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The Theory of Constraints Approach for Analysing Constraints in the Process of Converting Prospects into Business Customers at Telkom Manyar Regional Office

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Abstract

Business prospect conversion is a critical process in achieving sales performance within Business-to-Business (B2B) telecommunications services. However, many organizations experience difficulties in converting prospects into customers due to various operational constraints throughout the sales process. This study aims to identify the primary constraints affecting the conversion of business prospects into customers at Telkom Manyar Regional Office by applying the Theory of Constraints (TOC) approach. The study integrates prospect data quality measurement using Tuple Completeness and predictive analytics through a Decision Tree model. A quantitative descriptive approach was employed using 600 prospect records collected from January to June 2025. Tuple Completeness was utilized to evaluate the completeness of prospect data, while Fishbone Diagram analysis was used to identify root causes of conversion constraints. Furthermore, a Decision Tree model was developed using Altair AI Studio to predict conversion outcomes and identify influential variables. The results indicate that prospect data quality represents the primary constraint in the conversion process. Prospects with 100% Tuple Completeness achieved a conversion rate of 79.29%, while prospects with 67% and 33% completeness achieved conversion rates of 25.15% and 0%, respectively. The Decision Tree model achieved an accuracy of 86.11%, identifying Tuple Completeness as the most influential predictor of conversion success. These findings demonstrate that improving prospect data quality can significantly enhance customer conversion performance. The study contributes to the integration of Theory of Constraints, data quality assessment, and predictive analytics in the context of B2B customer acquisition within the telecommunications industry.

INTRODUCTION

Business-to-Business (B2B) customer acquisition is a critical process that directly influences organizational growth, revenue generation, and long-term competitiveness. In the telecommunications industry, the ability to convert business prospects into customers determines the effectiveness of marketing and sales activities. Companies increasingly rely on prospect databases to support customer targeting, communication, needs assessment, and sales conversion efforts. However, the effectiveness of these activities depends not only on sales execution but also on the quality of prospect data used throughout the conversion process (Kotler & Keller, 2016; Chaffey, 2017).

At Telkom Manyar Regional Office, customer conversion performance experienced significant fluctuations during the January–June 2025 period. Customer acquisition achievement declined from 98.99% of the target in January to 46.24% in April before showing gradual improvement in subsequent months. Despite the continuous distribution of prospect data to Account Representatives (ARs), customer conversion performance remained below organizational expectations. This condition indicates that the availability of prospect data alone does not guarantee successful customer acquisition and suggests the existence of constraints within the prospect-to-customer conversion system.

One potential source of these constraints is the quality of prospect data. Incomplete prospect information may create information bottlenecks that restrict the effectiveness of sales activities, customer communication, and decision-making processes. When essential information such as customer identity, contact details, or address information is unavailable, Account Representatives may encounter difficulties in conducting prospect validation, customer engagement, and follow-up activities. As a result, the probability of successful customer conversion may decline significantly. Therefore, prospect data quality represents an important issue that requires systematic investigation within the context of B2B customer acquisition.

Data quality has been widely recognized as a key determinant of organizational performance and decision-making effectiveness. Brohman et al. (2003) emphasized that customer data completeness significantly affects the effectiveness of digital service systems, where information deficiencies may create information gaps that reduce service quality and conversion performance. Similarly, Batini et al. (2009) proposed data quality assessment methodologies that highlight completeness as one of the most important dimensions of data quality. Panse et al. (2014) further developed a formal approach for measuring relational data completeness through the concept of tuple completeness, providing a quantitative basis for evaluating the completeness of information stored within organizational databases.

The importance of data completeness has also been confirmed by Chen et al. (2014), who identified completeness as a critical dimension in ensuring the reliability of information systems and supporting data-driven decision-making. In marketing and customer acquisition contexts, Gopalakrishna et al. (2022) demonstrated that data quality significantly influences the effectiveness of prospecting activities and customer conversion processes. Their findings suggest that incomplete customer information may reduce analytical accuracy and weaken decision-making effectiveness, ultimately affecting business performance. These studies collectively indicate that data completeness plays a substantial role in supporting organizational effectiveness; however, its role as a potential system constraint within B2B customer conversion processes remains insufficiently explored.

