_project}_{p} \in \mathbb{R}^+$
- $\text{assign\_skill\_to\_worker}_{w,s} \in \{0, 1\}$
- $\text{set\_task\_effort}_{tsk} \in \mathbb{Z}^+$
- $\text{set\_sprint\_goal\_achievement}_{sg} \in \{0, 1\}$
- $\text{set\_blocker\_severity}_{bl} \in \{1, 2, 3\}$
- $\text{set\_team\_location}_{t} \in \{\text{remote}, \text{onsite}, \text{hybrid}\}$
- $\text{set\_stakeholder\_relevance}_{sh,f} \in \{1, 2, 3, 4, 5\}$
- $\text{set\_documentation\_quality}_{fed} \in \{1, 2, 3, 4, 5\}$
- $\text{set\_velocity\_trend}_{vel} \in \{-1, 0, 1\}$
- $\text{set\_user\_story\_priority}_{us} \in \{1, 2, 3, 4, 5\}$
- $\text{set\_team\_satisfaction}_{sre} \in \{1, 2, 3, 4, 5\}$
- $\text{set\_epic\_priority}_{e} \in \{1, 2, 3, 4, 5\}$