

# Leveraging ChatGPT for Enhanced Logical Analysis in the Theory of Constraints Thinking Process

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**Background/Purpose:** Artificial intelligence (AI) has traditionally been used for quantitative analysis using explicit data. However, much of the information critical to decision making remains undocumented and is not stored in a structured way. This study explores the integration of AI, specifically ChatGPT, into Theory of Constraints (TOC) Thinking Process (TP) tools.

**Method:** In this study, we applied ChatGPT to a real-world IT project management case using a variety of research methods, including international literature analysis, observation, and personal experience. The use of the TOC TP allowed us to understand the decision-making process of ChatGPT and to systematically explore its advantages and limitations in creating logical trees of TOC TP.

**Results:** ChatGPT significantly enhanced efficiency and depth in TOC TP data collection and analysis, effectively addressing logical leaps for more coherent structures. It also promoted deeper analytical thinking and aided root cause identification. The integration of ChatGPT into the TOC TP process led to faster decision-making, reduced bias, and clearer analysis. Challenges of ChatGPT including the need for human oversight, specific TOC TP training, and ethical considerations were noted.

**Conclusion:** This study provides an initial investigation into the use of ChatGPT in TOC TP tools. The results suggest that ChatGPT has the potential to be a valuable tool for organizations seeking to improve their decision making and performance. However, further research is needed to validate these findings and explore the full potential of AI in TOC TP.

**Keywords:** *ChatGPT, Artificial Intelligence, Theory of Constraints, Theory of Constraints Thinking Process, Logical Analysis, Decision Making, Structured Analysis Framework*

## 1 Introduction

Artificial intelligence (AI), notably represented by ChatGPT (Zamfiroiu et al., 2023), presents a transformative avenue for enhancing logical analysis in intricate decision-making processes. Integrating AI into established frameworks, such as the Theory of Constraints (TOC) Thinking Process (TP) (Gaspar et al., 2019; Goldratt, 2008), holds increasing importance as organizations seek advanced solutions. This study explores the integration of

ChatGPT within the TOC TP to improve logical analysis, thereby enhancing decision-making outcomes.

The TOC TP (Dettmer 2007) incorporates essential tools for systematic logical analysis and decision-making. These tools provide a structured approach to identifying and resolving root causes of problems and implementing effective solutions using logical trees: Current Reality Tree (CRT) identifies the root cause of a problem; Future Reality Tree (FRT) envisions the outcomes of proposed changes; Prerequisite Tree (PRT) establishes the necessary

conditions for change; and Transition Tree (TT) develops a roadmap for executing the changes.

Traditional methods for constructing logical trees often involve manual analysis of unstructured data. This process can be time-consuming, error-prone, and susceptible to biases. ChatGPT's ability to process and understand unstructured data presents an opportunity to overcome these challenges, potentially improving the accuracy and efficiency of logical analysis.

The primary research question guiding this study is: How can ChatGPT be effectively integrated into the TOC TP to enhance logical analysis and decision-making outcomes? This study aims to investigate the potential of ChatGPT in integrating with TOC TP, focusing on bias reduction, decision-making acceleration, and clarity and accuracy of logical analysis.

The research design adopts a comprehensive multi-faceted approach, integrating international literature analysis from reputable databases such as SpringerLink and Scopus, alongside direct observation and insights derived from personal experience. Utilizing ChatGPT in this methodology, diverse prompts related to IT project management were posed, ranging from extracting common factors leading to project delays to investigating causes for resource unavailability. This approach ensures a thorough examination of ChatGPT's integration within the TOC TP, particularly in real-world IT project management scenarios.

Despite the transformative potential of AI, the existing body of research in this area remains remarkably scarce. A cursory review of academic databases reveals a limited number of publications, a lack of comprehensive reviews, and a dearth of empirical studies dedicated to this emerging intersection. This scarcity of research highlights the need for further investigation to fully understand the opportunities and challenges associated with this novel combination. By leveraging ChatGPT's capabilities, this study contributes to existing knowledge by exploring the benefits, challenges, and implications of integrating ChatGPT into TOC TP, with a specific focus on constructing CRTs. The findings aim to empower organizations in making informed decisions about implementing ChatGPT into their decision-making processes.

The study is organized as follows. Section 2 provides a brief review of the current research and problem definition on which our study is based. The research methodology in Section 3, while Section 4 presents the results. Section 5 summarizes and discusses the findings and implications for further practice. Section 6 draws conclusions.

The significance of this study lies in its potential to offer organizations an innovative approach to decision-making, bridging the gap between traditional structured analysis methods and the transformative capabilities of AI, as embodied by ChatGPT.

## 2 Current Research on the Integration of ChatGPT in TOC TP

This chapter provides an overview of the current research landscape related to the integration of ChatGPT and the tools of TOC TP. While this is a relatively new area of research, we aim to explore the existing knowledge and identify potential research gaps to establish a foundation for our study.

