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A Fire Title

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Abstract. In humanitarian logistics, efficient resource allocation is paramount for ensuring timely and effective delivery of aid to populations in need. This paper presents a novel approach to optimize resource allocation in humanitarian logistics using stochastic programming. By integrating stochastic elements into the modeling framework, our approach accounts for uncertainty in demand, supply, and transportation constraints, providing decision-makers with robust and adaptable solutions. We develop a mixed-integer linear programming formulation to minimize the total cost of relief operations while meeting demand requirements under varying scenarios. Through computational experiments and a case study, we demonstrate the effectiveness of our approach in improving decision-making and resource utilization in humanitarian relief efforts. Our findings underscore the importance of incorporating stochastic programming techniques in addressing the complex challenges of humanitarian logistics.

Key words: Communication effectiveness, B2B sales, sales attribution

1. Introduction

Something about how communication is important in sales relationships, but we don't know which communication methods are the most important across the board or if it is strictly based on customer preference. We also don't know the limitations or opportunities on ChatGPT's ability to identify themes from customer reviews and correctly identify reviews that contain those themes.

Past model of attribution in this category?

ATTENTION: The following displayed equation, in its current form, exceeds the column width that will be used in the published edition of your article. Please break or rewrite this equation to fit, including the equation number, within a column width of 240 pt / 84.67 mm / 3.33 in (the width of this red box).

$$\text{Cost\_Red}_j = \rho_0 + \rho_1 N_{m_j} + \rho_2 N_{l_j} + \rho_3 I2_{m_j} + \rho_4 I2_{l_j} + \rho_5 OS_{m_j} + \phi \mathbf{X}_j + \mu_j \tag{1}$$

$$\begin{aligned} \text{Cost\_Red}_j = \rho_0 + \rho_1 N_{m_j} + \rho_2 N_{l_j} + \rho_3 I2_{m_j} \\ + \rho_4 I2_{l_j} + \rho_5 OS_{m_j} + \phi \mathbf{X}_j + \mu_j \end{aligned} \tag{2}$$

In this paper, we present a stochastic programming approach to optimize resource allocation in humanitarian logistics (Jones 2010). Our approach aims to balance the trade-off between cost minimization and service quality while considering uncertainty in demand, supply, and transportation constraints. We develop a mixed-integer linear programming (MILP) formulation that captures the stochastic nature of humanitarian crises and provides decision support for relief agencies. The proposed model integrates both deterministic and stochastic components, allowing decision-makers to make informed decisions in uncertain environments.

2. Literature Review

In many business relationships, but especially B2B sales relationships, there is a critical component of creating and nurturing business relationships in order to maintain consistent customer transactions. This is particularly important in B2B sales as current and potential customers lists are usually much smaller than in typical B2C transactions. There is much literature on how relationships and their facets impact sales. The quality of the relationship between selling teams and their key accounts plays a critical role in determining profitability (Gupta, 2019). To create quality business relationships, salespeople need to shift from persuasion-based approaches to communication-centered strategies. Specifically, one should foster interactive communication processes in order to foster trust and commitment (Duncan, 1998). In conjunction with interactive communication, strategic collaboration communication that involves the customer in decision making positively influences key account performance through emphasized trust building, mutual understanding and shared goals (Schultz, 2002). Furthermore, co-producing the product or service with the customer increases performance. However, when the intensity, or stress, associated with co-producing the end result is high, it negatively affects customer satisfaction. But, implementing value-enhancing communication strategies can mitigate this effect (Haumann, 2015). Firms need to measure and manage the value they provide to customers, and the value customers provide to the firm through sales (Kumar, 2016). In order to effectively communicate value and maintain quality of relationships, firms need to understand the most effective type and frequency of communication with their customer. For differing levels of performance from the customer, the level of firm-initiated communication must differ (Ramos, 2024). There are also specific forms of communication that are situationally beneficial. For example, synchronous communication (i.e. face-to-face) is better for repairing a business relationship compared to asynchronous communication (i.e. email). The perceived salesperson competence and warmth mediate the effectiveness of communication formats as well (Mangus, 2024). Regarding modeling this relationship between communication and performance, there have been three key drivers identified: the volume of communication, the mix of communication channels, and the alignment with customers' preferences. Once the ideal level of communication is exceeded, customers begin to react negatively. That negative response can be exacerbated with the use of multichannel communication but mediated by aligning the channels with customer preferences (Godfrey, 2011).