To identify and manage organizational constraints, many researchers have adopted the Theory of Constraints (TOC), originally introduced by Goldratt and Cox (2004). TOC proposes that system performance is primarily limited by a small number of constraints or bottlenecks that restrict throughput and overall organizational effectiveness. Previous studies have demonstrated the effectiveness of TOC in various operational contexts. Pérez-Campdesuñer et al. (2017) applied TOC in tourism services and reported improvements in service system performance through systematic constraint management. Similarly, Tsai and Chi (2022) found that TOC effectively improved manufacturing competitiveness by identifying and managing

critical bottlenecks. In the Indonesian context, Inayati and Wahyuningsih (2018) showed that TOC could enhance organizational efficiency through the identification and control of operational constraints. Although these studies confirm the effectiveness of TOC in improving system performance, most applications remain focused on operational and production environments rather than data-driven marketing systems and customer conversion processes.

In parallel with the development of constraint-based management approaches, predictive analytics has emerged as an important tool for supporting business decision-making. Decision Tree algorithms are widely recognized for their interpretability and effectiveness in classification tasks (Mienye et al., 2019). Pereira et al. (2021) demonstrated that Decision Tree models can effectively predict customer conversion behavior in digital marketing environments, while Prasetio et al. (2025) reported that Decision Tree algorithms provide valuable insights into customer conversion patterns and marketing performance. Furthermore, Wahyuni et al. (2025) and Paimin et al. (2025) highlighted the effectiveness of machine learning approaches in supporting predictive decision-making through data-driven analytical frameworks. Nevertheless, previous studies have generally focused on prediction accuracy and customer behavior analysis without integrating predictive analytics with Theory of Constraints and data quality assessment frameworks.

Based on the review of previous studies, several research gaps can be identified. First, previous studies on data quality and tuple completeness have not explicitly linked data completeness with Theory of Constraints within B2B marketing systems (Brohman et al., 2003; Batini et al., 2009; Chen et al., 2014; Gopalakrishna et al., 2022). Second, studies applying Theory of Constraints have primarily focused on operational and production contexts without examining customer conversion systems supported by prospect databases (Pérez-Campdesuñer et al., 2017; Tsai & Chi, 2022; Inayati & Wahyuningsih, 2018). Third, Decision Tree studies have concentrated on conversion prediction without incorporating data quality dimensions and constraint identification approaches (Pereira et al., 2021; Prasetio et al., 2025). Consequently, limited research has integrated Theory of Constraints, tuple completeness measurement, and predictive analytics within a unified framework for analyzing customer conversion constraints.

The novelty of this study lies in the integration of three complementary perspectives: Theory of Constraints (TOC), Tuple Completeness-based data quality assessment, and Decision Tree predictive analytics. Unlike previous studies that examined these approaches separately, this research combines them to identify, analyse, and validate constraints affecting the conversion of business prospects into customers within a B2B telecommunications environment. Importantly, prospect data quality was not assumed to be the primary constraint at the outset of the study. Instead, it was evaluated as a potential constraint and subsequently assessed using TOC principles and predictive analytics techniques. Furthermore, this study extends the application of TOC from traditional operational settings into a data-driven marketing context, providing a new perspective on constraint identification in customer acquisition systems.

Therefore, this study aims to identify the primary constraint affecting the conversion of business prospects into customers at Telkom Manyar Regional Office using the Theory of Constraints framework. Specifically, the study evaluates whether prospect data quality, measured through tuple completeness, constitutes the main system constraint, applies TOC principles to analyse the conversion process, and develops a Decision Tree classification model

to predict conversion outcomes based on prospect data quality attributes. The findings are expected to contribute both theoretically and practically by providing an integrated framework for improving customer conversion performance in data-driven B2B marketing systems.

METHOD

Data Types and Sources

This study employed a quantitative descriptive research approach to analyse constraints affecting the conversion of business prospects into customers at Telkom Manyar Regional Office. The research utilized secondary data obtained from the internal sales database of Telkom Manyar Regional Office.

The dataset consisted of 600 business prospect records collected during the period of January–June 2025. The data included prospect information, conversion outcomes, sales area assignments, and Account Representative (AR) information. Prospect records were used as the unit of analysis because they represent the initial stage of the customer acquisition process within the Business-to-Business (B2B) marketing system of Indibiz services.

Data Collection Technique

Data were collected through documentation and archival data review of internal company records. The collected data consisted of prospect information, including customer name, customer contact person (PIC), customer address, assigned Account Representative, sales area, and conversion status.

The collected dataset was subsequently processed and prepared for analysis. Prospect data quality was evaluated using the Tuple Completeness approach, while conversion outcomes were used to assess customer acquisition performance. The prepared dataset was then utilized in both descriptive analysis and predictive modelling stages.