The systematic literature review conducted from 18 June 2023 to 21 July 2023 covered the fields of engineering, computer science, decision science, and business management and accounting. Keyword searches in SpringerLink and Scopus databases, combining terms such as ChatGPT, Bias, Theory of Constraints, Theory of Constraints Thinking Process, Logical Analysis, Decision Making, and Structured Analysis Framework, yielded over 1.8 million papers. Refining the search with criteria such as "ChatGPT\*" OR "Theory of Constraints Thinking Process" and English language narrowed down the results to 744 papers in SpringerLink and 369 papers in Scopus. A thorough review of abstracts revealed no direct research on the integration of ChatGPT and TOC TP, indicating a significant research gap in this specific area.

While there is no direct research on the integration of ChatGPT and the TOC TP, related research examines their individual components. In the study (Hanmeng et al. 2023), ChatGPT significantly outperformed GPT-4 on logical reasoning benchmarks, indicating its stronger logical reasoning ability. The study (Hackaday, 2023) shows the effectiveness of ChatGPT in solving and scoring logic puzzles. On the other hand, the study (Escape Velocity Labs, 2022) reveals ChatGPT's surprising ability to imitate reasoning, identify fallacies, and solve puzzles. These results suggest that ChatGPT accelerates the construction of logic trees and provides valuable insights for decision making.

Another area of research focuses on using ChatGPT to reduce bias and speed up logical analysis. Using its ability to process large amounts of information and generate unbiased responses could minimize human bias in the construction of logical trees, thereby improving the objectivity and accuracy of decision making. However, research (Fischer et al., 2023 and Frackiewicz, 2023) reveals ChatGPT's vulnerability to unconscious bias.

In addition, a study (Chen et al., 2023) specifically investigated behavioral biases relevant to operations management. ChatGPT exhibits human-like biases in complex, ambiguous, and implicit problems, such as conjunction bias, probability weighting, framing effects, salience of anticipated regret, and reference dependence. It also struggles to process ambiguous information and assess risk differently from humans, exhibiting heuristic-like responses and confirmation biases, which are exacerbated by overconfidence. Moreover, it highlights the importance

of considering potential AI biases in the development and implementation of AI for business operations.

It is noteworthy that the existing body of research in this specific area remains remarkably scarce. This apparent research gap presents significant opportunity for researchers to delve into this unexplored area and conduct original research on this novel combination. By addressing this gap, our study aims to make an initial contribution to the emerging field of ChatGPT and TOC TP integration, thereby advancing the understanding and practical applications of this combination. The specific research questions that this study will address are:

- What are the potential benefits of integrating ChatGPT and the TOC TP?
- What are the challenges and implications of this approach?
- How can ChatGPT be used to accelerate decision making and problem solving in real-world applications?

By addressing these research gaps, this study aims to provide a better understanding of the potential of this approach and how it can be used to improve decision making and problem solving.

### 3 Methodology

In this study, we adopted a comprehensive case study methodology, focusing on a real-world scenario in IT project management to assess the decision-making efficacy of ChatGPT. This involved examining typical challenges in IT project management, including task management diversity, cross-functional team coordination, and risk mitigation, particularly unforeseen delays, and resource

constraints. The choice of such projects was driven by the need to understand the dynamic interplay of various factors in complex IT environments and how ChatGPT could potentially navigate these complexities.

To effectively evaluate ChatGPT's role in this context, we concentrated on its application within the TOC TP. Our analysis primarily centered around the development of a CRT, utilizing the process outlined by Holt and Aljaž (2020) as shown in Figure 1. This approach was instrumental in dissecting ChatGPT's decision-making process, allowing us to explore its potential benefits and limitations in a structured and methodical manner.

The research design involved a multi-faceted approach, combining international literature analysis (SpringerLink and Scopus databases), observation, and personal experience. Leveraging ChatGPT, we posed diverse prompts related to the IT project management case, such as retrieving common factors contributing to project delays or exploring causes for resource unavailability.

Human validation played a crucial role in ensuring the reliability and accuracy of ChatGPT-generated responses. One person accessed <https://chat.openai.com/> for input prompts, and the generated ChatGPT responses were manually scored by at least two people, with disagreements resolved by majority vote. This approach emphasizes the importance of human oversight in validating ChatGPT generated content.

Our methodology is grounded in the principles of logical reasoning and problem-solving within the TOC, as detailed in (Scheinkopf, 1999). We adapted these principles to incorporate the capabilities of ChatGPT, thus enhancing the traditional framework with ChatGPT driven insights. The process is structured into three distinct steps, as depicted in Figure 2.