While there is much research on attribution in various business models, there is a lack of literature on attribution models in a B2B sales situation with emphasis on different communication methods or mix of communication methods. This study will empirically show the effectiveness of varying communication methods on sales performance, while also taking into account customer preferences.

Since the survey data that will be used will also feature qualitative data, a text analysis will be crucial to understanding the holistic picture of the customer's perspective. Two methods for making text analysis more effective were suggested by Allenby and Singh. Allenby found that incorporating sentence structure into the text analysis model helps with accuracy and added value, because many sentences are structured with a single underlying topic (Allenby, 2016). Singh tested differing sampling methods in developing a text-analysis model. He found that both a largest number of information units sampling method and a sequential random sampling method were more effective than traditional simple random sampling methods, as they only sampled for information rich data

(Singh, S.N., 2011). Singh emphasizes the limitation and place for further research in adding an additional analysis that draws common themes out of the customer reviews, which we will add to our text analysis model.

An effective model that combines different sectors of knowledge found in previous literature, both theoretical and empirical, will be able to provide empirical evidence that quality communication that aligns with customer preferences will increase sales performance. This would be a more applicable quantitative approach to many of the previously proven sales frameworks. A model showing the effectiveness of communication will provide salespeople with a starting point in their sales strategy as they will know which communication methods are most profitable.

3. The Data

The data used for this research was collected from a Manufacturer Sales Representative Company in the Plumbing Industry. The data was collected using a survey that asked customers to rank their perceived value of various communication methods and how often they preferred those communication methods be used by their sales representative. They also were asked an open ended question about why that communication method was preferred and how that created value for their own companies. The customers were also asked about their preferred method of product trainings, with the same type of open-ended question asking to explain their preferences.

These survey responses were not collected anonymously, so they were then tied back to the sales data from each customer.

Add a numeric summary of the responses? Means of rankings of communication methods?

4. The Model

Currently living on a prayer that I will figure out a model that will at least somewhat work. Also praying that the data will show something helpful. But who knows. Cue Bon Jovi because I wish I was halfway there with this project.

But, we'll have to have a paragraph explaining the chatgpt theme extraction, and then asking it to dummy code whether or not each open-ended question has the theme. We'll show the four different options of open-ended answers theme extraction, and determine if any one method produced statistically significant variables.

Then we'll get into the logistic regression or whatever we decide to do. There'll be a fairly simple equation that will look more complicated once we apply all the variables to it.

The cost function $C(x)$ is defined as the sum of procurement, transportation, and distribution costs:

$$C(x) = \sum_{i=1}^{n} \left(c_i p_i + \sum_{j=1}^{m} d_{ij} t_{ij} + \sum_{k=1}^{l} s_k q_k \right) \tag{3}$$

The objective function of the stochastic programming model is formulated as follows:

$$\min_{x,y} \quad \sum_{s \in S} \left[f(x, y, s) \cdot \mathbb{P}(s) \right]$$

subject to:

$$g(x, y, s) \leq 0 \quad \forall s \in S \tag{4}$$

$$h(x, y, s) = 0 \quad \forall s \in S \tag{5}$$

THEOREM 1 **(Optimality Conditions)**. *Let x^* be an optimal solution to the stochastic programming problem. If the objective function and constraint functions are convex, then x^* satisfies the Karush-Kuhn-Tucker (KKT) conditions.*

Proof The proof follows from the convex optimization theory, which states that for convex objective and constraint functions, the KKT conditions are necessary and sufficient for optimality. Therefore, if x^* is an optimal solution, it must satisfy the KKT conditions. □

