

Stock records accuracy assignment



' Stock Records Accuracy' means: (1) a correspondence between what is present on the computer file and what physically exists, in reality, (2) that activities which have been recorded as taking place against stock are truly what in fact occurred, and (3) that no activity which took place is unrecorded in the system. As we shall see, the central stock file is a most important element of any system within the company. The records within the file are ' keyed' on each product's unique item code**. That is , specifying an item code enables the system's user to find and retrieve an item's record on the VDU directly.

In many companies also, it is necessary or desirable to keep track of physically discrete batches of the item in order to facilitate lot tracing or to differentiate batches of the item having different quality. In addition, in a variable (or ' random') location store or warehouse, since stock of the item is potentially stored in many locations, the stock record will consist of many groups of data under the main item key, with each group within the record showing a quantity of stock and the location where that stock quantity is stored.

Many of the data fields on the stock record are unchanging – obvious examples are an item's code, name and unit of measure (eg square feet, each, kilograms). Other data elements are relatively static, but do change from time to time. Examples are annual usage, standard cost or standard purchase price. Although the concern of this on-line Course is with stock quantities, procedures should be in place to update static and semi-static data as needs be. As well, one might also regard the transactions raised in the course of maintaining the system as being part of the stock record.

Although the role of transactions is to change the main record, by communicating through the system data relating to what has physically occurred so that it can be used to modify the main record, such transactions can be displayed separately and independently, and examined as part of an ‘audit trail’.

1. The Value of Stock Records Accuracy

It is important to identify the value of stock records accuracy for three reasons: 1. By quantifying the value of accuracy ... alternatively, the cost of inaccuracy ... we will obtain valuable insight into what objectives we should aim for; 2. By identifying where inaccuracy is having the greatest positive or negative effect, we will see where best to concentrate our attention; 3. The value of records accuracy tells us how important it is to get the data right, and how justified we are in going to what may seem as relatively extreme lengths to achieve very high standards of exactness. *One value of accuracy is the avoidance of costs *associated with inaccuracy.

These include (a) split batches and short production runs (because there turned out to be insufficient material to start a full production job**); (b) failures to meet deliveries (having promised the delivery on the basis of the computer record, the material was short when it came to picking it physically)**; (c) spoilage and obsolescence (unknown material eventually stumbled upon)**; (d) double handling (a location supposed to be empty according to the record turns out to be occupied)**; (e) excess stock holding (other staff may not know if you are holding a little **too much of a product, but everyone in the company knows if you run out ! . *A third value of records accuracy is to maintain financial control*. There are two reasons why

the accountant must verify on an annual basis the value of all stock held.

The first** is the place of stock on the balance sheet**. The balance sheet is struck at the end of the company's financial year, and states its assets and liabilities. Assets are split between fixed assets (machinery, land and buildings) and 'current' assets (cash, debtors and stock).

Stock is regarded as an asset since it is acquired (ie made) speculatively, in the hope and expectation of a future sale - ie it is in effect a corporate investment. The second** reason relates to the financial nature of stock. As just stated, stock is regarded as an investment made in the expectation of a future sale. Consequently, expenditure on the manufacture of stock is not regarded from the viewpoint of accountancy as an expense in the normal, financial sense of the word. It is (speculative) expenditure, which becomes a financial expense in the profit and loss account only when the sale is realised.

Consequently, it is highly convenient from the accounting viewpoint to keep a close watch on the status and quantity of stock, since these inform the accountant how much money has been spent as stock investment, as opposed to having been spent on other "true" expenses such as rent and tax which are able to be charged to the accounts and set against revenue to derive profit. {text: bookmark-start} {text: bookmark-end} 1. 3 How

Records Inaccuracy invalidates Planning *The fourth value of accurate stock records is for production planning*. Accurate data for planning is essential if the plans reduced are to be valid and believable. It is only through accurate stock records that the advantages of such planning systems as MRPII will be achieved. It is often difficult to get the attention of senior management with

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regard to stock accuracy, but never difficult to attract attention to planning and logistics systems. Yet without stock accuracy, planning and logistics systems are worthless. Consider the plans to manufacture Product A and support the plans for A with plans for Product B immediately below it in the Bill of Materials.

The plans for A and B must clearly be based on the starting stock balances of the two products as read on the products' computer records. Suppose however that the actual stocks of A and B are different from what is recorded. The real needs of product A are consequently different from what was previously calculated. If the needs for product A are different, then the needs for product B must also be different. Stock records inaccuracy creates over-production, over stock and above all, uncertainty throughout the chain of manufacture.

The reaction of most manufacturing staff to uncertainty and possible shortages is to over-produce ... no-one ever got promoted for creating shortages. An expensive MRPII system can be destroyed in weeks when the output therefrom {text: bookmark-start} {text: bookmark-end} 1. 4 Defining Accuracy There are a number of ways by which the accuracy of a group of records might be defined, and the choice of a preferred method depends on the purposes to which the accuracy figure is to be put. Strictly, the method which best expresses accuracy of the records is the mathematical measurement of "variance".

It may be thought, however, that the refinement obtained by calculating the variance is obtained at too high a price in terms of complexity. Instead, the

three methods below may be preferred – they provide a reasonable picture of accuracy and have the merit of being straightforward – simpler to calculate and simpler to comprehend. {text: bookmark-start} {text: bookmark-end} 1. 4a The Percentage Piece Variance The percentage piece variance is also known as the absolute piece variance, and compares the sum of the absolute variances of a group of actual product stock counts with the products' records.

For example, if the stock counts of two products A and B were 98 units and 105 units, and the records of the stock figures were 100 each, the piece variances between the two sets of figures are - 2 and + 5. The absolute** variances ignore the negative sign, however, and so that these are simply 2 and 5, total 7. The percentage absolute piece variance of the group of two products compares the total absolute variance of 7 to the total of the recorded figures (200 ... ie 100 + 100). Thus the absolute accuracy is $7 / 200$, or 3.5%. This is expressed as 96.5%. {text: bookmark-start} {text: bookmark-end}

1. 4b The Financial Percentage Piece Variance The financial percentage piece variance, or absolute financial percentage piece variance, is calculated in a similar way to the percentage piece variance above, except that variances are expressed in terms of the monetary value of the stock. Thus if the stock value of products P and Q were ? 97 and ? 108, and the records of the stock figures were ? 110 and ? 102, the variances in these financial terms are - ? 13 and + ? 6. The absolute** variances are thus ? 3 + ? 6, total ? 9. Consequently, the percentage financial piece variance is $9 / ? 212$, or 4.2%. Thus the financial percentage absolute variance is 96.1%. Note that if the absolute figures were not used, and positives and

negatives were therefore allowed to cancel, the records accuracy would appear much better – in this case, – 7, giving an accuracy of 96.7%. It is common for the accountant to express records accuracy in this way, since what is primarily of interest to him is the total value of the stock, not the accuracy of the records per se**.