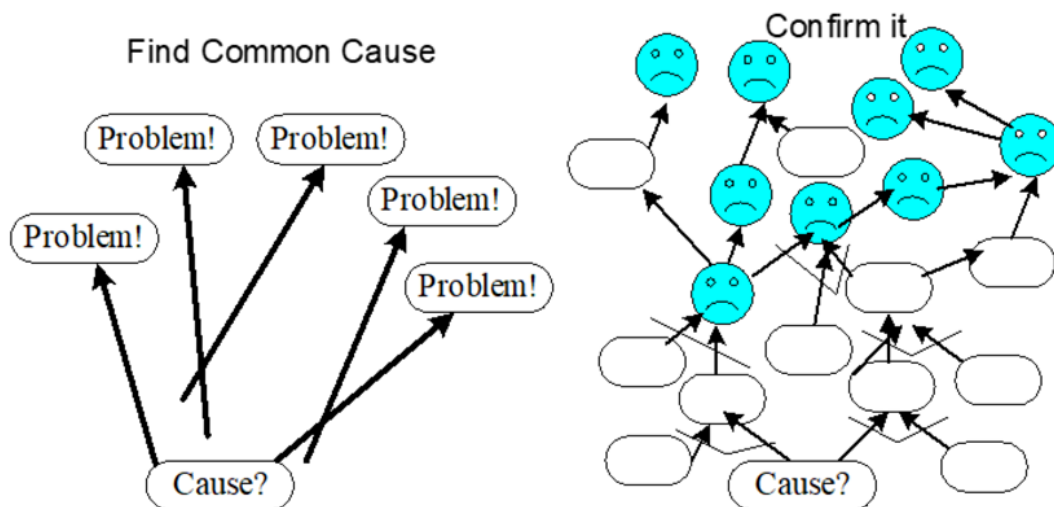


Figure 1: Workflow of creating CRT (Holt and Aljaž, 2020)

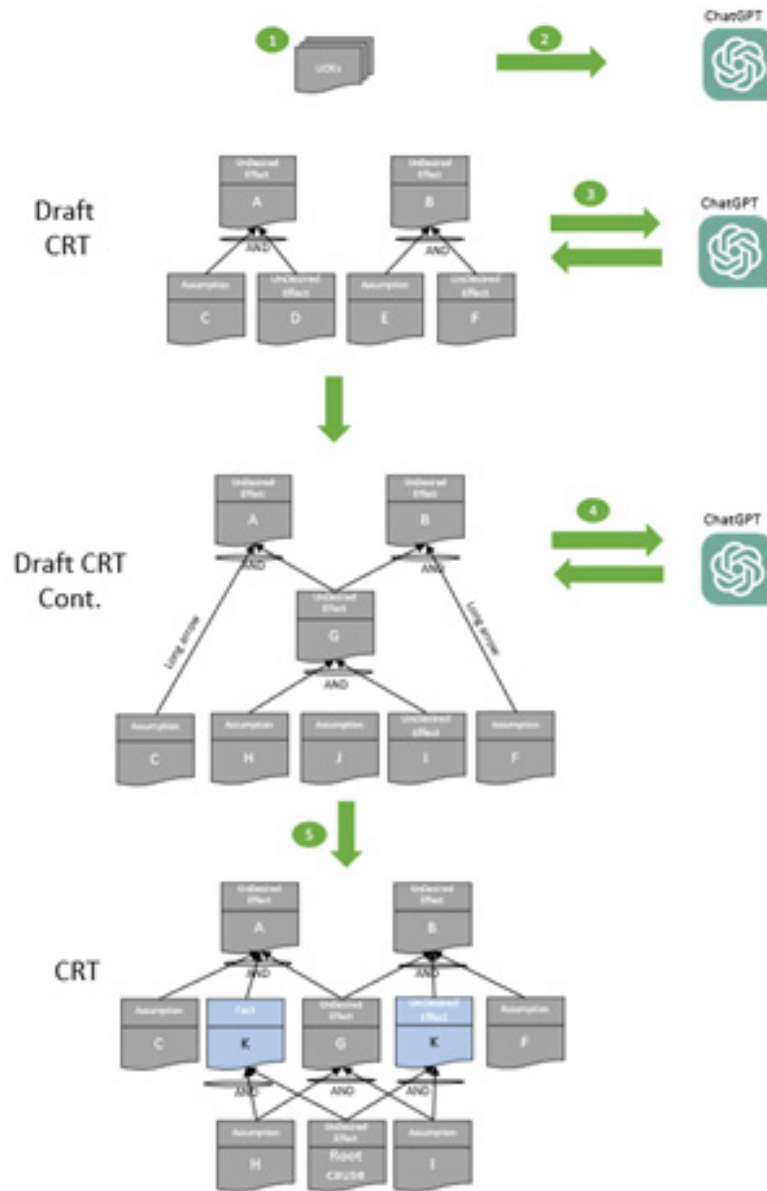


Figure 2: Workflow with ChatGPT in the use case of creating CRT

- **Draft analysis:** This step involves the collection and identification of relevant data (UnDesirable Effects - UDEs) related to the problem under investigation, gathered from various sources such as observations, interviews, reports, measurements, and ChatGPT. A draft CRT is then constructed that outlines initial cause and effect relationships.
- **Leaps of logic:** This step involves identifying and analyzing cause and effect relationships. In some cases, data may be insufficient to establish direct