Variables and Operational Definitions

Four variables were employed in this study. Tuple Completeness was used as a representation of prospect data quality and served as the primary predictor variable. Sales Area and Account Representative were included as additional predictor variables in the Decision Tree model. Conversion Status was used as the target variable.

Table 1. Operational Definition of Variables

Variable	Operational Definition	Indicator	Data Scale	Data Source	Role in the Model
Tuple Completeness	The level of completeness of key attributes in prospect data.	Prospect name, prospect PIC contact, and prospect address.	Ratio	Prospect data from Telkom Manyar Regional Office	Predictor Variable
Sales Area	The geographical area assigned for prospect marketing activities.	Sales area category.	Nominal	Prospect data from Telkom Manyar Regional Office	Predictor Variable
Account Representative	Personnel responsible for following up and managing prospects.	Account Representative identity.	Nominal	Prospect data from Telkom Manyar Regional Office	Predictor Variable
Conversion Status	The final outcome of the prospect-to-business-customer conversion process.	Successful and Unsuccessful.	Nominal	Customer conversion data from Telkom Manyar Regional Office	Target Variable

Tuple Completeness was measured based on the completeness of three prospect attributes, namely customer name, customer contact person (PIC), and customer address. The metric was

calculated using Equation (1), adapted from the completeness dimension proposed by Batini et al. (2009).

$$Tuple\ Completeness = \frac{Number\ of\ Completed\ Attributes}{Total\ Number\ of\ Attributes}, \quad (1)$$

Based on the resulting score, prospect records were classified into three completeness categories: 33%, 67%, and 100%.

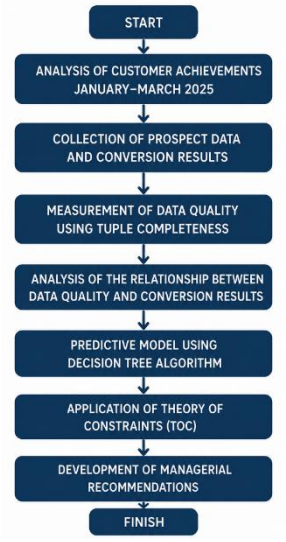
Research Stages

The research was conducted through a series of systematic stages to identify and analyse constraints affecting the prospect-to-customer conversion process.

The first stage involved analysing customer achievement performance during January–June 2025 to identify indications of conversion constraints within the sales system. The second stage consisted of collecting prospect data and conversion records from the internal database of Telkom Manyar Regional Office. The third stage focused on measuring prospect data quality using the Tuple Completeness approach. Subsequently, descriptive analysis was performed to examine the relationship between data completeness and customer conversion outcomes. The fourth stage involved developing a Decision Tree classification model using Altair AI Studio. The model utilized Tuple Completeness, Sales Area, and Account Representative as predictor variables, while Conversion Status served as the target variable. Model performance was evaluated using a Confusion Matrix, Precision, Recall, and Accuracy metrics. The fifth stage applied the Theory of Constraints (TOC) framework to identify and analyse the primary constraint affecting customer conversion performance. The analysis adopted the TOC improvement logic proposed by Goldratt and Cox (2004), consisting of identifying the constraint, exploiting the constraint, subordinating related processes to the constraint, and elevating the constraint through managerial improvement initiatives.

Finally, the findings obtained from Tuple Completeness analysis, Decision Tree modelling, and TOC assessment were integrated to formulate managerial recommendations aimed at improving prospect-to-customer conversion performance at Telkom Manyar Regional Office.

Figure 1. Research Framework



Position and Role of Decision Tree Algorithm

In this study, the Decision Tree algorithm was not employed as a statistical hypothesis-testing tool nor as the primary method for determining system constraints. Instead, it was utilized as a predictive and diagnostic analytical tool to support the identification of patterns associated with business prospect conversion outcomes.

The Decision Tree model was developed to examine the relationship between prospect data quality and customer conversion performance, as well as to identify the attributes that most strongly influence conversion success or failure. Due to its interpretable classification structure, the algorithm enables the visualization of decision rules and predictor variables that contribute to conversion outcomes.

Within the research framework, the Theory of Constraints (TOC) serves as the primary managerial approach for identifying and analysing system constraints, whereas the Decision Tree algorithm functions as a complementary analytical tool that provides quantitative evidence based on historical data. Consequently, the results generated by the Decision Tree model are not interpreted as deterministic conclusions regarding system constraints, but rather as supporting information that strengthens the diagnostic process conducted within the TOC framework.

This complementary integration allows managerial interpretation and data-driven analysis to be combined, enabling a more comprehensive understanding of factors affecting the conversion of business prospects into customers.

