Optimization Model for Agile Software Development using SCRUM

Generated by ChatGPT

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Entities

The domain model includes the following entities (denoted by their logical roles):

- P: Projects
- T: Teams
- E: Employees
- F: Features
- S: Skills
- R: Roles
- PO: Product Owners
- SM: Scrum Masters
- PB: Product Backlogs
- SP: Sprints
- EP: Epics
- US: User Stories
- TS: Tasks / Sub-Tasks
- DS: Development Snapshots
- B: Blockers
- SH: Stakeholders
- V: Velocity
- RP: Release Plans
- RM: Roadmaps

Decision Variables

Let the following decision variables be defined:

$$
\begin{aligned}
x_1 &= \text{Team size} && (3 \leq x_1 \leq 9) \\
x_2 &= \text{Sprint length (days)} && (7 \leq x_2 \leq 30) \\
x_3 &= \text{Effort per task (hours)} && (1 \leq x_3 \leq 16) \\
x_4 &= \text{Team availability (\%)} && (50 \leq x_4 \leq 100) \\
x_5 &= \text{Max blockers per sprint} && (0 \leq x_5 \leq 5) \\
x_6 &= \text{Number of active stakeholders} && (1 \leq x_6 \leq 10) \\
x_7 &= \text{Certified skills ratio} && (0.0 \leq x_7 \leq 1.0) \\
x_8 &= \text{Story points per sprint} && (20 \leq x_8 \leq 80) \\
x_9 &= \text{Team satisfaction score} && (1 \leq x_9 \leq 10) \\
x_{10} &= \text{Test pass rate} && (0.0 \leq x_{10} \leq 1.0)
\end{aligned}
$$

Objective Function

We aim to optimize a multi-objective function with goals to maximize and minimize:

$$
\begin{aligned}
&\text{Maximize } Z = \alpha_1 x_4 + \alpha_2 x_9 + \alpha_3 x_{10} + \alpha_4 x_6 + \alpha_5 x_7 + \alpha_6 x_8 \\
&\text{Minimize } W = \beta_1 x_2 + \beta_2 x_3 + \beta_3 x_5
\end{aligned}
$$

where α_i and β_i are weights assigned to goals and penalties.

Constraints

C1: $x_3 \leq 16$ (Max effort per task)
C2: $x_5 \leq 5$ (Max blockers allowed)
C3: $x_7 \geq 0.6$ (Certified skills ratio preferred)
C4: $x_1 \in [3, 9]$ (Team size range)
C5: $x_2 \in [7, 30]$ (Sprint length range)
C6: $x_8 \leq 80$ (Story points limit)
C7: $x_9 \geq 7$ (Minimum team satisfaction)
C8: $x_{10} \geq 0.8$ (Test pass rate)

Conclusion

This optimization model aims to balance software development efficiency and quality in an agile (SCRUM) environment, aligning both internal team dynamics and external stakeholder requirements.