links between entities, leading to “leaps of logic” where long arrows connect entities based on theoretical or assumed relationships. ChatGPT helps to validate the draft CRT by identifying inconsistencies or leaps in logic, thereby improving the accuracy and credibility of the analysis.

- **CRT:** This step involves identifying the root causes of the problem. ChatGPT helps to uncover hidden assumptions and encourages critical thinking about the beliefs underlying the problems.

Example prompts for ChatGPT:

- Draft analysis:
  - “Retrieve common factors contributing to IT projects not being completed on time.”
  - “Explore possible causes for recurring issues with resource unavailability in IT projects.”
  - “Rank identified UDEs based on common patterns in project management.”
  - “Explain the concept of bottlenecks in IT project management.”
- Leaps of logic:
  - “Validate/critically review the logical validity of cause-and-effect relationships in the Draft CRT for potential logical gaps.”
- CRT (finalizing):
  - “Help us identify any hidden assumptions about our team’s productivity and how we can challenge them.”

The time it takes to create a CRT can vary depending on the complexity of the system being analyzed, the experience of the person creating the CRT, and the availability of resources. To empirically assess these variables, a survey was conducted targeting students from FIŠ Novo mesto and Washington State University. The participants, who were enrolled in courses related to the TOC TP during the years 2016 and 2020, were queried regarding the time they allocated to the creation of logical trees within the TOC TP framework. The survey question posed was: ‘How long did you spend creating logical trees of TOC TP?’ The responses from this survey are intended to provide quantitative insights into the time variability associated with CRT construction in diverse educational and experiential contexts.

## 4 Results

The integration of ChatGPT into the IT project management area, particularly within the construction of CRTs, has demonstrated notable enhancements in logical analysis. The application of ChatGPT has enabled project teams, the Project Management Office, and other stakeholders to gain deeper insights, develop more accurate assessments, and devise effective strategies for improving project performance.

As outlined in previous section, the TOC TP methodology starts with the identification of UDEs bothering the organization. In the CRT, these identified UDEs are logically linked through intermediate entities, specifying relationships down to a core problem. Analyzing the IT project management area has revealed multiple gaps (UDEs) and their interconnectedness across the organization.

### 4.1 Draft analysis

ChatGPT can significantly speed up the data collection process during the Draft analysis phase of the TOC TP. By retrieving specific data related to the project(s), ChatGPT can help gain a comprehensive understanding of the current state and identify potential UDEs. Additionally, ChatGPT can communicate with stakeholders in a way that is easy for them to understand, which can help to ensure that stakeholders are on board with the CRT and the solutions that are proposed. An example of UDEs related to our study is shown in Figure 3.

In addition to data retrieval, ChatGPT serves as an effective brainstorming partner during the construction of the Draft CRT. By posing questions and scenarios related to project challenges, ChatGPT prompts the generation of alternative cause-and-effect relationships, uncovering hidden UDEs and potential root causes.

Through the analysis of large datasets and pattern identification, ChatGPT contributes to data-driven decision-making during the Draft Analysis phase.

The model can assist in prioritizing UDEs, as shown in Figure 4, based on their impact and probability, allowing us to focus on high-impact areas for improvement. ChatGPT’s instant responses enable quick answers to specific questions, supporting stakeholders in resolving uncertainties and maintaining productive momentum in the analysis process.

### 4.2 Leaps of logic (long arrows)

Long arrows, representing leaps of logic, are effectively addressed with ChatGPT during the TOC TP analysis phase. The large language model identifies and mitigates logical leaps that might not be obvious to humans, generating text that comprehensively describes the current reality. Moreover, ChatGPT proposes multiple potential solutions for bridging these leaps, ensuring the identification of optimal solutions.

In the IT project management area, ChatGPT can be utilized to enhance the cause-and-effect relationship in a CRT. Figure 5 illustrates the preliminary cause-and-effect relationships within the IT project management area.

By validating and critically reviewing the logical validity of cause-and-effect relationships, as shown in Figure 6, ChatGPT contributes to improved input for constructing the CRT. This iterative process helps in refining and clarifying the cause-and-effect relationships, thereby reducing the likelihood of errors or oversights in the final CRT.