Analysis Method

The analysis method employed in this study was descriptive-analytical in nature, utilizing the Theory of Constraints (TOC) as the primary managerial framework and Tuple Completeness as the operational representation of prospect data quality. The analysis was conducted through four complementary stages.

1. Quantitative Descriptive Analysis

Quantitative descriptive analysis was performed to examine customer achievement performance and the distribution of prospect data completeness. This stage provided an overview of the condition of prospect data and customer conversion outcomes during the January–June 2025 period. Comparative analysis was subsequently conducted to evaluate differences in conversion performance across Tuple Completeness categories.

2. Tuple Completeness Analysis

Tuple Completeness analysis was conducted to measure the completeness level of prospect data. The assessment focused on three mandatory prospect attributes: customer name, customer contact person (PIC), and customer address. Based on the completeness score calculated using Equation (1), prospect records were classified into three categories: 33%, 67%, and 100%.

The resulting completeness categories were then analysed in relation to customer conversion outcomes to determine whether prospect data quality constituted a potential system constraint affecting conversion performance.

3. Decision Tree Analysis

Predictive analysis was conducted using the Decision Tree algorithm implemented in Altair AI Studio.

The model utilized Tuple Completeness, Sales Area, and Account Representative as predictor variables, while Conversion Status served as the target variable. The modelling process included data preprocessing, training and testing data partitioning, model development, and performance evaluation. The Decision Tree algorithm was selected because of its ability to generate interpretable classification rules and identify dominant factors influencing conversion outcomes.

Model performance was evaluated using a Confusion Matrix and several classification metrics, including Accuracy, Precision, and Recall. In addition, cross-validation was applied to improve model reliability and reduce the risk of overfitting.

4. TOC-Based Managerial Analysis

The Theory of Constraints (TOC) framework was applied to identify the primary system constraint affecting business prospect conversion performance. The analysis followed the TOC improvement logic proposed by Goldratt and Cox (2004), consisting of four stages: Identify the Constraint, Exploit the Constraint, Subordinate Everything Else, and Elevate the Constraint.

The findings obtained from Tuple Completeness analysis, Decision Tree modelling, and root cause identification were integrated to support managerial diagnosis and formulate improvement recommendations. Through this approach, the identified constraint was analysed not only from a quantitative perspective but also from a managerial and systemic viewpoint, enabling the development of practical recommendations for improving customer conversion performance at Telkom Manyar Regional Office.

RESULTS AND DISCUSSION

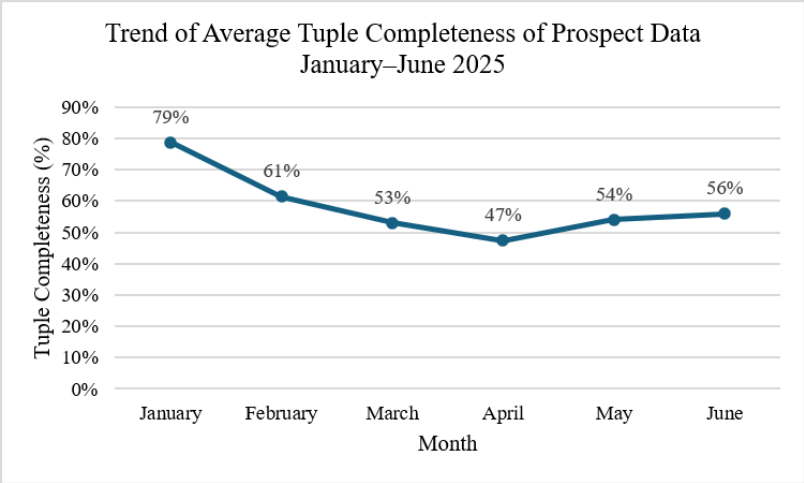
Research Data Overview

This study utilized 600 business prospect records obtained from the internal marketing database of Telkom Manyar Regional Office during the period of January–June 2025. Each month contributed 100 prospect records, resulting in a balanced dataset for analysis. The dataset contained information related to prospect quality and conversion outcomes. Prospect data quality was measured using the Tuple Completeness approach based on three mandatory attributes: customer name, customer contact person (PIC), and customer address. In addition, Sales Area and Account Representative were included as supporting predictor variables in the Decision Tree model, while Conversion Status (Successful or Unsuccessful) served as the target variable. The use of prospect-level data as the unit of analysis enabled the study to examine the relationship between data quality and customer conversion performance within a Business-to-Business (B2B) marketing environment. This dataset also provided the basis for identifying potential system constraints using the Theory of Constraints (TOC) framework and validating findings through predictive analytics.