This third definition is by far the most common in logistics management and will be used throughout the remainder of this on-line Course. It relies on the simple designation of a stock record, when compared to the count of actual stock, as either being correct (“good”) or incorrect (“bad”). Thus if there are two products X and Y with actual stock of 96 units and 100 units, and their records show stock of 100 units each, then the record for X is incorrect and that for Y is correct. The definition of accuracy is Total number of good counts / Number of Counts in Total.

In the case of X and Y, the accuracy of the records is therefore $1 / 2 \times 100\% = 50\%$. {text: bookmark-start} {text: bookmark-end} 1.5 The Accuracy Goal The Good Count / Bad Count definition introduced above is the most common and widely understood measurement of accuracy when applied to the records of any file, whether held on a card index or computer, and is given by the expression below. Again, as implied, it is a particularly useful and obvious yardstick for inventory records, readily understood by all. The number of records measured which are correct $\times 100\%$ The total number measured A number of suggestions have been made by various gurus in industry as to the accuracy goal to be aimed for. For example, the late Oliver Wight suggested that to support the MRP II planning system, 95.0% was the minimum figure. Other logistics experts would nowadays however put

forward 97.0% as the minimum. In fact, as we shall see below, because of the notion of tolerances**, the precision of the number is meaningless, although 97.0% is a reasonable target to be accepted for now. {text: bookmark-start} {text: bookmark-end} 1. Tolerances The question that the subject of tolerances** addresses is whether the computer record must match the physical stock quantity *exactly* for the record to be declared “correct”. The degree of difference allowed between the recorded figure** and the actual amount** of stock present, such that the record is nevertheless deemed to be correct** for the purpose of calculating good count / bad count, is termed its *tolerance*. There are two interrelated constituents of the tolerance assigned to a particular product: (1) The percentage tolerance**, and (2) the absolute tolerance**.

Both of them must be assigned to every stock record on an individual basis and together define the amount by which the record can differ from the physical stock present and still be considered “correct” for the purposes of arriving at a stock accuracy figure. As an example, if the percentage tolerance* is $t_1\%$ and the physical count is n , then, if we were using **this basis alone, the record would be considered to be correct if it was between $(n - t_1 \times n)$ and $(n + t_1 \times n)$. For example, if the percentage tolerance was 5.0% and the physical count was 1000, the record would be considered correct if it was between 950 and 1050.

If the *absolute tolerance* is t_2 and the physical count is n , the record would be correct on **that basis alone if it were between $(n - t_2)$ and $(n + t_2)$. For example, if the absolute tolerance is 30 units and the physical count is 1000 units, the record would be considered *correct if it were between 970 units

and 1030 units. To use the two tolerance figures in conjunction with each other, the rule is that if $t1 \times n$ (ie the calculated percentage figure) is greater than $t2$ (the absolute figure) then it is the percentage tolerance which determines whether the record is correct.

However, if $t2$ is greater than $t1 \times n$ it is the absolute tolerance which determines whether the record is correct. For example, suppose the percentage and absolute tolerances on a product ' Size 4 brads' held in a certain store are 5% and 30. Then (1) on one occasion** the physical count of brads in the store is 6, 000 so that $t1 \times n$ is 300 (ie $6000 \times 5\%$). Since this is greater than $t2$ (ie 30), the percentage tolerance applies. That is, the computer record is considered to be correct if it lies between 5, 700 and 6, 300. 2) On a second occasion** the physical count is 400 so that $t1 \times n$ is 20 ($400 \times 5\%$). Since the absolute tolerance of 30 is now greater than the percentage tolerance, the record is now deemed to be correct if it lies between 370 and 430. Many companies do not adopt the sophistication of both a percentage and absolute tolerance. Instead they rely only on a percentage figure. However, the reason for maintaining the two, interrelated, tolerances here becomes clear when comparatively low stocks are considered, especially those of common products that are replenished in large lots.

One simple rule that might be applied is to set the absolute tolerance such that it ' takes over' when the stock quantity falls below, say, 2% of the delivery quantity. For example, by this rule, a product X replenished in lots of 100, 000 would have an absolute tolerance of 2000. The necessity for an absolute figure can be illustrated with Size 4 Brads above: when the quantity

in stock is reduced to 400 with the percentage tolerance of 5% alone still applying, the record would need to lie between 380 and 420 to be correct.

This degree of exactitude may not seem reasonable in this case and would in any case jeopardise the viability of cycle counting systems within the stores based on low stock routes, described below. In the remaining text of this on-line course, the general term ‘tolerance’ is used and implies both the percentage and absolute. When a product/record tolerance is set, the two elements must be considered in conjunction with each other.

The rule for setting the absolute tolerance equal to the actual percentage tolerance at x% of the replenishment quantity may well be useful for warehouse products subject to steady customer demand and stores items which are consumables. Stores items planned in large lots by MRP or a similar planning system may have comparatively lower absolute tolerances. *Finally, let it be firmly stated that no attempt should be made to make the accuracy of a stores’ or warehouse’s records appear more accurate than they are by manipulating the tolerances that have been set on the products. For one thing, this reprehensible trick simply does not work!

It would be necessary to enlarge the tolerance gaps to quite unacceptable margins to make any appreciable difference to the overall accuracy. The idea of tolerances is to give the company a more reasonable view of the records accuracy than a strict adherence to the requiring of absolutely exact correspondence between the record and the actual. Indeed, for products which are weighed or reckoned by length or volume, rather than simply counted in ‘eaches’, absolute exactness* is impossible to measure even with

the most sensitive measuring instruments (see 1. 7 below). See also Section 5. 12. text: bookmark-start} {text: bookmark-end} 1. 7 Assigning Tolerances

Before considering the actual assignment of tolerances to products in the stores or warehouse, it is first necessary to deal with some theory relating to measurement. First, we can divide the data resulting from measuring stock into continuous data** and count data**. C o n t i n u o u s D a t a (stock measured by weight, volume, length etc**.) There is inevitably a difference between the measured value M and the ' true' value of what is measured T . That is: Measurement Error = $M - T$ The difference ($M - T$) can be reexpressed as $(M + \mu_1) + (\mu_2 - T)$.

