Optimization Model for Scrum-Based Software Development

Sets and Indices

- $t \in \mathcal{T}$: Teams

- $k \in \{1, \ldots, S\}$: Sprints

- $p \in \mathcal{P}$: Projects

- $f \in \mathcal{F}$: Features

- $u \in \mathcal{U}$: User Stories

- $e \in \mathcal{E}$: Employees

Decision Variables

$$
\begin{aligned}
S &: \text{Number of Sprints } (DV1) \\
Tsize_t &: \text{Team Size for team } t \ (DV2) \\
d_k &: \text{Length of sprint } k \ (DV3) \\
F_k &: \text{Features in sprint } k \ (DV4) \\
h_u &: \text{Hours for task } u \ (DV5) \\
y_{\text{phase}} &: \text{Budget percentage for each phase } (DV6) \\
DevCount_t &: \text{Developers in team } t \ (DV7) \\
QACount_t &: \text{QA personnel in team } t \ (DV8) \\
U_k &: \text{User Stories in sprint } k \ (DV9) \\
SMCount_t &: \text{Scrum Masters in team } t \ (DV10)
\end{aligned}
$$

Objectives

$$
\min \sum_{k=1}^{S} d_k \quad \text{(Minimize total project duration)} \tag{1}
$$

$$
\max \ V \quad \text{(Maximize sprint velocity)} \tag{2}
$$

$$
\min \ \text{Var}_{\text{budget}} \quad \text{(Minimize budget variance)} \tag{3}
$$

$$
\max \sum_{r \in \mathcal{R}} |\{f : f \text{ released in } r\}| \quad \text{(Maximize features per release)} \tag{4}
$$

$$
\min \sum_{k=1}^{S} \#\{\text{open bugs in } k\} \quad \text{(Minimize open bugs)} \tag{5}
$$

$$
\max \sum_{rev} \text{StakeholderScore}_{rev} \quad \text{(Maximize stakeholder satisfaction)} \tag{6}
$$

Constraints

$$Tsize_t \geq 3 \qquad \forall t \in \mathcal{T} \qquad \text{(C1)} \qquad (7)$$

$$Tsize_t \leq 9 \qquad \forall t \in \mathcal{T} \qquad \text{(C2)} \qquad (8)$$

$$d_k = 14 \qquad \forall k = 1, \ldots, S \qquad \text{(C3)} \qquad (9)$$

$$\text{Budget}_p \geq \sum_{\text{phase}} y_{\text{phase}} \cdot \text{Budget}_p \qquad \forall p \in \mathcal{P} \qquad \text{(C4)} \qquad (10)$$

$$\sum_{e \in t} \mathbf{hasSkill}(e, s) \geq \mathbf{reqSkill}(f, s) \qquad \forall f \in \mathcal{F}, \forall s \qquad \text{(C5)} \qquad (11)$$

$$\text{Availability}_{e,k} = 1 \qquad \forall e \in \mathcal{E}, k \qquad \text{(C6)} \qquad (12)$$

$$|\mathcal{B}| \leq 200 \qquad \text{(C7)} \qquad (13)$$

$$\text{TimeZone}(t) = \text{const} \qquad \forall t \qquad \text{(C8)} \qquad (14)$$

$$\text{StartDate}_k \notin \text{PublicHolidays} \qquad \forall k \qquad \text{(C9)} \qquad (15)$$

$$F_k \geq \sum_{f \in \mathcal{F}_{HP}} x_{k,f} \qquad \forall k \leq 2 \qquad \text{(C10)} \qquad (16)$$