

Optimization Model for Software Development Company Using SCRUM

Sets and Indices

P : set of projects
 T : set of teams
 E : set of employees
 F : set of features
 S : set of sprints
 U : set of user stories
 K : set of tasks/sub-tasks
 B : set of blockers/problems/bugs
 R : set of release plans
 Po : set of product owners
 V : set of velocity records

Decision Variables

$x_{s,f}^{feat} \in \{0,1\}$: Feature f assigned to sprint s
 $y_{e,k}^{emp} \in \{0,1\}$: Employee e assigned to task k
 $a_e^{emp} \in [0,1]$: Availability of employee e
 $d_k^{task} \in \mathbb{R}^+$: Effort estimate for task k
 $sz_t \in \mathbb{Z}^+$: Team size of team t
 $b_s \in \mathbb{Z}^+$: Number of blockers in sprint s
 $v_t \in \mathbb{R}^+$: Velocity of team t
 $g_s \in [0,1]$: Achievement percentage of sprint goal s
 $l_{e,sk} \in \{1, \dots, 5\}$: Skill level of employee e for skill sk
 $po_{apo} \in [0,1]$: Availability of Product Owner po

Objective Functions

$$\max \sum_{p \in P} \text{on_time}_p \quad (\text{Maximize on-time project completion}) \quad (1)$$

$$\max \sum_{t \in T} v_t \quad (\text{Maximize team velocity}) \quad (2)$$

$$\min \sum_{b \in B} \text{resolution_time}_b \quad (\text{Minimize blocker resolution time}) \quad (3)$$

$$\max \sum_{s \in S} \sum_{f \in F} x_{s,f}^{feat} \quad (\text{Maximize features delivered}) \quad (4)$$

$$\max \sum_{e \in E} a_e^{emp} \quad (\text{Maximize employee availability}) \quad (5)$$

$$\min \sum_{s \in S} (\text{actual_effort}_s - \text{planned_effort}_s) \quad (\text{Minimize sprint overruns}) \quad (6)$$

$$\max \sum_{po \in Po} po_{apo} \quad (\text{Maximize Product Owner involvement}) \quad (7)$$

$$\max \sum_{s \in S} sat_s \quad (\text{Maximize team satisfaction}) \quad (8)$$

$$\max \sum_{e \in E} \sum_{sk} \mathbf{1}_{l_{e,sk} \geq l_{req,sk}} \quad (\text{Maximize skill coverage}) \quad (9)$$

$$\min \sum_{s \in S} \text{unplanned_tasks}_s \quad (\text{Minimize unplanned work}) \quad (10)$$

Constraints

- **Project Budget:**

$$\forall p \in P : \quad \text{cost}_p \leq \text{budget}_p$$

- **Team Size Limits:**

$$\forall t \in T : \quad \text{min_team_size} \leq sz_t \leq \text{max_team_size}$$

- **Employee Availability:**

$$\forall e \in E, k \in K : \quad y_{e,k}^{emp} \leq a_e^{emp}$$

- **Skill Match:**

$$\forall e \in E, k \in K : \quad y_{e,k}^{emp} = 1 \implies l_{e,sk_k} \geq l_{req,sk_k}$$

- **Sprint Duration:**

$$\forall s \in S : \quad \text{start}_s + \text{duration}_s \leq \text{max_end}_s$$

- **Sprint Goal Achievement:**

$$\forall s \in S : \quad g_s \geq g_{min}$$

- **Blocker Limit:**

$$\forall s \in S : \quad b_s \leq b_{max}$$

- **Release Plan Feature Coverage:**

$$\forall r \in R, f \in F_{critical} : \quad \sum_{s \in S} x_{s,f}^{feat} \geq 1$$

- **Task Effort Limits:**

$$\forall k \in K : \quad d_{min}^{task} \leq d_k^{task} \leq d_{max}^{task}$$

- **Product Backlog Status Active:**

$$\text{status}_{backlog} = \text{active}$$