The first term ($M + \mu_1$) merely states that there is a difference from the true value in the measurement taken, due to random variation in the measuring process. The second term ($\mu_2 - T$) expresses the bias in the measuring process due to such systematic errors as mis-calibration of equipment. The calibration of instruments and apparatus is a vital matter in stock accuracy and will be touched on below. Presence of the random element in measurement is inevitable. To prevent it obscuring the simple matter of determining whether a record is or is not accurate, a tolerance is set to eliminate its effect.

A simple and usually effective way of setting tolerances on measurements of continuous data is first to rank the items in order of unit financial value. The 2% of the items at the top of the list may take a tolerance of 0. 1 % and the remainder 5%. (Those at the top are managerially more sensitive, regardless of the measurement process). C o u n t D a t a A simple way of dealing with measurements having to do with counting is to divide the items into those

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which are dispensed on a day to day basis by hand counting, and those which are dispensed by weigh or scale counting.

Hand counted items are assigned 0% tolerance and weigh/scale counted items may be assigned 5%. In summary, the assignment of tolerances can be swiftly accomplished even where very large numbers of items are involved. As a quick rule of thumb, most continuous materials and all weigh counted materials can be assigned a 5% tolerance. Expensive continuous items and hand counted items will have a 0% tolerance. Excessive time and effort spent on assigning tolerances is to be avoided. As stated above, it is shown by experience that it is not possible to increase the % accuracy of the records by manipulating tolerances.

Imprecision of measurement is a very small factor contributing to inaccuracy. Extreme Cases There are two cases where there may be difficulty in making exact measurements, but where the use of tolerances may not be best or may not be acceptable. If stock is of high value or is of similar critical importance, and measurement is difficult because of its physical nature and/or the type of apparatus needed to count it, it is necessary to take several measurements and average them.

To reduce uncertainty by 50% in the average value calculated, it is necessary to take and average 3 readings. To reduce uncertainty to 25%, 10 measurements are necessary. (The theory from which these figures are obtained relates to the mathematical distribution of the random errors μ_1 referred to above**.) The greatest danger to accuracy in these circumstances, however, will remain the perennial enemy of systematic

errors in the measuring process. These are undetectable errors caused by off-centre instrumentation, poorly calibrated apparatus and so on.

Systematic errors must be reduced to negligible proportions by careful examination of the measurement process, both with regard to procedure and instruments. One of the more sobering statements made on a regular basis by the UK Atomic Energy Authority relates to the loss each year of weapons- and reactor-grade plutonium. In the past 25 years, more than 80 kilograms have ‘ gone missing’ in the Sellafield nuclear facility alone. A spokesman for the UK Atomic Energy Authority said the annual amount reported as lost “ were mainly caused by margins of error in the counting process.

Plutonium going through reprocessing plants is not always in a form in which it can be physically measured, so its presence has to be calculated. At each stage of the process as it is chopped up, dissolved, or whatever, calculations are made of how much plutonium there is. We cannot calculate it totally accurately. As well, outright losses have happened – sometimes a fuel rod gets lodged somewhere and avoids the processing line”. [Sunday Telegraph, 7. 12. 97]. Where the value of stock is very low, but the nature of the material makes counting and control expensive, it may be worthwhile to give up counting altogether and revert to a simple two-bin system. The two-bin system ... the procedure we all use to control the replenishment of coffee in our kitchens ... is purely a replenishment system and does not rely on measurement as such. {text: bookmark-start} {text: bookmark-end} 1. 8

The Starting Accuracy Audit To begin the journey to high stock records accuracy, it is recommended that an “ accuracy audit” be conducted to find

the starting position. In fact, such audits should be performed from time to time on an on-going basis.

Accuracy audits are not the same as cycle counts, since their purpose is different. The purposes of cycle counting are error correction and investigation. Here, the purpose is merely that of audit. Although the final result of accuracy auditing may be a single figure relating to the records in total, it is usually desirable in practice to determine the accuracy of distinct separate groups of items, especially if it is suspected that the accuracy of product records in the groups identified will be different because of different factors affecting stock.

In a stores, obvious examples of groups are raw materials**; intermediate components**; and finished goods**. Other groups relating to a particular store's environment might be: fast moving items**; items stored off-site**; items which are very numerous**; and material which is physically difficult to count**. In order to find the accuracy of the records for a particular group, it is suggested that a randomly selected sample of 50 counts be taken from the group and the accuracy calculated in the way explained above.

In order, later, to combine the individual group results and calculate the stock records accuracy of the stores overall, the percentage accuracies of the individual groups should be weighted according to the number of items in each of the groups. An example of doing so is given as follows: Group accuracy of Raw Materials (from sample) 72. 0% Number of Raw Materials in Store 1100 Number of inaccurate Raw Material Records $1100 \times 28\% = 308$ Group accuracy of Components (from sample) 84. 0% Number of

Components in Store 900 Number of inaccurate Component Records 900 ?
6% = 144 Group accuracy of Finished Goods (from sample) 94% Number of
Finished Goods in Store 500 Number of inaccurate Finished Goods Records
500 ? 6% = 30 Overall records accuracy $(2500 - 482) / 2500 = 80.7\%$ Care
should be taken with combining accuracy figures calculated by financial
value, to avoid positives and negatives cancelling, resulting in an
unrealistically good figure. {text: bookmark-start} {text: bookmark-end} 2.

The Physical Environment {text: bookmark-start} {text: bookmark-end} 2.
Controlled Stores / Warehouse Access The first assault on eliminating the
special causes of variation in accuracy levels, on the journey to high, stable
stock records accuracy, relates to the matter of controlled access to the
stock itself. Dealing first with a stores, if the stores supervisor and his staff
are to be accountable for the accuracy of the stock records and the integrity
of the material in their charge, it is essential that they should maintain full
control and supervision, at all times, of stock issues and receipts. In short,
the stores must be physically secured and manned at all times.

