Table 1 Introduction Questionnaire for End Users

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| Question | Options (Blank for open answer) |
| Company name: |  |
| Job Title: |  |
| What is your experience in building schedules (number of years)? | a. 0-5 b. 6-10 c. 11-20 |
| What is your experience in the project management area (number of years)? | a. 0-5 b. 6-10 c. 11-20  d. More than 20 years |
| When managing a project, what is the order of importance you give to safety, quality, time and budget? (In the order of highest to lowest priority) |  |
| Which of these lean construction concepts or methods are you familiar with? (Checklist) | a. Last Planner System b. Location-based Management System (Line of Balance) c. Takt Production d. Just in time e. Push and Pull Planning  f. Other |
| Which digital tools/technology do you use to assist you in planning? | a. BIM b. Virtual Design and Construction (VDC) c. Traditional Scheduling Software (MS Project, Primavera P6, Procore, Microsoft Excel etc.) d. Lean Scheduling Software (VICO, VisiLean, Sitedrive, etc.) e. Automated Progress Monitoring Solutions  f. Computer-aided design (CAD) g. Other: \_\_\_\_\_\_\_\_\_\_\_ |
| What construction projects have you managed (building a residential project, commercial, civil infrastructure etc.)? What is the average/range of sizes (by cost units)? |  |
| What is the average relative delay in your projects? For example, if a project’s planned duration is 20 months and there is a 2-month average delay, the percentage of delay relative to the total project duration is 10% | a. less than 5%  b. 6%-10% c. 11%-20% d. more than 20% |
| Rank these types of disruptions that you most commonly encounter in projects. And in which activity or phase (e.g., structural frame, MEP, HVAC, painting)? (rank from 1 to 5, very likely 5%, likely 4, about as likely as not 3, unlikely 2, very unlikely 1, exceptionally unlikely 0 | a. labor shortage/delay b. material delivery delays/quality issues c. Congested locations d. Equipment failure e. Crane utilization f. Elevator/material haul g. rework (quality control) |
| How often do you and discuss with your subs and team to review the project progress for medium-term planning (4-8 weeks look ahead)? |  |
| What Key performance indicators, visual aids, or project data do you refer to during the project’s review meetings? | 1. Percentage Plan Complete (PPC) 2. Earned Value Curve 3. Safety 4. Quality 5. Time 6. Budget 7. Other |
| What questions do you regularly ask yourself or your team when trying to get the project back on track? (for example, can we add a crew? Do we have another supplier to get materials from faster?) |  |
| Suppose there is a software that automatically optimizes your plan according to your instructions, what instructions would you like to give to it?  Some Examples:  “Give me plans that leads to the least time and cost.”  “Try to make sure there is no waiting time between work for crews”  “Give me plans that has the least risk of time overrun”  “Show me how much more resources I need to add to stay on time” |  |
| once the software comes up with several feasible plans, what kind of information and visual aids would you like from the software to compare the plans? |  |

Table 2 Questionnaire for Confirm Users’ Understanding

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| Question | Options (Blank for open answer) |
| How well did you understand the introduction to the BIM2TWIN project, the simulation software, and the pilot project? | a. Not at all  b. Somewhat  c. Moderately  d. Almost completely  e. Completely |
| Based on your current understanding of the Suvela project, are there any guidelines/explanations that you would suggest adding or clarifying? | Yes/No, which? |
| Is there specific information you feel is missing regarding the status of the Suvela project? In other words, Is there other information you need to make a planning decision? |  |
| Rate from 0-10 how complete is your understanding of the current state of the Suvela project? You need to explain what 10 refers to and the others. For instance, 10 could be “fully understand” | 0 1 2 3 4 5 6 7 8 9 10 |
| Can you provide an overview of your strategy for identifying and addressing the new schedule? (For example, identifying bottlenecks gaps, maximizing time management, or establishing a regular workflow)? |  |

Table 4 User Experience Input to the Simulation Questionnaire

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| Question | Options (Blank for open answer) |
| What are the reasons for changes selection (alternative plans)? (why exactly are these? Why not more or less? In your answer, refer to judgment from experience or assumptions you made) |  |
| What changes were important and what were not important? |  |
| Would you like to run the simulation again? If so, what would you do differently? |  |
| For each section of the interface, rank each of the input columns in terms of relevance (i.e., how often you would consider changing this option or how practical this option is to implement) | Section: Material  • Batch size  • Buffer quantity  • Logistic Policy  Section: Equipment  • Quantity  • Maintenance rate  • Availability  Section: Crew  • Number of crews  • Crew size  • Working Hours per Day  • Labor Assignment Policy  • Batch size |
| Do you agree? The input options of this interface match the alternatives I look into when trying to correct the project’s trajectory in medium-term planning. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Do you agree? The user interface is intuitive and easy to get used to. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Do you agree? This user interface and the input options are applicable to most commercial and residential construction projects. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| What do you like about this interface? |  |
| What needs to be improved in this interface? Is there information or functions that are missing? |  |
| The goal of this user interface is to allow the user to define a set of alternative production plans they want to simulate and get their predictions. Giving a score from 0 to 10, how well do you think this interface achieves its goal? | 0 1 2 3 4 5 6 7 8 9 10 |
| What did you learn about the project or schedule from the first run of the simulation? |  |

Table 5 Recommendation Dashboard Questionnaire

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| Question | Options (Blank for open answer) |
| Which alternative plan would you choose and why? Refer in your answer to time, budget, flow, and reliability/risk. |  |
| Do you agree? I have all the information needed to decide which alternative plan to choose. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Do you agree? The information and visual aids in the dashboard allow me to compare the baseline and alternative plans comprehensively. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Do you agree? I am confident that the alternative plan I selected is better than the baseline one. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| What additional information would you like to know about the alternative plans? What information would make you more confident about the simulation results? |  |
| Is there another alternative plan you would like to try? If yes, what would it be? |  |

### Review of the whole system

Table 6 Simulation Overview Questionnaire

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| Question | Options (Blank for open answer) |
| From 1-5, how well do you think this software achieved its objective (1 is not achieving the objective, 5 the objective completely achieved)::   1. Transform production management from reactive to proactive 2. Provide a user-friendly tool for people to evaluate, in real-time, the possible outcomes of design/plan decisions they consider. | 1 2 3 4 5 |
| Do you agree? It is clear how the software inputs are connected to the output results (process flow). | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Do you agree? This software is compatible with my current planning workflow. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Do you agree? Using this software will help me make more optimal decisions in medium-term planning. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Do you agree? I would like to use a more mature version of this software in my professional work. | a. Strongly Disagree  b. Slightly Disagree  c. Neither Agree nor Disagree  d. Slightly Disagree  e. Strongly Agree |
| Are there any other thoughts or feedback you would like to share? |  |