Tuple Completeness Measurement Results

The completeness level of prospect data was measured using the Tuple Completeness metric. The analysis revealed fluctuations in average data completeness throughout the observation period.

Figure 2. Trend of Average Tuple Completeness of Prospect Data (January–June 2025)



The results indicate that the average Tuple Completeness score decreased from 79% in January to 47% in April before showing a slight recovery to 56% in June. This trend suggests a deterioration in prospect data quality during the first half of the observation period, followed by modest improvement in the later months. The decline in data completeness is important because prospect data serve as the primary input for customer acquisition activities. Incomplete customer information may limit the ability of Account Representatives to conduct prospect identification, communication, and follow-up activities effectively. Consequently, reductions in data completeness may negatively affect customer conversion performance. Furthermore, the distribution of prospect records showed that low-completeness data were dominant during several months, particularly in March and April. This condition indicates the existence of potential weaknesses in prospect data management processes and suggests the presence of quality-related issues that may affect overall marketing system performance. The findings support previous studies emphasizing the importance of data completeness as a critical dimension of information quality and organizational effectiveness (Batini et al., 2009; Chen et al., 2014).

Analysis of the Relationship between Data Quality and Conversion Results

The relationship between prospect data quality and customer conversion outcomes was analysed by comparing conversion performance across different Tuple Completeness categories.

Table 2. Distribution of Tuple Completeness and Conversion Rate

Tuple Completeness	Total Prospects	Converted	Not Converted	Conversion Rate (%)
100%	140	111	29	79.29%
67%	171	43	128	25.15%
33%	289		289	0.00%

The results demonstrate a clear and consistent relationship between data completeness and conversion performance. Prospect records with 100% Tuple Completeness achieved a conversion rate of 79.29%, with 111 successful conversions out of 140 records. In contrast, prospect records with 67% completeness achieved a conversion rate of only 25.15%, while

records with 33% completeness failed to generate any successful conversions. These findings indicate that higher levels of prospect data completeness substantially increase the probability of successful customer conversion. Complete prospect information enables more effective customer targeting, communication, and needs assessment, thereby improving sales performance. A particularly important finding is that none of the 289 prospect records classified within the 33% completeness category were successfully converted into customers. This consistent failure pattern suggests that prospect data with very low completeness provide insufficient information to support effective sales decision-making and customer acquisition activities. From a managerial perspective, the results indicate the existence of a minimum data quality threshold required to support successful conversion activities. As the completeness level decreases, the effectiveness of the conversion process also declines significantly. Therefore, prospect data quality should be considered a strategic factor influencing marketing system performance.

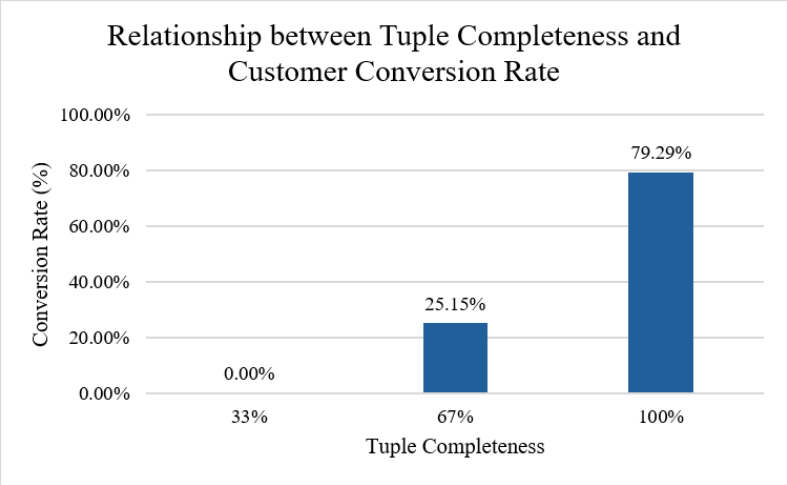
These findings are consistent with previous studies that identified data completeness as a critical determinant of information quality, decision-making effectiveness, and customer-related business performance (Brohman et al., 2003; Chen et al., 2014; Gopalakrishna et al., 2022).

Constraint Analysis Based on the Theory of Constraints (TOC)

The Theory of Constraints (TOC) emphasizes that system performance is primarily determined by the presence of one or a few constraints that limit the achievement of organizational objectives (Goldratt & Cox, 2004). In the context of this study, the primary objective of the marketing system is to convert business prospects into customers. Therefore, the identification of factors that potentially restrict customer conversion performance represents a critical step in understanding overall system effectiveness.