One of the problems in achieving this, particularly in a manufacturing
environment, is clearly the need - and the cost - of manning the entry to the
facility, although this may not be as expensive as it first sounds if the current
(informal) time is subtracted of supervisors and other shop floor operatives
searching for parts themselves and counting out material. Although the
principle of a fully-closed store must not be violated, there are a number of
ways to mitigate its cost and possible inconvenience. Examples are (1)
Instituting pre-planned issues.

Although the normal manning of the stores may be (say) three people, it may be possible to reduce this number for the 2nd or 3rd shift by instituting pre-planned issues to the shop floor in the 1st shift, or by pre-kitting. (2) Bulk Issues to the Shop Floor of high usage, low cost items. (3) Making periodic supplies to the shop floor. Provided the system is rigidly controlled and supported by a good shop floor data collection system, each work centre might be issued with (say) 2 days of materials. In general, physically securing the stores is a matter where it is necessary to bite the bullet.

A storesman must man the gate to the store and insist on (1) authorisation, and (2) documentation from everyone before any issue is made or a receipt accepted. By eliminating this special cause of variation in records accuracy, the imposition of physical security will typically result in increased accuracy of some 20% in a very short time ... say, up from 60% to 80% in weeks. Note that since the shop floor must be capable of receiving service throughout the whole time that staff are working, it follows that the stores must be manned during that time.

Managers in industry who take the view that shop floor workers (or one nominated shop floor worker entrusted with a key) are capable of maintaining high stock records accuracy are deluding themselves. They are undermining the responsibility of stores staff; their view has been disproved over the years, again and again. Dealing next with a warehouse environment, the problems of access are different in nature, since the very job of a large number of the warehouse staff is the storing and removal of material.

The rule in warehouse sites is that if a person's job does not of itself require him to handle stock, he should not have access to the place where such stock is stored. Overcoming the practical problems of imposing limited access. {text: bookmark-start} {text: bookmark-end} (1) The Creation of a Secondary Store/Warehouse One means of overcoming the problem of limited access is to create a secondary store, or mini store, as a small version of the main storage area itself. Access to the main stores is strictly limited, as described above, but access is** allowed to the mini stores (though not freely).

The records in the mini stores will go wrong quickly. However, it is possible to make a 100% stock count of the mini stores in a very short time, and this is performed every two or three days to correct errors. {text: bookmark-start} {text: bookmark-end} (2) Line-side stocks and the use of backflushing Manufacture involving assembly lines, continuous production and cell production usually relies on “ backflushing” to determine the amounts of components used – that is, to determine the amounts of material in stock on the shop floor.

For example, suppose that a bill of material showed that Product A consisted of 2 units of Component B, 1 unit of Component C and 1 unit of Component D. Suppose further that 20 units of Product A are manufactured. (Careful account must be kept of spoiled manufacture and production waste. **) If so, the stock quantity on the record of Product B should be reduced, or backflushed**, by 40 units, the stock of Product C should be reduced by 20 units, and that of Product D by 20 units as well.

If the starting quantities are 160 units of B, 80 of C and 80 of D, then the remaining amounts are 120 B, 60 C and 60 D. There are three circumstances where backflushing might be used to advantage in a manufacturing environment: (a) Where “ point-of-use” stock is stored – ie “ line-side” stock, always kept on the production line at a machine location; (b) Where bulk materials are used in production, especially since withdrawing exactly the correct amount of such material is sometimes difficult or impossible, and (c) Where scrap in production is very variable, so that production runs must continue until enough good material has been produced. Backflushing is, however, an error-prone method, since it assumes a perfect world – it cannot deal with non-standard actions such as shrinkage direct from the assembly line, components removed for a quality tests, or ones borrowed and never returned, or with variations in the usages of the bill of materials.

It is consequently necessary to 100% count the stock on a frequent, perhaps daily basis. Minimum floor stock should be issued to minimise this counting task**. See below for further information relating to backflushing. {text: bookmark-start} {text: bookmark-end} Retail {text: bookmark-start} {text: bookmark-end} 2. 2 The Value of Variable (Random) Locations If a variable, or random, location system is adopted, the location associated with each separate occurrence of stock is clearly every bit as important as the quantity.

The immense advantage of a random location system from the viewpoint of stock records is that locations** in the store or warehouse are continually becoming empty. When they do so, the location is liable to be filled by another product as dictated by the “ put- away” procedures of the computer

program governing the operation of the system. However, in addition, when a location becomes empty, the fact that it has so become empty can be considered to constitute a free stock count (of zero stock).

To make use of these free stock counts, the storesman or warehouseman must report back to the system whenever a location is emptied following a stock withdrawal. This subject is dealt with again under the Cycle Counting of Random Locations. {text: bookmark-start} {text: bookmark-end} 2. 3

Equipment for Weighing & Measuring To help eliminate further special causes of records variation, and allied to the question of tolerance above, consideration must be given to the inherent accuracy and the calibration of the devices available in the facility for weighing and measuring.

As everyone knows, there are a large number of machines on the market capable of counting and/or measuring, ranging from basic weighing machines to sophisticated computer-controlled electronic sensors. Weighing Machines Accurate “sample scales” are used for small quantities to find the unit weight of products. Large electronic scales weigh the main stock, with direct links possible to the computer. Care must be taken to account correctly for the container weight (the ‘tare’), and to ensure the items’ weight is not distorted by oil, wetness etc.

Standard Over-Packaging This is the simplest of all counting methods, obtained through the provision of packages which can contain only exact multiples of items (ie the egg box, holding 6 eggs). Techniques Special to the Process Industries Oil and chemical companies are required to measure bulk liquids, often choosing to do so by flowmeters

or even simple dip tapes. Many of the methods used are acknowledged as being problematical, with comparatively wide tolerances arising inherent in the techniques themselves.

Problems are often compounded by the need to take account of the temperature of the liquid, and then the further need to assume that the temperature is uniform throughout the material's bulk. The records accuracy of such companies' stock is frequently largely dependent on the measuring devices used. It is interesting to note that when a tanker discharges oil at a refinery, an 'arbitrator' appointed by the two parties (ie the refinery manager and the tanker captain) is on hand to decide the quantity of oil deemed to have been discharged for payment purposes. text: bookmark-start} {text: bookmark-end} 2. 4 On-Line Data Processing The desirability of adopting an on-line IT system to eliminate special causes of error and prevent yet further variation in the records stems from the fast feedback provided relating to on-line errors in the transactions, and the far greater confidence that the records are up to date when access to them is wanted.

