

► When should an operation replenish its inventory?

- Partly this depends on the uncertainty of demand. Orders are usually timed to leave a certain level of average safety stock when the order arrives. The level of safety stock is influenced by the variability of both demand and the lead time of supply. These two variables are usually combined into a lead-time usage distribution.
- Using re-order level as a trigger for placing replenishment orders necessitates the continual review of inventory levels. This can be time-consuming and expensive. An alternative approach is to make replenishment orders of varying size but at fixed time periods.

► How can inventory be controlled?

- The key issue here is how managers discriminate between the levels of control they apply to different stock items. The most common way of doing this is by what is known as the ABC classification of stock. This uses the Pareto principle to distinguish between the different values of, or significance placed on, types of stock.
- Inventory is usually managed through sophisticated computer-based information systems which have a number of functions: the updating of stock records, the generation of orders, the generation of inventory status reports and demand forecasts. These systems critically depend on maintaining accurate inventory records.

Case study Trans-European Plastics

Trans-European Plastics (TEP) is one of Europe's largest manufacturers of plastic household items. Its French factory makes a range of over 500 products that are sold to wholesalers and large retailers throughout Europe. The company dispatches orders within 24 hours of receipt using an international carrier. All customers would expect to receive their requirements in full within one week. The manufacturing operation is based on batch production, employing 24 large injection-moulding machines. Weekly production schedules are prepared by the Planning and Control office, detailing the sequence of products (moulds and colours) to be used, the quantity required for each batch, and the anticipated timing of each production run. Mould changes ('set-ups') take on average three hours, at an estimated cost of €500 per set-up.

Concerned about the declining delivery reliability, increased levels of finished goods inventory and falling productivity (apparently resulting from 'split batches' where only part of a planned production batch is produced to overcome immediate shortages), the CEO, Francis Lamouche, employed consultants to undertake a complete review of operations. On 2 January, a full physical inventory check was taken. A representative sample of 20 products from the range is shown in Table 12.7.

Because of current high demand for many products, the backlog of work for planned stock replenishment



Source: Alamy/ArchivBerlin Fotoagentur GmbH

currently averages two weeks, and so all factory orders must be planned at least that far in advance. The re-order quantities (see Table 12.7) had always been established by the Estimating Department at the time when each new product was designed and the manufacturing costs were established, based on Marketing's estimates of likely demand. Recently, however, to minimize the total cost of set-ups and to maximize capacity utilization, all products are planned for a *minimum* production run of 20 hours. The individual re-order levels have not been reviewed for several years, but were originally based on two weeks' average sales at that time. About 20 per cent of the

Table 12.7 Details of a representative sample of 20 TEP products

Product reference number*	Description	Unit manuf'g variable cost (Euro)	Last 12 mths' sales (000s)	Physical inventory 2 Jan (000s)	Re-order quantity (000s)	Standard moulding rate** (items/hour)
016GH	Storage bin large	2.40	10	0	5	240
033KN	Storage jar + lid	3.60	60	6	4	200
041GH	10 litre bucket	0.75	2,200	360	600	300
062GD	Grecian-style pot	4.50	40	15	20	180
080BR	Bathroom mirror	7.50	5	6	5	250
101KN	1 litre jug	0.90	100	22	20	600
126KN	Pack (10) bag clips	0.45	200	80	50	2,000
143BB	Baby bath	3.75	50	1	2	90
169BB	Baby potty	2.25	60	0	4	180
188BQ	Barbecue table	16.20	10	8	5	120
232GD	Garden bird bath	3.00	2	6	4	200
261GH	Broom head	1.20	60	22	20	400
288KN	Pack (10) clothes pegs	1.50	10	17	50	1,000
302BQ	Barbecue salad fork	0.30	5	12	8	400
351GH	Storage bin small	1.50	25	1	6	300
382KN	Round mixing bowl	0.75	800	25	80	650
421KN	Pasta jar	3.00	1	3	5	220
444GH	Wall hook	0.75	200	86	60	3,000
472GH	Dustbin + lid	9.00	300	3	10	180
506BR	Soap holder	1.20	10	9	20	400

*The reference number uses the following codes for ranges:

BB = Babycare BQ = Barbecue BR = Bathroom GD = Garden GH = General household KN = Kitchen

**Moulding rate is for the product as described (e.g. includes lids, or pack quantities).

products are very seasonal (e.g. Garden Range), with peak demand from April to August. Storage bins sell particularly well from October to December.

The European Marketing Manager summarized the current position, 'Our coverage of the market has never been so comprehensive; we are able to offer a full range of household plastics, which appeals to most European tastes. But we will not retain our newly developed markets unless we can give distributors confidence that we will supply all their orders within one week. Unfortunately, at the moment, many receive several deliveries for each order, spread over many weeks. This certainly increases their administrative and handling costs, and our haulage costs. And sometimes the shortfall is only some small, low-value items like clothes pegs.'

The factory operates on three seven-hour shifts, Monday to Friday: 105 hours per week, for 50 weeks per year. Regular overtime, typically 15 hours on a Saturday, has been worked most of the last year. Sunday is never used for production, allowing access to machines for routine and major overhauls. Machines are laid out in groups so that each operator can be kept highly utilized, attending to at least four machines. Any product can be made on any machine.

Pierre Dumas, the production manager, was concerned about storage space: 'At the moment our warehouse is full, with products stacked on the floor in every available corner, which makes it vulnerable to damage from passing forklifts and from double-handling. We have finally agreed to approve an extension (costing over one million Euros) to be constructed in June–September this year, which will

replace contract warehousing and associated transport which is costing us about 5 per cent of the manufacturing costs of the stored items. The return on investment for this project is well above our current 8 per cent cost of capital. There is no viable alternative, because if we run out of space, production will have to stop for a time. Some of our products occupy very large volumes of rack space. However, in the meantime we have decided to review all the re-order quantities. They seem either to result in excessive stock or too little stock to provide the service required. Large items such as the Baby Bath (Item 143BB) could be looked at first. This is a good starting point because the product has stable and non-seasonal demand. We estimate that it costs us around 20 per cent of the manufacturing variable costs to store such items for one year.'

Questions

- 1 Why is TEP unable to deliver all its products reliably within the target of one week, and what effects might that have on the distributors?
- 2 Applying the EBQ model, what batch size would you recommend for this product? How long will each batch take to produce, and how many batches per year will be made? Should this model be applied to calculate the re-order quantity for all the products, and if not, why?
- 3 How would the EBQ change if the set-up costs were reduced by 50 per cent, and the holding costs were reassessed at 40 per cent, taking account of the opportunity costs of capital at TEP?

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