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Optimizing logistics operations in a country's currency supply network

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ABSTRACT

We optimize a large country's currency supply network for its central bank. The central bank provides currency to all branches (who in turn serve consumers and commerce) through its network of big vaults, regional vaults, and retail vaults. The central bank intends to reduce its total transportation cost by enlarging a few retail vaults to regional vaults. It seeks further reductions by optimizing the sourcing in the updated currency network. We develop an optimization model to select the retail vaults to upgrade, so that the total cost is minimized. Optimally choosing which retail vaults to upgrade is strongly NP-hard, so we develop an efficient heuristic that provides solutions whose costs average less than 3% above the optimum for realistic problem instances. An implementation of our methodology for a particular state has generated a total cost reduction of approximately 57% (equivalently, $2 million). To optimize the sourcing, we

propose an alternative delivery process that further reduces the transportation cost by over 31% for the actual collected data and by over 38% for randomly generated data. This alternative optimizes the sourcing within the new currency network and requires significantly less computational effort.

KEYWORDS:

Financial services | currency network | sourcing optimization | mixed-integer programming | minimum cost flow

Additional information

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