*Batch data processing, by contrast, means that data 'events' are recorded on a device (whether a paper form or an electronic recording collector) and input to the computer records in bulk.

With batch processing, the data transactions are deliberately held back until a reasonable quantity of them have been collected, so that input, although efficient, is usually made several hours after the events to which they relate. Many companies insist that batch data is at least input within two or three hours, and certainly before the start of any new planning run. **On-line means that *instant access is made to the computer holding the stock

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records. That is, data is notified to the computer as soon after the event as possible.

Except in a totally automated environment, however, there is nevertheless a time delay between the event and the recording of it. (The delay may be seconds, minutes or, in a slacker environment, one or two hours.) A very important further advantage of on-line is that the person responsible for the data is also the one who inputs it to the database. As a consequence, if the computer immediately detects an error in the transaction, an error message is signalled at once to the person who has input it.

That person can then correct what was wrong, saving a great deal of time that would otherwise be spent in identifying him and asking him to effect a correction. Tied up with the question of on-line and batch data processing are the matters of data recording and data collection. Thus: P a p e r F o r m s. A dominant method of collecting data about stores and warehouse ' events' is through the completion of paper forms, which must then be taken to a VDU so that the data recorded on the form can be input to the computer. V D U s.

Within the main stores, the most common method of obtaining on-line access to the computer is via an ordinary VDU situated at a convenient point, which must be connected to the computer by coaxial cable and the use of a computer network. R D T s. A radio data terminal is an outstanding alternative to a fixed-position VDU, being essentially a hand-held VDU linked to the computer by a radio signal. RDTs can operate from over a mile distance. A major problem with RDTs which makes them unpopular with

storesmen is that they occupy a hand of the operator - materials handling in the stores/warehouse requires the use of both** hands. RDTs are used by HM Customs at ports and airports.) D a t a C o l l e c t o r s. These are devices similar in appearance to Psion or Sharp electronic organisers (not dissimilar from large calculators), and are used for directly inputting and storing transaction data. When the devices' memories are full, or perhaps at the end of a shift, the data collected so far are downloaded via an input port to the computer as a stream of data transactions. L o c a l D a t a C o m m u n i c a t i o n s. ' Local communications' here means within the company - ie between factory, stores and the company's computer installation.

Coaxial cabling and radio links are common. R e m o t e D a t a C o m m u n i c a t i o n s. Data may be sent to and from a depot or other outlying transmitter or data cable, through a so-called ' value added network', or VAN. The VAN can be regarded as a network of computer post offices. That is, the network subscriber who wishes to send data dials into the system and transmits the data, including the (electronic) address of the intended recipient. The message or data is directed to a computer close to the recipient's geographical address.

The recipient accesses his local VAN computer on a frequent basis to see if any message has been sent to him, and, if it has, reads it into his own computer. There are four VAN networks in the UK, operated by INS Tradanet, AT Istel, BT and IBM. Compatibility problems between these networks have now been largely resolved. In order to send any data via a communications network, it is necessary to follow strict rules relating to the electronic format

of the ' message', so that it can be properly handled by the complex computer software program governing the network.

The rules are known as the network's protocol**. The standards for the VANs are X. 12, X. 400 and X. 435. The last two can deal with both EDI and E-Mail (electronic mail). The remaining technical issue concerns the software employed by the sender and recipient themselves to translate and interpret the information being sent. A number of ' EDI translation' software packages are on the market. Most of them, such as Sterling Software's Gentran, can access all four VAN networks. {text: bookmark-start} {text: bookmark-end}

2. Bar Coding and RFID Tags B a r C o d e s The familiar bar code is the representation of a numeric, alphabetic or alphanumeric code by a pattern of dark and light stripes, with ' start' and ' stop' characters at either end, and which can be interpreted, or read, by a light scanning device called a bar code reader. Bar code readers are either contact or non-contact. Contact readers** such as those used in retail shops are also called fixed beam readers**, since the device needs to be very close to the bar code. They are comparatively inexpensive (? 100 +).

Non-contact scanners, **or line scan readers**, work by repeatedly reading the code with a laser beam fired by a gun, perhaps mounted on a truck, until the reading is error free. They cost about ? 1000. There are a dozen or so different bar coding systems for assigning a code to a material. One used extensively in the warehousing of consumer goods, including the outside carton packaging of groceries, is termed Interleaved 2 of 5. ** It is numeric only, and requires the code to comprise an even number of digits. With

Interleaved 2 of 5, even numbers are represented by the white stripes and odd numbers by the dark bars.

Its advantage is its physical density. In industry generally, however, there is a preference for the Code 39 **system. This is capable of encoding numbers and letters. Each character is represented by a group of 5 bars and 4 spaces, and has an in-built check to eliminate mistakes in the physical reading and interpretation of the code by the bar code reader. Other bar code systems are EAN (European Numbering System)** and UPC (Universal Product System)**. UPC was devised by IBM in 1973 and is the one used in groceries in supermarkets.

Its advantage is that the code does not need to be on a flat surface to be read by the reader. Bar coding in the stores or warehouse is not always successful even when those attempting its implementation have carefully assessed that it will be. There are three issues. First, there is the matter of ergonomics**. Ergonomics is the science of ' man-machine interaction', and here means how codes are to be assigned, how (literally) they are to be attached to the objects and locations in question, how the codes are to be read, and what equipment is to be used.

It also encompasses the nature of the computer system that will read the codes and how associated data, such as quantities, are to be recorded.

Thirdly, if it is intended that incoming raw materials are to be bar coded by suppliers, their competence and willingness to do so must be considered (or, at least, their willingness to apply bar code labels and documents supplied by the company). If bar coding works well and easily, without a

continual struggle to keep it going, there are two advantages to its use. First, self-evidently, material and location codes are read correctly and more easily.

