Optimization Model for Scrum-based Software Development

Generated by Meta AI

September 5, 2025

Contents

1 Sets (Entities)

- Project (P)
- Team (T)
- Worker (W)
- Feature (F)
- Skill (S)
- Role (R)
- Product Owner (PO)
- Scrum Master (SM)
- Product Backlog (PB)
- Sprint (SP)
- Sprint Planning (SPP)
- Daily Scrum (DS)

- Sprint Review (SR)
- Sprint Retrospective (SRE)
- Sprint Backlog (SBL)
- Sprint Goal (SG)
- Epic (E)
- User Story (US)
- Task (TSK)
- Development Snapshot (DEV)
- Blocker (BL)
- Stakeholder (SH)
- Velocity (VEL)
- Release Plan (REP)
- Roadmap (RM)
- Scrum Board (SCB)
- Feature Documentation (FED)

2 Indices

- $p \in P$ (Project)
- $t \in T$ (Team)
- $w \in W$ (Worker)
- $f \in F$ (Feature)
- $s \in S$ (Skill)
- $r \in R$ (Role)
- $po \in PO$ (Product Owner)
- $sm \in SM$ (Scrum Master)
- $pb \in PB$ (Product Backlog)
- $sp \in SP$ (Sprint)
- $sg \in SG$ (Sprint Goal)

- $us \in US$ (User Story)

- $tsk \in TSK$ (Task)

- $dev \in DEV$ (Development Snapshot)

- $bl \in BL$ (Blocker)

- $sh \in SH$ (Stakeholder)

3 Goals

- G0: maximize_team_velocity $\max \sum_{t \in T} VEL_t \cdot avg\_story\_points_t$

- G1: minimize_blocker_severity $\min \sum_{bl \in BL} severity_{bl}$

- G2: maximize_sprint_goal_achievement $\max \sum_{sg \in SG} achievement\_status_{sg}$

- G3: minimize_task_effort $\min \sum_{tsk \in TSK} effort_{tsk}$

- G4: maximize_feature_completion $\max \sum_{f \in F} status_f$

- G5: minimize_sprint_retrospective_improvement_actions $\min \sum_{sre \in SRE} improvement\_actions_{sre}$

- G6: maximize_stakeholder_satisfaction $\max \sum_{sh \in SH} influence\_level_{sh}$

- G7: minimize_development_snapshot_bugs $\min \sum_{dev \in DEV} test\_status_{dev}$

- G8: maximize_product_backlog_quality $\max \sum_{pb \in PB} number\_of\_entries_{pb}$

- G9: minimize_scrum_board_blocked_tasks $\min \sum_{scb \in SCB} number\_of\_cards_{scb}$

- G10: maximize_release_plan_included_features $\max \sum_{rep \in REP} included\_features_{rep}$

- G11: minimize_roadmap_risk $\min \sum_{rm \in RM} milestones_{rm}$

- G12: maximize_team_collaboration $\max \sum_{t \in T} team\_size_t$

- G13: minimize_worker_availability_issues $\min \sum_{w \in W} availability_w$

- G14: maximize_product_owner_experience $\max \sum_{po \in PO} availability_{po}$

4 Conditions

- C0: team_size_condition $team\_size_t \geq 5 \quad \forall t \in T$

- C1: sprint_goal_achievement_condition $achievement\_status_{sg} \geq 0.8 \quad \forall sg \in SG$

- C2: feature_completion_condition $status_f \geq 0.7 \quad \forall f \in F$

- C3: task_effort_condition $\sum_{tsk \in TSK} effort_{tsk} \leq 1000$

- C4: blocker_severity_condition $severity_{bl} \leq 5$ $\forall bl \in BL$

- C5: stakeholder_satisfaction_condition $influence\_level_{sh} \geq 0.8$ $\forall sh \in SH$

- C6: product_backlog_quality_condition $number\_of\_entries_{pb} \geq 0.8$ $\forall pb \in PB$

- C7: scrum_board_blocked_tasks_condition $number\_of\_cards_{scb} \leq 5$ $\forall scb \in SCB$

- C8: release_plan_included_features_condition $included\_features_{rep} \geq 5$ $\forall rep \in REP$

- C9: roadmap_risk_condition $milestones_{rm} \leq 5$ $\forall rm \in RM$

- C10: team_collaboration_condition $team\_size_t \geq 0.8$ $\forall t \in T$

- C11: worker_availability_condition $availability_w \geq 0.8$ $\forall w \in W$

- C12: product_owner_experience_condition $availability_{po} \geq 5$ $\forall po \in PO$

5   Decision Variables

- D0: team_size ($team\_size_t \in \{5, 10, 15\}$)

- D1: sprint_goal_achievement_rate ($achievement\_status_{sg} \in [0.5, 1]$)

- D2: feature_completion_rate ($status_f \in [0.5, 1]$)

- D3: task_effort ($effort_{tsk} \in [0, 1000]$)

- D4: blocker_severity ($severity_{bl} \in [0, 10]$)

- D5: stakeholder_satisfaction ($influence\_level_{sh} \in [0.5, 1]$)

- D6: product_backlog_quality ($number\_of\_entries_{pb} \in [0.5, 1]$)

- D7: scrum_board_blocked_tasks ($number\_of\_cards_{scb} \in \{0, 1, 2, 3, 4, 5\}$)

- D8: release_plan_included_features ($included\_features_{rep} \in \{5, 100, 150\}$)

- D9: roadmap_risk ($milestones_{rm} \in [0, 10]$)

- D10: team_collaboration ($team\_size_t \in [0.5, 1]$)

- D11: worker_availability ($availability_w \in [0.5, 1]$)

- D12: product_owner_experience ($availability_{po} \in [1, 5]$)

- D13: development_snapshot_quality ($test\_status_{dev} \in [0.5, 1]$)

- D14: sprint_retrospective_improvement_actions ($improvement\_actions_{sre} \in \{0, 1, 2, 3, 4, 5\}$)