SUMMARY

Recent computer developments have allowed a new dimension to the scientific inventory control. An example is the multi-item inventory model described in Johnston (1980) which represents the departure from the traditional optimization towards decision aid models which the manager can use interactively in the examination of the trade-offs which could improve his current policy.

The Johnston model has however limitations. The scope of this thesis is to overcome some of these limitations, namely, the treatment of the non-captive demand, the determination of the reorder frequency and the extension to a two level inventory system, together with a critical examination of the variables involved, in order to improve the decision making.

In relation to non-captive demand, the problem can become relevant when more than one order overlaps. Then, service levels and average stocks are normally higher than the predictions from formulas derived for captive demand. The main result now achieved is the introduction of the notional control level which relates to the conventional reorder or top up levels and to the lost demand. The notional level allows the extension of established formulations, including the Johnston model, from non-captive to captive demand.

Johnston leaves the reorder frequency to be decided on a practical basis. Here, the same criteria adopted by Johnston have been used to derive consistent expressions for the number of orders. Empirical functions have been incorporated to reach formulas ready for use.

The two level system comprises one main warehouse and its satellites. The analysis covers, basically, the rules to decide the allocations, the theoretical prediction of service levels and the extension of the initial Johnston formulation to this system. The allocation rule derived says that quantities should be allocated so as to have the same probability of depletion. For the prediction of service levels, the depletion time distribution rather than the demand distribution has been used in the formulations, because the conventional approach, based on the latter, does not produce the desired results. Implementable formulas are given for situations in which satellites are of the same order of magnitude.

The results in the three areas mentioned above are accompanied by considerations about the economic meaning of the variables and a method is suggested to cross-check the consistency of the decisions. They are new contributions for the inventory control and constitute an important complement to the initial Johnston model.