Secondly, the reading process ensures that each transaction relating to an activity is indeed raised, and is not forgotten, and that it is then input to the computer system in a timely manner. In other words, it has the ability to eliminate a frequent cause of stock records inaccuracy, namely that of lost and missing transactions. R F I D T a g s (R a d i o F r e q u e n c y I d e n t i f i c a t i o n T a g s). By 'identification' is meant the attachment of a small "tag" bearing the code, and potentially much other data, of what is to be identified, and the subsequent reading of the tag code and data at some later stage by a tag reader.

The physical tag attached to the object may commonly be a label, in a flat, thin, flexible ticket, often referred to as a smart label**, or may take other forms such as a glass bead, depending on the application to hand. Important attributes of tags are that they are robust and capable of functioning in extremely harsh environments and that they are reusable and can last for many years. The code and other data associated with the tag is read by a tag reader,** or special tag interrogator, a primary function of the interrogator, or reader, being *to excite a component within the tag termed its *antenna*. Although the technology associated with RFID tags and interrogators is changing rapidly, as at the date of this on-line course, the microchip used in the tag is likely to be a silicon microprocessor (chip) and the antenna is likely to be formed from conductive carbon ink. The silicon microprocessor or chip will be attached to carbon - ink electrodes at the <https://assignbuster.com/stock-records-accuracy-assignment/>

back of the tag itself, or at the back of the smart label. Note particularly in an RFID tag that a tiny enclosed battery is optional. That is, a tag may have a small lithium battery to boost power.

Tags with batteries are referred to as active tags** and those without as passive tags**. Power is transmitted to the tag in the first place from an electric field created by the tag interrogator. Data is transferred from the tag to the interrogator through the modulation by the tag of the interrogator signal**. With their extra power, active tags are able to communicate with an interrogator over considerably greater distances than passive tags (many thousands of feet rather than only tens of feet).

Active tags are also capable of carrying and conveying greater amounts of data (thousands of bits rather than tens). Not surprisingly, active tags are more expensive than passive tags. Cost is currently a major issue in RFID technology, especially as it concerns its widespread adoption in retail. A critical milestone in the practicality and acceptability of RFID technology has been the adoption in late 2005 of the GEN2 data technology standard and the ALE standard. GEN2 governs the basic tag reading technology essential to the production of tags themselves and tag readers.

ALE deals with the collection, management and routing of data; it addresses the problem of huge amounts of raw data generated by RFID readers – readers can make multiple readings of the same tag in a fraction of second, so that this “dirty” data must be filtered. In summary the key benefits of GEN2 and ALE are that they give the ability to read RFID tags quickly and simultaneously. Finally, and most importantly, we see from the technical

nature of the interaction between the RFID interrogator and the RFID tag, that two major advantages lie with the technology and distinguish it from bar coding.

These are: *First, that in order to read a tag, it is unnecessary to have a direct view of it*. Communication is by electrical waves and antennas, and line of sight is no more required than it is required of a radio in order to broadcast to it a programme from a transmitter. *Secondly, it is possible easily to read tags which have been attached to a succession of irregularly shaped items which would be unsuitable to bar code reading. The examples in everyday life typical of the application of RFID tags are: car tagging for toll booths; hospital patients; criminals on licence; airline luggage; library books; the tagging of wild and domestic animals; and marathon runners {text: bookmark-start} {text: bookmark-end} For the stores, one critical application of tags is in making use of the ability to read simultaneously the identities of all the tagged components of an incoming or outgoing load merely by scanning it from a distance with the tag interrogator.

A second application is the ability quickly and easily to verify and count stored stock, as in cycle counting or in the conduct of an annual stock take. An example relates to a national company distributing wines and spirits, which wished to double check assembled loads for correctness on its vehicles before despatching them to customers, and to a major retailer receiving loads of garments hanging on rails at its major stores from its distribution warehouse.

Besides the examples above, there are an ever increasing number of other applications involving the simultaneous, mass reading of palletised loads at the point of despatch and the verification of loads at their destinations. In order to commence a move to RFID, the stores supervisor might first attend a one-day course on the subject held at the DTI's RFID Research Centre in Bracknell, Berks.. In addition, it is possible to see RFID in action at an RFID demonstration site run by Unipart and others at Oxford. A contact name is Mark Howard at Unipart on 01865-383440.

A hands-on introduction to the technology can also be gained from the “RFID in a box” starter kit obtainable from the consultancy firm Manhattan Associates (London 0870-3514770 or Bracknell 01344-318000). {text: bookmark-start} {text: bookmark-end}

2. 6 The Working Environment

Although the environment in which manufacture takes place in many factories is simply a fact of life, the manager should be aware that noise, dirt, heat and a shortage of space will work against the accurate completion and submission of transactions.

Every effort should therefore be made to eliminate unnecessarily stressful conditions, and where complete avoidance is not possible, at least to mitigate their effect. The atmosphere in which the storeman is to work – its freedom from disruption and distraction – is as much a part of the stock recording system as the operation of computer programs and the clarity and correctness of the computer transactions.

Four areas to observe and, if necessary, reorganise and improve are: (1) goods receiving from outside; (2) goods receiving from the shop floor; (3) the

point of physically picking and assembling stock; and (4) packing and despatch. Questions critical to the conduct of activities in these four areas are considered below under a number of headings. In each case, the manager addressing the stock recording system should observe the various areas for himself and listen to the testimony and opinions of those who work there.

As stated, the recording and submission of data transactions should be undertaken in an atmosphere free of stress and chaos – it should be a calm atmosphere conducive to error-free, accurate work. Provision of Ample Space: The degree to which there is loss of productivity, and indeed the degree to which there is an increase in liability to accidents and errors, increases as the percentage occupation of the facility itself increases. The increase has been graphed. The graph shows that liability to accidents and error does not rise linearly as the percentage occupation of the workspace rises.

Instead, liability rises exponentially. That is, as occupation gets higher and higher, the probability of accident and error becomes nearer and nearer a certainty. Housekeeping: Just as clearing away clutter and sweeping and cleaning are principal rules of lean production, so they should be in stores/warehouse management to achieve an environment conducive to accuracy. Damaged cartons must be seen to and containers closed. Unstable loads must not be allowed on racking or as floor stock. Untidiness is an invitation to allow stock to “wander” to the next location or behind crates.

