

UNIVERSITI TEKNOLOGI MARA

**OPTIMIZING FOOTBALL PLAYER
SIGNINGS USING INTEGER
LINEAR PROGRAMMING BY
CONSIDERING THE INJURY RISK
ADJUSTMENT AND MONTE
CARLO SIMULATION**

**RAJA AMIRUL MUHAMMAD BIN
RAJA AZLAN**

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ABSTRACT

The modern football industry has increasingly used data-driven approaches to support decision-making, especially in player recruitment and squad planning. With increasing transfer fees and wage demands, football clubs need to use their resources efficiently while still maintaining competitive performance. As a result, mathematical modelling and optimization techniques have become important tools to improve efficiency in team selection and financial management.

Although a large amount of player performance data is available, many clubs still face difficulties in selecting an optimal squad under multiple constraints such as budget limits, positional requirements, and player risk factors. Traditional selection methods often depend on subjective judgement, which may lead to less effective decisions and inefficient use of resources. This situation shows the need for a more structured and quantitative approach to squad optimization.

The main objective of this study is to develop an optimization model that helps football clubs select an optimal squad by maximizing overall team performance while meeting financial and tactical constraints. Specifically, the study aims to combine player performance data, cost factors, and uncertainty elements into a single decision-making framework.

To achieve these objectives, an Integer Linear Programming (ILP) model is developed to represent the squad selection problem. Important constraints such as squad size, positional balance, budget limits, and wage caps are included in the model. In addition, a Monte Carlo simulation method is used to consider uncertainty in player performance and injury risk, allowing the strength of the selected squad to be tested under different scenarios. The model is implemented using Python to ensure efficiency and flexibility.

The results show that the proposed approach is able to produce an optimal and feasible squad that performs better than basic selection methods in terms of performance efficiency and cost-effectiveness. In conclusion, this study confirms that optimization and simulation techniques can serve as useful decision-support tools for football management and contribute to more informed and sustainable squad planning strategies.