The empirical findings presented in the previous section demonstrated a strong relationship between prospect data quality and customer conversion outcomes. To further examine this relationship within the TOC framework, conversion performance was analysed across different Tuple Completeness categories.

Figure 3. Relationship between Tuple Completeness and Customer Conversion Rate



The results show a substantial increase in conversion performance as the level of data completeness improves. Prospect records with 33% Tuple Completeness produced no

successful conversions, whereas records with 67% and 100% completeness achieved conversion rates of 25.15% and 79.29%, respectively.

This pattern indicates that prospect data quality should no longer be viewed merely as an operational characteristic of the database. Instead, it represents a factor that directly influences system throughput by affecting the ability of Account Representatives to perform effective customer acquisition activities. Within the TOC perspective, these findings suggest that prospect data quality may constitute a potential system constraint because it limits the effectiveness of subsequent sales processes and restricts the conversion of prospects into customers.

Identify Constraints (Identify the Constraint)

According to the first step of the Theory of Constraints, organizational improvement begins with the identification of the primary constraint that limits system performance (Goldratt & Cox, 2004). Based on the empirical evidence obtained from the Tuple Completeness analysis, prospect data quality was identified as the primary system constraint within the B2B marketing system of Telkom Manyar Regional Office.

The identification of prospect data quality as a constraint was based on two key criteria. This is based on two main criteria:

1. Quantitative Criteria

   The first criterion concerns conversion performance. Prospect records classified within the 33% Tuple Completeness category consistently failed to generate customer conversions throughout the six-month observation period. Among 289 prospect records within this category, none were successfully converted into customers, resulting in a conversion rate of 0%.

   This finding indicates that low-completeness prospect data provide insufficient information to support effective prospecting, communication, and sales follow-up activities.

2. Dominance Criteria

   The second criterion concerns the proportion of low-quality prospect data within the overall dataset. The 33% completeness category accounted for 289 out of 600 prospect records, representing approximately 48% of the total dataset.

   The large proportion of low-quality prospect data significantly amplifies its impact on overall system performance. Even if sales activities are executed effectively, the dominance of incomplete prospect information restricts the system's ability to achieve higher conversion outcomes.

   Based on these two criteria, prospect data quality was identified as the primary constraint limiting the achievement of the system objective, namely increasing the number of converted business customers.

Interpretation of Constraints in B2B Marketing Systems

Within a B2B marketing system, customer conversion can be understood as a process consisting of three interconnected components: input, process, and output. Prospect data serve as the system input, sales activities conducted by Account Representatives represent the process, and successful customer conversion represents the output.

The findings indicate that the primary constraint exists at the input stage, specifically within the quality of prospect data. Incomplete prospect information creates an information bottleneck that restricts the effectiveness of downstream sales activities.

When essential information such as customer identity, contact details, or address information is unavailable, Account Representatives face difficulties in conducting prospect validation, customer communication, needs assessment, and follow-up activities. Consequently, the likelihood of successful conversion decreases substantially.

From a TOC perspective, improving downstream processes alone is unlikely to produce significant performance gains if the quality of the input remains inadequate. Therefore, prospect data quality should be considered a foundational element that determines the effectiveness of the entire customer acquisition system.

This finding extends the application of the Theory of Constraints beyond traditional production and operational environments by demonstrating that information quality can function as a system constraint within a data-driven marketing context.

Impact of Constraints on System Performance

The presence of prospect data quality constraints generates several systemic consequences that affect overall marketing performance :

1. Throughput Reduction
   Lower customer conversion rates due to limited prospect quality.
2. Prospect Inventory Accumulation
   Increasing number of unconverted prospects remaining in the system.
3. Sales Activity Inefficiency
   Additional effort and resources spent on low-potential prospects.

The first impact is throughput reduction. Because a large proportion of prospect data lacks sufficient information, many prospects fail to progress through the sales funnel and ultimately do not become customers.

The second impact is the accumulation of prospect inventory. In TOC terminology, inventory represents entities within the system that have not yet been transformed into throughput. In this study, unconverted prospects accumulate within the sales pipeline, reducing overall system efficiency.

The third impact is sales activity inefficiency. Account Representatives are required to spend time and resources following up prospect records that have limited conversion potential due to incomplete information. Consequently, valuable sales resources are consumed without generating proportional business outcomes.