Noise, Heat and Cold: Work should be redesigned as far as possible so that storemen required to perform work under these conditions can at least complete and submit actual transactions back in the office away from the stressful areas. Every storeman should have his own desk. Lighting: Inadequate lighting very obviously leads to errors in recording and counting. Have lighting redesigned by an expert – the technology in this area is constantly on the move. As well, remember that natural light is far preferable and far less stressful.

Item Identification: Ensure that all labelling is clear, employing a large, clear font. {text: bookmark-start} {text: bookmark-end} 3. The Stock Recording System {text: bookmark-start} {text: bookmark-end} 3. 1 The Total System There are certain characteristics of the stock recording system which make a wholly IT oriented approach to its design and implementation quite inappropriate. One characteristic is the detachment of the data processing from the actuality of stock movement – ie no data need be verified in order for a real-world “ event” to take place, and no event is ever invalidated or reversed. For example, stock can be picked and issued without the literal completion of a transaction, and if a transaction were to be completed wrongly, the stock would remain duly picked. **) A second is the reliance on a great many system operators, with diverse professional interests and from many different backgrounds, working in a stressful environment – ie storemen, drivers, cycle counters and others. Yet a third characteristic is the potential informality of the data transactions themselves, at least, usually, in the first stage of the data trail as paper forms.

As a consequence, it is necessary to consider the stock recording system from a wide, outside in** viewpoint, and include for consideration not only data procedures and IT, but such other matters as the recruitment and capability of staff, the procedures followed by external suppliers and drivers, and the data they raise, the role and responsibility of shop floor staff, staff bonus schemes, training and education, links with sales department and customers to whom goods are despatched.

As stated, the approach to the stock recording system which encompasses this total viewpoint is referred to as outside in**. In considering stock records accuracy, then, all facets must be considered. Thus it is pointless to have excellent data measuring and recording devices but to employ dyslexic staff to operate them. Although the outside in view of the system is important, naturally one cannot sideline the formal data processing system itself. The data processing aspects of the system are considered below. {text:

bookmark-start} {text: bookmark-end} 3. The Data Processing Procedures

The data transactions – records of events – are the essential means of ensuring the system itself is backed up by actual data reflecting the real events that happen. It is normal to organise transaction records into files of data by transaction type, and to relate each such transaction record to the main stock record via the Item Code. The stock data on a transaction record (perhaps a transaction dealing with an issue, say “ Type 05”) will obviously depend on that transaction type and the product in question.

If Type 05 was “ Stores Issue”, the data associated with an “ 05” might be ...

Transaction Type Code 05 : Product Code; Date and Time of Transaction;
Issue/Order Number Quantity Issued; Unit of Measure. The main stock record

and the various associated transaction records will be related through their common item code. Other data will be associated with other types of transactions. Some data are present to assist with the task of data reconciliation should things go wrong – see Audit Trails below.

A separate computer program is needed in the system for each type of transaction. A large number of transaction types will typically be defined to the system. By checking the names of the transactions it is possible to assess broadly whether the system is sufficiently comprehensive. Failure to provide a comprehensive set of transactions and procedures to meet all circumstances will result in the system being side-stepped and in an immediate deterioration in stock records accuracy. [Note however that there is an alternative view to this.

Roger Brooks and Larry Wilson in their book *Inventory Records Accuracy* **state that the number and diversity of transactions should be minimised, with, say, a given transaction serving several situations. For example, Transaction X may relate to the issue of stock from the stores. There may be several different, distinct stores activities which relate to the issue of stock, each activity therefore calling for the use of the common Transaction X. The training of staff in such a system must clearly be thorough. {text: bookmark-start} {text: bookmark-end} T y p i c a l T r a n s a c t i o n T y p e s

Examples of actual transactions in two categories are given below. Each example corresponds to a data processing program that allows the on-line or batch update of the database. It will be backed up by other data processing programs: for example, programs allowing personnel to make enquiries;

programs to support cycle counting; by programs producing regular reports (including a report of the stock records accuracy figure itself).

Category 1 (stock movements originating within the Stores) Issue material from stores/warehouse to the factory; Issue material to goods outward for despatch to a customer; Return material to outside supplier (+ reason); Cycle count of stock; Scrap obsolete/spoiled stock in the stores (+ reason, such as quality, deterioration etc; Move or consolidate stock within stores; Direct stock adjustment (+ reason).

Category 2 (stock movements originating outside the Stores) Process batch charged / completed; Receive material from the factory into stores; Supplier receipt adjustment; Material placed in quarantine; Direct stock adjustment (+ reason); Complete & report works order in the shop; Start / complete machine operation in the shop; Start Works Order in the shop; Deliver goods outward to customer; Inter-factory movement of material; Receipt of external material direct from supplier; Deliver material to stores; Receive material from outside supplier into stores; Return of unused material from the shop floor to the stores; Report loss Chemical batch formulation / BOM adjustment; Cycle count (WIP). {text: bookmark-start} {text: bookmark-end}

3. Procedures & Responsibilities for Raising Data Processing Defining

Procedures for Transaction Processing Stock records accuracy will not be achieved without the understanding and commitment of those involved, backed up by defined responsibilities and physical tools. In this sense it is a mistake to view the task purely as a systems or technical one. On the other hand, it is a mistake also to believe that goodwill alone will accomplish the job. Procedures must be set up which make it easily possible to record what

needs to be done. They must be documented, simple to follow and comprehensive. If personnel do not know how to cope with a situation through the formal system, they will create or revert to an informal method in order to make progress with the physical side of their jobs. Data should be validated whenever an opportunity presents itself.

The scale of the validation and the usefulness of the error messages will be an indication of the quality of the background software. Examples of general data validation are (1) general data field validity; and (2) cross-checking against master data files. Other examples are: (i) Message Patterns It is often possible to define a sequence of transactions that must – without variation – be followed by a particular order throughout its life. Then, to ensure that no step is missed along the way, an internal computer check can be made as each successive transaction in the defined sequence is reported. Missing or out-of-order transactions are then picked up on.

A typical example relates to the succession of procedures taking place on receipt of an external supplier delivery. Two further examples might be (a) the required put-away transactions issued as instructions in a variable (random) location system, and (b) the required stock retrieval transactions also issued by a variable location system. (ii) Reasonableness Limits A not uncommon error in the operation of the system is the entering of a product quantity that is grossly too large or grossly too small. For example, a storesman might receive two boxes of 300 widgets and enter '2' instead of '600'. "2" is not a reasonable receipt quantity for these items if they are usually ordered in multiples of 300.