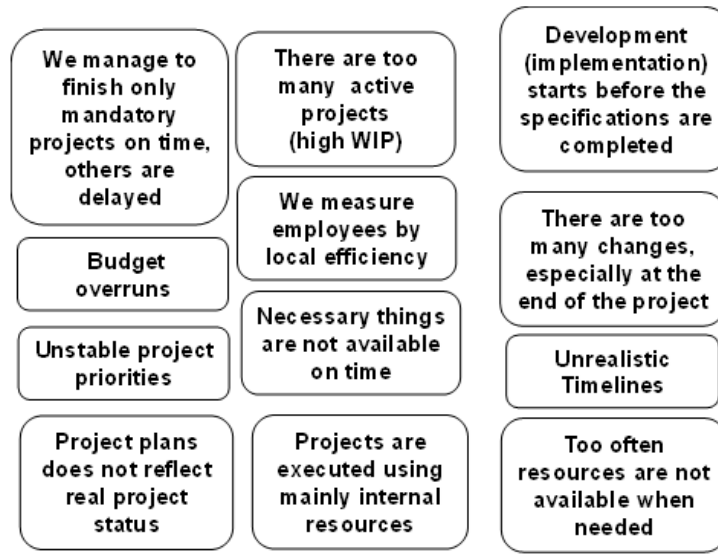



Figure 3: UDEs in the IT Project management area


**T** Please rank following undesirable effects "We manage to finish only mandatory projects on time, others are delayed", "Budget overruns", "Unstable project priorities", "Project plans does not reflect real project status", "There are too many active projects", "We measure employees by local efficiency", "Necessary things are not available on time", "Projects are executed using mainly internal resources", "implementation starts before the specifications are completed", "There are too many changes, especially at the end of the project", "Unrealistic Timelines", "Too often resources are not available when needed" based on common patterns in project management

 Ranking undesirable effects in project management based on common patterns:

1. "Budget overruns": Overspending can lead to financial constraints and hinder the project's success.
2. "Unrealistic Timelines": Setting impractical deadlines can lead to rushed work, compromised quality, and increased risk of failure.
3. "Too often resources are not available when needed": Resource constraints can cause delays and impact project timelines.
4. "There are too many changes, especially at the end of the project": Frequent changes can disrupt workflow and create uncertainty.

Figure 4: Prioritized UDEs by ChatGPT

**T** please evaluate the logic validity of the following statement: Premise: Flow of information is not optimal. Conclusion: Project plans do not reflect real project status.

 The provided statement consists of a premise and a conclusion. Let's evaluate the logic validity of the argument:

Premise: Flow of information is not optimal.  
Conclusion: Project plans do not reflect real project status.

The premise states that the flow of information is not optimal, meaning there are issues or inefficiencies in how information is communicated or shared within the project.

The conclusion drawn from the premise is that project plans do not reflect real project status. This conclusion suggests that the suboptimal flow of information is the reason why project plans are not an accurate representation of the actual project status.

To evaluate the logic validity, we need to assess if the conclusion necessarily follows from the premise. In this case, there is a logical connection between the premise and the conclusion:

1. A suboptimal flow of information can lead to incomplete or inaccurate data being used to create project plans.
2. If project plans are based on incomplete or inaccurate information, they may not accurately reflect the real project status.

Therefore, the conclusion is logically valid based on the premise provided.

Figure 5: Initial cause-and-effect relationship

### 4.3 Current Reality Tree

As mentioned in Chapter 1, the CRT is a visual representation of the cause-and-effect relationships within a system, highlighting the root causes of problems and constraints.

ChatGPT can be used to generate text describing the various elements of the CRT and the relationships between them. This text can be used to identify gaps in the analysis and potential areas for improvement. For example, as shown in Figure 8, ChatGPT could be used to ask questions and encourage users to think critically about their beliefs. This approach can engage users in a deeper exploration of their perspectives and viewpoints, leading to more insightful analysis and accelerate creation of CRT.

Additionally, this process could help users uncover the assumptions underlying their problems, which is a crucial

step in the CRT process. As illustrated in Figure 9, by using ChatGPT to probe these underlying assumptions, users can gain a clearer understanding of the foundational beliefs impacting their problem-solving approach. This accelerates the identification and examination of assumptions, facilitating a more efficient and effective creation of CRT. The ability to swiftly pinpoint and challenge these assumptions is particularly beneficial in complex scenarios where they might be less obvious or more deeply ingrained.

The TOC TP is not a one-time activity; it is an ongoing process that can be revisited and refined as new information becomes available or as the system evolves. For example, if a new constraint is identified, the CRT can be updated to reflect this change. An example of a simplified CRT from the area of IT project management is shown in Figure 10.

#### 4.4 Time efficiency in CRT Construction


The time it takes to create a CRT can vary depending on the complexity of the system being analyzed, the experience of the person creating the CRT, and the availability of resources.