Collectively, these impacts demonstrate how deficiencies in prospect data quality propagate throughout the marketing system and constrain organizational performance.

Improvement Strategy Based on the Theory of Constraints (TOC)

After identifying prospect data quality as the primary system constraint, the next step within the Theory of Constraints framework is to formulate improvement strategies aimed at reducing or eliminating the impact of the constraint. This study adopted three TOC improvement stages: Exploit the Constraint, Subordinate Everything Else, and Elevate the Constraint (Goldratt & Cox, 2004).

1. Exploit the Constraint

   The exploitation stage focuses on maximizing the utilization of existing resources without requiring substantial organizational changes. Based on the findings, prospect records with 100% Tuple Completeness consistently demonstrated the highest conversion performance. Therefore, these records should be prioritized during prospecting and sales activities.

   In addition, prospect filtering mechanisms should be implemented before data distribution to Account Representatives. Prospect records with critically low completeness levels should be separated and improved before entering the sales pipeline. This approach enables the organization to improve conversion effectiveness without increasing the volume of prospect data or additional operational resources.

2. Subordinate Everything Else

   The subordinate stage requires organizational processes to be aligned with the identified constraint. In the context of this study, all activities related to prospect management should support improvements in prospect data quality.

   Several actions may be implemented, including quality-based prospect distribution, adjustment of Account Representative performance indicators, and strengthening data validation procedures. These initiatives ensure that organizational resources are focused on supporting the management of the identified constraint rather than unintentionally reinforcing it.

3. Elevate the Constraint

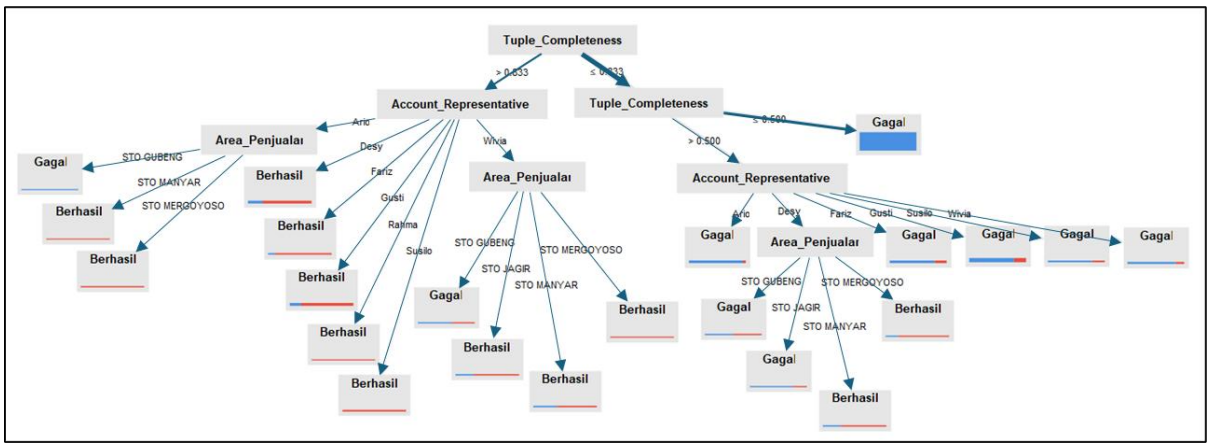
   The elevate stage aims to reduce or eliminate the constraint through structural improvements. The findings suggest several long-term initiatives, including the implementation of mandatory data-entry fields, development of data enrichment mechanisms, establishment of minimum prospect quality standards, and utilization of predictive analytics systems.

These initiatives address the root causes of poor prospect data quality and support sustainable improvements in customer conversion performance.

Decision Tree Validation of Constraint Identification

To strengthen the findings obtained through the Theory of Constraints framework, predictive analysis was conducted using the Decision Tree algorithm implemented in Altair AI Studio.

Figure 4. Decision Tree Model



The resulting Decision Tree structure identified Tuple Completeness as the root node of the model, indicating that prospect data quality was the most influential predictor of customer conversion outcomes. This finding is particularly important because the model independently selected Tuple Completeness as the primary classification variable based on historical data patterns. The model generated two critical threshold values, namely 0.500 and 0.833, which separated prospect records into groups with substantially different conversion characteristics. Prospect records with completeness values below 0.500 were predominantly classified as unsuccessful conversions, whereas records above 0.833 demonstrated significantly higher conversion potential. The model also revealed that Account Representative and Sales Area only became influential after prospect data quality reached an acceptable level. This indicates that improvements in sales execution cannot fully compensate for poor-quality prospect data. In other words, data quality functions as a prerequisite condition before other operational factors can significantly contribute to customer conversion performance. These findings provide quantitative support for the TOC-based diagnosis that prospect data quality constitutes the primary system constraint.

