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):**

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

- **G6 (maximize_stakeholder_relevance):**

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

- **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_worker_availability):**

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

- **G10 (maximize_epic_priority):**

$$\text{Maximize} \sum_{e \in \mathcal{E}} \text{priority}_e \times \text{weight}_{G10}$$

- **G11 (minimize_sprint_duration):**

$$\text{Minimize} \sum_{sp \in \mathcal{SP}} \text{duration}_{sp} \times \text{weight}_{G11}$$

- **G12 (maximize_skill_level):**

$$\text{Maximize} \sum_{s \in \mathcal{S}} \text{level}_s \times \text{weight}_{G12}$$

- **G13 (maximize_user_story_completion):**

$$\text{Maximize} \sum_{us \in \mathcal{US}} \mathbb{I}(\text{status}_{us} = \text{completed}) \times \text{weight}_{G13}$$

- **G14 (maximize_development_snapshot_quality):**

$$\text{Maximize} \sum_{dev \in \mathcal{DEV}} \text{test\_status}_{dev} \times \text{weight}_{G14}$$

4   Conditions

- **C0 (team_size_limit):**

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

- **C1 (project_budget_limit):**

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

- **C2 (sprint_duration_fixed):**

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

- **C3 (worker_availability_required):**

$$\text{availability}_w = 1 \quad \forall w \in \mathcal{W}$$

- **C4 (blocker_resolution_required):**

$$\text{status}_{bl} = \text{resolved} \quad \forall bl \in \mathcal{BL} \text{ with severity}_{bl} \geq 3$$

- **C5 (feature_priority_threshold):**

$$\text{priority}_f \geq 3 \quad \forall f \in \mathcal{F}$$

- **C6 (role_assignment_required):**

$$\sum_{r \in \mathcal{R}} \mathbb{I}(r = \text{Scrum Master}) \geq 1 \quad \forall t \in \mathcal{T}$$

- **C7 (velocity_trend_positive):**

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

- **C8 (release_plan_status_active):**

$$\text{status}_{rep} = \text{active} \quad \forall rep \in \mathcal{REP}$$

- **C9 (epic_status_active):**

$$\text{status}_e = \text{active} \quad \forall e \in \mathcal{E}$$

- **C10 (task_type_valid):**

$$\text{type}_{tsk} \in \{\text{development}, \text{testing}, \text{documentation}\} \quad \forall tsk \in \mathcal{TSK}$$

- **C11 (stakeholder_influence_limit):**

$$\text{influence\_level}_{sh} \geq 3 \quad \forall sh \in \mathcal{SH}$$

- **C12 (scrum_board_columns_required):**

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

- **C13 (feature_documentation_required):**

$$\text{title}_{fed} \neq \emptyset \quad \forall fed \in \mathcal{FED}$$

- **C14 (sprint_goal_achievable):**

$$\text{achievement\_status}_{sg} \geq 70 \quad \forall sg \in \mathcal{SG}$$

5 Decision Variables

- $x_{w,t} \in \{0,1\}$: **DV0** assign_worker_to_team
- $y_{f,sp} \in \{0,1\}$: **DV1** select_feature_for_sprint
- $z_{tsk,w} \in \{0,1\}$: **DV2** assign_task_to_worker
- $d_{sp} \in [7,30]$: **DV3** set_sprint_duration
- $b_p \in [0,1000000]$: **DV4** allocate_budget_to_project
- $a_w \in \{0,1\}$: **DV5** set_worker_availability
- $s_{bl} \in [1,5]$: **DV6** set_blocker_severity
- $n_t \in [3,9]$: **DV7** set_team_size
- $p_f \in [1,5]$: **DV8** set_feature_priority
- $u_{us} \in \{0,1\}$: **DV9** set_user_story_status
- $g_{sg} \in [0,100]$: **DV10** set_sprint_goal_achievement
- $l_s \in [1,5]$: **DV11** set_skill_level
- $e_{tsk} \in [0.5,40]$: **DV12** set_task_effort
- $r_{sh} \in [1,5]$: **DV13** set_stakeholder_relevance
- $v_{vel} \in [0,100]$: **DV14** set_velocity_avg