We can assume that one AM machine is available at each facility and that the production is made on-demand. This means that when dealing with AM we do not stock parts but we need to stock raw material to produce the parts. We can as first step assume that the printing time is negligible, especially when compared to the transportation time. So the difference with the CM model is:

* Storage of raw materials now instead of parts
* We have to consider the investment costs for AM printers (annual depreciation)

So a first attempt of modelling the AM problem could be this:

**Indices and sets**

|  |  |
| --- | --- |
|  | Candidate facilities, indexed by |
|  | Customers, indexed by |
|  | Potential replacement conditions, indexed by |

**Data**

|  |  |
| --- | --- |
|  | Fixed facility operation cost for facility (in € per year) |
|  | Fixed AM machine operation cost for AM machine installed in facility (in € per year) |
|  | Unit inventory holding cost for the AM raw material at facility (in € per year) |
|  | Raw material replenishment lead time for facility (in years) (from an outside source to facility ) |
|  | Mean demand for customer with replacement condition when it is served by facility (in units per year) |
|  | Standard deviation of demand for customer with replacement condition when it is served by facility (in units per year) |
|  | Cost of allocating customer with replacement condition when it is served by facility (in € per year) (assumed to include downtime, shipping and replacement costs) |
|  | fractile of the standard normal distribution, i.e., |

**Decision variables**

|  |  |
| --- | --- |
|  | 1 if facility prints and serves customer with replacement condition , 0 otherwise |
|  | 1 if facility is open, 0 otherwise |
|  | Raw material stock level for facility |
|  | Standard deviation of total demand for facility |

Subject to