Model Performance Evaluation

To evaluate model reliability, classification performance was assessed using a Confusion Matrix and several classification metrics. Table 3 presents the confusion matrix and classification performance of the Decision Tree model.

Table 3. Confusion Matrix of the Decision Tree Model

Classification	**Actual Unsuccessful**	**Actual Successful**	**Class Precision**
Predicted Unsuccessful	123	14	89.78%
Predicted Successful	11	32	74.42%
Class Recall	91.79%	69.57%	-

The model achieved an overall accuracy of 86.11%, indicating a strong ability to classify prospect conversion outcomes correctly. Furthermore, the model demonstrated a recall value of 91.79% for unsuccessful conversions, meaning that most failed conversion cases were accurately identified. The precision value for the unsuccessful conversion class reached 89.78%, indicating a high degree of reliability in failure predictions. The F1-score for the unsuccessful conversion class was 90.77%, demonstrating a balanced trade-off between precision and recall. These results suggest that the model effectively captures the characteristics associated with conversion failure and reinforces the conclusion that prospect data quality plays a dominant role in determining conversion outcomes. From a TOC perspective, the Decision Tree model serves as quantitative validation of the constraint identification process. The convergence between descriptive analysis, TOC interpretation, and machine learning results strengthens the robustness of the study's conclusion that prospect data quality represents the primary bottleneck within the B2B marketing system of Telkom Manyar Regional Office.

Managerial Implications

The findings of this study provide several managerial implications for improving customer conversion performance within the B2B marketing system of Telkom Manyar Regional Office.

First, prospect data quality management should become a strategic priority. The identification of critical Tuple Completeness thresholds indicates that data quality must be improved before prospect records are distributed to Account Representatives. Organizations should establish standardized validation procedures and minimum completeness requirements to ensure that prospect data meet operational needs.

Second, performance monitoring should incorporate data quality indicators alongside traditional sales metrics. Since the effectiveness of Account Representatives is influenced by the quality of prospect data received, performance evaluation systems should consider both prospect volume and prospect quality to provide a more objective assessment of sales performance.

Third, sales strategies should be continuously evaluated based on the characteristics of different Sales Areas. The Decision Tree analysis suggests that regional market characteristics contribute to conversion outcomes after adequate data quality has been achieved. Consequently, sales approaches may need to be adapted according to local market conditions.

Fourth, predictive analytics capabilities should be integrated into prospect management processes. The successful application of the Decision Tree algorithm demonstrates the potential of machine learning to support data-driven decision-making, prospect prioritization, and resource allocation. By identifying high-potential prospects at an early stage, the organization can improve sales effectiveness and optimize customer acquisition efforts.

Overall, the study highlights the importance of integrating data quality management, Theory of Constraints principles, and predictive analytics to enhance customer conversion performance within data-driven B2B marketing systems.

CONCLUSION

This study aimed to identify the primary constraint affecting the conversion of business prospects into customers at Telkom Manyar Regional Office by integrating the Theory of Constraints (TOC), Tuple Completeness analysis, and Decision Tree predictive modelling.

The findings demonstrate that prospect data quality represents the primary system constraint within the B2B marketing process. The Tuple Completeness analysis revealed a strong relationship between data quality and customer conversion performance. Prospect records with 100% Tuple Completeness achieved a conversion rate of 79.29%, while records with 67% and 33% completeness achieved conversion rates of 25.15% and 0%, respectively. These results indicate that higher levels of data completeness significantly increase the likelihood of successful customer conversion.

From the TOC perspective, low-quality prospect data were identified as an information bottleneck that restricts the effectiveness of sales activities and reduces overall system throughput. The constraint was further validated through Decision Tree modelling, which identified Tuple Completeness as the root node and most influential predictor of conversion success. The model achieved an accuracy of 86.11% and revealed critical threshold values of 0.500 and 0.833 that distinguish productive and non-productive prospect data.

The study contributes to the extension of Theory of Constraints into a data-driven B2B marketing context by demonstrating that information quality can function as a system constraint. The integration of TOC, Tuple Completeness, and Decision Tree analysis provides a practical framework for identifying, validating, and managing conversion constraints within

customer acquisition systems. Therefore, improving prospect data quality should become a strategic priority for organizations seeking to enhance customer conversion performance and overall marketing effectiveness.

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