Algorithm 1 Random Forest Training

```
procedure RandomForest(X_train, y_train, num_trees)
    forest ← []
    for i ← 1 to num_trees do
        X_sampled, y_sampled ← bootstrap_sample(X_train, y_train)
        tree ← DecisionTree(X_sampled, y_sampled)
        append tree to forest
    end for
    return forest
end procedure
```

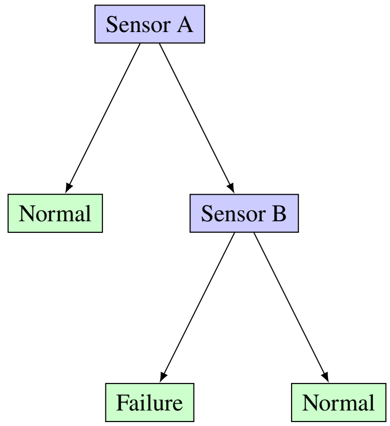
Algorithm 2 Random Forest Training II

```
procedure DecisionTree(X, y)
    if StoppingCondition(X, y) then
        return LeafNode(y)
    else
        (feature, threshold) ← FindBestSplit(X, y)
        left_indices ← X[feature] ≤ threshold
        right_indices ← X[feature] > threshold
        left_subtree ← DecisionTree(X[left_indices], y[left_indices])
        right_subtree ← DecisionTree(X[right_indices], y[right_indices])
        return TreeNode(feature, threshold, left_subtree, right_subtree)
    end if
end procedure

procedure Predict(forest, x)
    predictions ← []
    for tree in forest do
        append TreePredict(tree, x) to predictions
    end for
    return AggregatePredictions(predictions)
end procedure

procedure TreePredict(tree, x)
    if tree is a leaf node then
        return tree.value
    else
        if x[tree.feature] ≤ tree.threshold then
            return TreePredict(tree.left_subtree, x)
        else
            return TreePredict(tree.right_subtree, x)
        end if
    end if
end procedure
```

Figure 1 Text of the Figure Caption.



Note. Text of the notes.

Table 1 Summary of Data for Case Study

Parameter	Value
Number of Resources	5
Number of Facilities	10
Number of Scenarios	50
Demand Variability	High
Budget Constraint	$1,000,000
Transportation Cost	$10 per unit
Facility Setup Cost	$5,000 per facility

Table Notes.

LEMMA 1 **(Feasibility of Scenario Sets)**. *Given a set of scenarios S generated from historical data and probabilistic forecasts, the scenario set S is feasible if it captures the range of possible outcomes with sufficient coverage.*

Proof The proof follows from the definition of feasibility, which requires that the scenario set S includes a representative sample of possible outcomes. Feasibility ensures that the stochastic programming model adequately represents the uncertainty in the problem domain and provides meaningful solutions. □

REMARK 1. This stochastic programming model assumes that demand and supply parameters follow known probability distributions.

DEFINITION 1. A feasible solution to the resource allocation problem satisfies all constraints and requirements without violating any constraints.

5. Results and Discussion

Who the heck knows what this ”model” is going to find.

6. Managerial Implications

We apply our model to B2B data. This provides specific implications for business transactions that rely heavily on salesperson relationships with their customers. The results of this paper can help managers understand which communication methods are the most valuable to focus on in a salesperson's limited time. In a relationship-based industry, the efficiency in which a salesperson can maintain multiple client relationships is directly linked to company profitability.

7. Conclusion

In this paper, we have presented a model approach for understanding effective communication techniques in B2B sales relationships. [1] The proposed model provides decision support for B2B companies to best allocate their human capital resources.

Future research directions include applying this model or a similar model to a larger dataset for better statistical validity. This also could be applied to B2B interactions with salesmen-reliant relationships as well to add to the generalizability of this model.

Notes

[1] Sample endnote text.

Acknowledgments

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for some reason the bibliography isn't working?

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