To investigate the time it takes to create TOC TP logical trees (without ChatGPT), we surveyed 40 students regarding the time taken to create logic trees. The responses were categorized into five distinct time ranges: 0-3 hours, 4-6 hours, 7-9 hours, 10-15 hours, and more than 15 hours. The data revealed, as shown in Figure 10, a diverse range of time commitments among the participants.

A significant 37% of students completed their logic trees within the shortest time frame of 0-3 hours, suggesting notable efficiency or familiarity with the task among

a significant portion of them. Another 22,2% of students reported needing 4-6 hours, indicating a moderate level of complexity or effort. A considerable segment, 18,5% of the students fell into the 10-15 hours bracket, suggesting a high level of engagement or complexity in the task for these individuals. Similarly, 14,8%, indicated a substantially longer time investment of more than 15 hours, which might reflect the complexity of the task or varying levels of prior experience. Lastly, 7,4% reported spending 7-9 hours on their logic trees, positioning this group between the moderately complex and the more time-consuming categories. These findings highlight the broad range of time investments required to complete logic trees among students, with the variance possibly attributed to factors like individual student's prior experience, understanding of the task, or the complexity of their specific logic trees.

**T** Are there some potential intermediate steps or additional causes that might help supporting conclusion?


 Yes, there are potential intermediate steps and additional causes that could support the conclusion that "Project plans do not reflect real project status" due to a suboptimal flow of information. While the initial premise suggests that the flow of information is not optimal, it is crucial to consider other factors that could contribute to the inaccuracies in project plans. Some potential intermediate steps and additional causes include:

1. **Inadequate Data Collection:** The suboptimal flow of information may result from insufficient data collection processes. If the project team does not gather complete and accurate data about the project's progress and status, it can lead to gaps in information that affect the reliability of the project plans.
2. **Lack of Timely Updates:** If the flow of information is slow or updates are not provided in a timely manner, project plans may not reflect the most current status of the project. Delayed or outdated information can lead to inaccuracies in the plans.
3. **Miscommunication and Misinterpretation:** Ineffective communication or misinterpretation of information can lead to misunderstandings among team members or stakeholders. This can result in incorrect data being incorporated into the project plans.
4. **Dependency on Unreliable Sources:** If project plans rely on data from sources that are not reliable or trustworthy, the plans may not accurately reflect the real project status.
5. **Lack of Transparency:** If there is a lack of transparency in sharing information across the project team or between different departments, it can lead to gaps in understanding and incomplete information in the project plans.

Figure 6: Improving cause-and-effect relationship for constructing CRT using ChatGPT



**T** what prompts should i use to ask questions and encourage users to think critically about their beliefs

 Encouraging users to think critically about their beliefs involves prompting questions that challenge assumptions, explore underlying reasons, and promote deeper reflection. Here are some prompts you can use to stimulate critical thinking:

**1. Assumption Challenge:**

- What assumptions are you making about this situation?
- Are there any hidden assumptions influencing your perspective?
- How might your conclusions change if some of these assumptions were incorrect?

**2. Cause-and-Effect Exploration:**

- What factors do you think contribute most to this issue?
- Can you identify the root causes behind the observed effects?
- Are there any secondary or indirect causes that might be overlooked?

**3. Counterfactual Analysis:**

- What would happen if the circumstances were different? How might that change your conclusions?
- Can you think of scenarios that would challenge your current understanding?

**4. Comparative Analysis:**

- How does this situation compare to others you've encountered?
- Are there analogies or parallels from different domains that could shed light on this issue?

**5. Evidence and Justification:**

- What evidence supports your current beliefs about this issue?
- How reliable is this evidence, and are there alternative interpretations?

*Figure 7: Encourage critical thinking, challenging beliefs, when constructing CRT using ChatGPT*

However, for more complex systems, it typically takes several days or even weeks to complete, especially if the analysis requires a deep understanding of the underlying processes and data collection. The time is also affected by how thoroughly the team wants to investigate and validate each causal relationship. It is important to spend enough time to ensure accuracy, but it is also important to avoid overanalyzing and overcomplicating the CRT.


Considering the diverse time investments required to create TOC TP logical trees, as shown in our survey, the integration of ChatGPT technology presents a transformative advantage. ChatGPT's usage in CRT construction significantly reduces the time and resources needed, especially for complex systems that typically demand extensive analysis. Its ability to quickly process and analyze large

datasets enables quicker identification of UDEs and more efficient construction of logical trees. GPT also aids in enhancing the accuracy of the CRT by providing a more thorough examination of causal relationships, minimizing the risk of oversights or errors. This results in a more robust and reliable CRT, ensuring that critical issues are not just identified but are understood in their entirety.