It is suggested that reasonableness limits be associated on the database with each transaction type for each product, especially raw materials. If the limits are broken, the computer can issue a warning. (iii) Duplicates If a second transaction is input within (say) 48 hours of a previous transaction and is otherwise identical to it in every regard, the system can issue a warning that the second one may be a duplication of a transaction already submitted and processed. {text: bookmark-start} {text: bookmark-end} 3. 4 Other Procedures {text: bookmark-start} {text: bookmark-end} 3. 4a Goods In C o n d u c t o f G o o d s – I n *The very first *action the Goods-In Supervisor must take when a vehicle arrives is to check that the load is indeed for his company.

The *next action* is to count and verify that the number of boxes, crates, pallets etc on the driver's delivery note tally with the number delivered. *Next, two actions* are taken as follows (though the sequence of the actions might be reversed – see below). *(1) The detailed receipted material is checked against what the supplier says has been sent on his Unpacking Note. (2) The transaction data from (1) is input to the computer. The principal issue in the receipt and validation of incoming loads is the extent to which the Goods In supervisor should go in opening packages and counting out material. The supplier's own assertion of what has been sent should be accepted only if the supervisor has evidence that his (the supplier's) procedures are sound.

Even if they are, there should still be spot checks. And if any evidence emerges that the supplier's paperwork differs from reality, the supplier's deliveries should be thoroughly checked until he is back in control. If

material is received in standard containers (the "egg box principle"), the stated number should be accepted without counting. Any non-standardised cases/amounts, however, should be counted. If weigh counting is employed, it is likely that, in the event of small discrepancies, the supplier's totals are more accurate than the receiving company's. Weigh counting, incidentally, can be effective for difficult materials, such as powders, liquids and bails.

In verifying the received amount versus the stated despatched quantity, a useful tip is to circle (with the stores' standard green pen) the goods despatched figure on the supplier's documentation, making sure this is not confused with the order quantity or any quantity "to follow". The receipt and staging areas where goods are to be off-loaded and counted should be well lit and tidy*. And the rule should be instituted that goods received today must be verified today and the database updated today**. The rule prevents mix-ups and mistakes, even though occasionally it may be necessary for the stores supervisor to draft in extra staff. See also the responsibilities of the purchasing manager, below. text: bookmark-start} {text: bookmark-end}

Note finally that the 'INCOTERM**' (International Chamber of Commerce Terms of Sale) agreed by the company with the supplier or customer regarding the responsibilities for either delivery (ie with the customer**) or receipt (ie with the supplier**) should, if possible, be DDP (Delivered), not EXW (Ex-Works). A major problem with Ex Works arrangements, by which the company's customers will collect the goods from our loading bay, is that frequently enough he does not turn up at the time, or even on the date, promised. Consequently, we find the goods, which are stacked and waiting

for him in the despatch area, to be an obstacle, and we are forced to continually shift them out of the way.

If our own company agrees to deliver the goods, however, by specifying the Incoterm 'DDP', everything regarding despatch is under our own control, from picking to assembly to loading (on our own transport). To be sure, there is a cost associated with delivery and this must be taken into account in the negotiation of the selling price. The purchasing manager and the sales manager must be made aware of these points and the impact of the selected INCOTERM on the stores'/warehouse's operations. [Note that under EXW, (1) the only wrapping required of the goods is 'immediate' wrapping, not wrapping for the journey, and (2) there is no obligation to load the customer's vehicle**.

If the vehicle is loaded for the customer (as a favour to him), who is to be responsible if it is done negligently? It is urged that the stores/warehouse manager should obtain the booklet published by the ICC, available for about ? 26 setting out the INCOTERMS terms in full. This may be ordered on the Internet through Amazon. co. uk*. It is also strongly suggested that the manager wishing to become seriously involved in using an Incoterm obtain the commentary on the Incoterms written by **Jan Ramberg, also available from Amazon*. Goods - In Transaction Processing The completion and processing of transaction data relating to goods-in is the biggest source of error in raw material stock records.

One reason for errors is that the sequence in which material is listed on the company's purchase order or the supplier's advice note will almost never be

the same as its sequence on the Unpacking Note. Another reason is the use by the supplier of different codes and, even, different names. To help overcome these difficulties, it is suggested that a provisional transaction set is raised first, before the physical count, the data required to raise it being obtained directly via computer from the purchase order or advice note. The data from this provisional transaction set must then be printed out by computer as a check list to assist in the verification process of the physical material. The check list might be augmented with other data such as units of measure and cross reference codes.) Clearly, somewhat complex software is needed to accomplish this. Such software very obviously must also allow the provisional transactions to be amended before confirmation. *The need for an overall system approach was emphasised a couple of years ago by a report relating to lost stock by the MOD. Thus some time ago, the Ministry of Defence admitted that thousands of key parts relating to the UK's Trident Nuclear weapons system had 'gone missing', some of the parts being cable subassemblies required to link different sections of the weapon.

According to the MOD, " the problem came to light after checks of incoming supplies at the Trident base in Faslane, Scotland, exposed " discrepancies in receipts. Parts which left the manufacturers in the US were missing when the consignments reached Scotland". The parts were British Government responsibility when they disappeared. Detailed enquiries with the shipping authorities, and exhaustive checks of stock holdings and historical records failed to track down the missing items and they were formally declared 'lost'. {text: bookmark-start} {text: bookmark-end} 3. 4b Put-Aways C o n d u c t o f P u t a w a y O p e r a t i o n s In putaway operations, errors can be

reduced by the adoption of on-line communication devices such as RDTs and by the adoption of bar coding.

To reduce the possibility of lost transactions, the storeman would do best to complete/scan in the transaction data at the time the material is being assembled for the putaway, rather than after the putting away has been accomplished. In putting away in a fixed location facility, errors will be rare since the presence in the location of the very same items that are being put away will help confirm validity. (To assist FIFO, when material is placed in the location, partial pallets and partial cases should be placed on top and/or in front, with labels facing the picking face.) P u t a w a y T r a n s a c t i o n P r o c e s s i n g Problems in putaway arise in variable (random) locations, however.

An obvious worry is that stock so placed under these systems, but