## 5 Discussion

The integration of ChatGPT into the construction of CRT within IT project management area, as explored in Chapter 4, represents a significant shift in approach and methodology. This chapter reflects on the implications and

**T** What assumptions are you making about the fact that some project plans are missing important project tasks?

 When considering the scenario of missing important project tasks in project plans, it's important to recognize the assumptions that might be shaping your understanding of the situation. Here are some assumptions you could be making:

- 1. Assumption: All project tasks are known and can be predicted accurately from the outset.**
  - Challenge: Consider that some tasks might emerge as the project progresses, especially in complex or evolving projects.
- 2. Assumption: Project planning is a one-time activity with a fixed scope.**
  - Challenge: Reflect on the need for continuous monitoring and adjustment as the project unfolds.
- 3. Assumption: Project managers have complete visibility into every aspect of the project.**
  - Challenge: Acknowledge that information gaps or unexpected developments might prevent comprehensive task identification.
- 4. Assumption: The project team is aware of all potential tasks and their dependencies.**
  - Challenge: Recognize that team members might have specialized expertise that uncovers tasks not initially considered.
- 5. Assumption: All project tasks have equal importance and impact.**
  - Challenge: Explore whether certain tasks are critical to project success while others might have a more marginal influence.
- 6. Assumption: Detailed task planning is more important than adapting to changing circumstances.**
  - Challenge: Consider whether excessive focus on detailed plans might hinder agility and responsiveness to changes.

Figure 8: Encourage critical thinking, challenging assumptions, when constructing CRT using ChatGPT

challenges of this integration, spanning from draft analysis and data collection to the final construction of CRT.

ChatGPT's role in the Draft Analysis phase (Section 4.1) has shown a substantial improvement in the efficiency and comprehensiveness of data collection and analysis. This advancement is particularly impactful in gaining comprehensive understanding of the current state and identify potential UDEs, enhancing both the speed and accuracy of the CRT construction process. Furthermore, as noted in Section 4.2, ChatGPT effectively addresses logical leaps within the CRT, aiding in the development of more coherent and logically sound structures. This contribution

is crucial in ensuring that the CRTs accurately reflect the complexities and nuances of IT project management area.

Moreover, the findings from Section 4.3 highlight ChatGPT's capacity to encourage deeper analytical thinking, guiding users to critically evaluate their beliefs and assumptions. This aspect of ChatGPT's application enhances the depth of the CRT analysis, leading to a more insightful understanding of the cause-and-effect relationships. Such depth is indispensable for identifying the root causes of problems and devising effective strategies in project management.

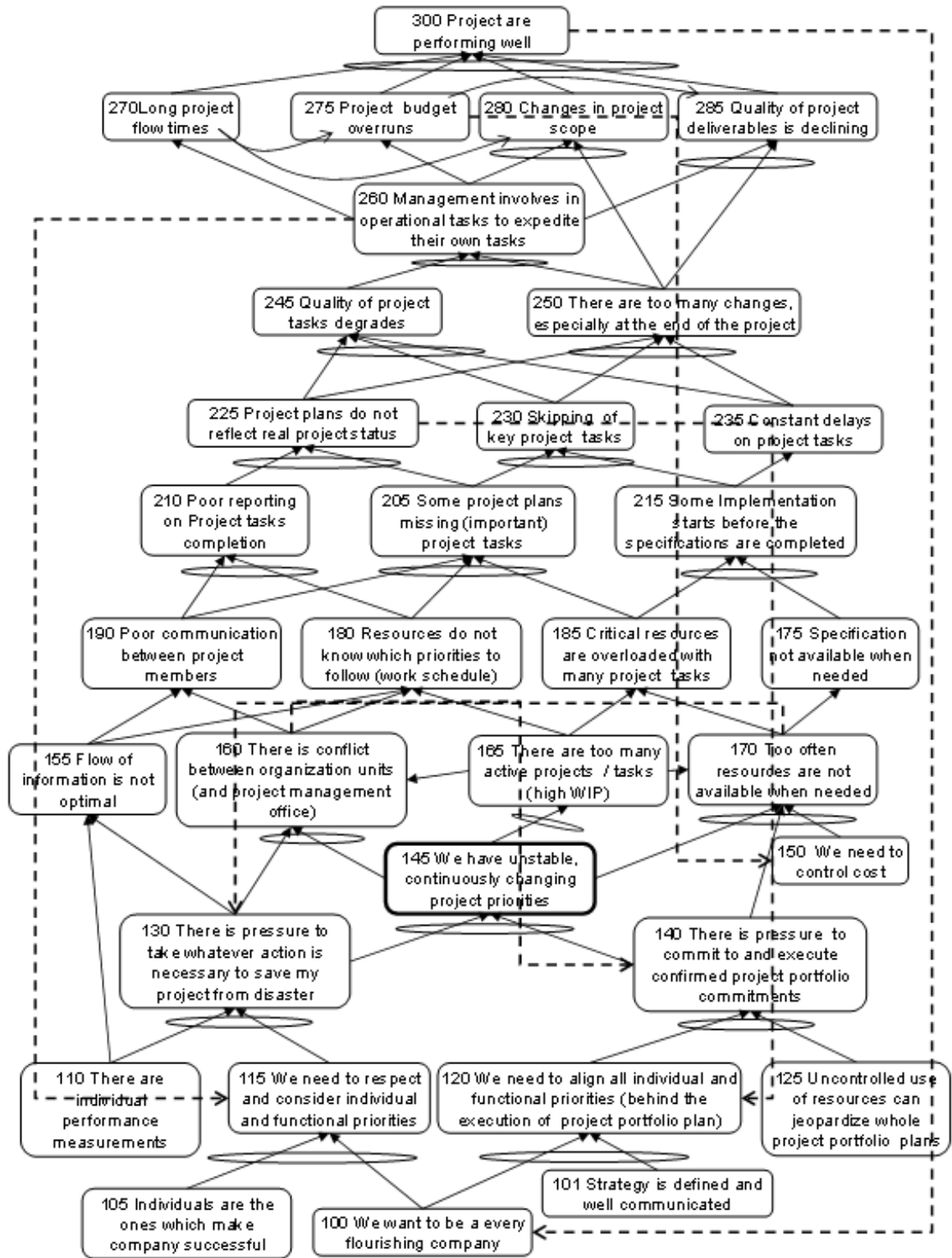


Figure 9: Resulting CRT (simplified) in the IT Project management area

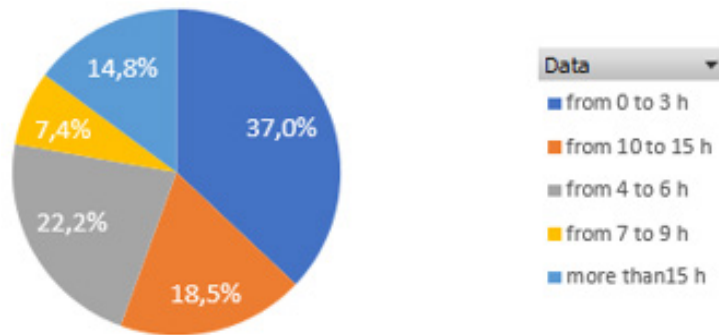


Figure 10: Time needed to create logical trees of TOC TP (without ChatGPT)

The results presented in Section 4.4 also sheds light on the time efficiency gained through ChatGPT integration in CRT construction, particularly in complex systems. This efficiency not only translates into time savings but also enables a more agile and responsive IT project management approach.

However, despite these benefits, several challenges need to be addressed. First, ChatGPT is not perfect and can sometimes generate inaccurate or misleading text. This could lead to incorrect conclusions being drawn during the TOC TP process. Second, ChatGPT is not a replacement for human judgment. Humans still need to be involved in the TOC TP process to ensure that the results are accurate and that the solutions are feasible. Third, ChatGPT is not yet trained on the specific concepts and terminology used in the TOC TP. This means that it would need to be trained on this terminology before it could be used effectively in the TOC TP. Finally, it is important to ensure that ChatGPT is used in a safe and ethical manner. ChatGPT is a powerful tool and could be used to generate text that is misleading or harmful. Thus, maintaining a balance between ChatGPT generated insights and human expertise is essential.

## 6 Conclusion

The integration of ChatGPT with TOC TP holds immense promise for enhancing logical analysis and decision-making. By leveraging ChatGPT's language capabilities and data insights, organizations can overcome constraints, make more informed choices, and achieve greater success.

Our study demonstrated ChatGPT's substantial impact on accelerating data collection, brainstorming, and validating cause-and-effect relationships within CRTs. However, successful integration necessitates addressing challenges related to ChatGPT's understanding, accuracy, and ethical use. Overcoming these hurdles is crucial for organizations to unlock the full potential of this integration and revolu-

tionize decision-making.

While our research focused on a specific IT project management case study, the findings provide valuable insights that can be extended to diverse organizational contexts. Further research and development are needed to refine ChatGPT's capabilities and expand its applicability across various industries and decision-making domains.

The synergistic combination of AI, exemplified by ChatGPT, and human expertise holds transformative potential for problem-solving and decision-making. Decision-makers can leverage this partnership to drive progress and innovation in a wide range of fields. However, it is paramount to approach this integration with care, ensuring continuous improvements in both technological capabilities and ethical considerations. Responsible, fair, and transparent use of AI is essential for its successful adoption in managerial and societal contexts.

In conclusion, our study contributes valuable insights into the integration of ChatGPT with TOC TP. By embracing ethical considerations and addressing research gaps, we can pave the way for a future where AI augments human decision-making, leading to more efficient, effective, and beneficial decision-making processes.

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