Systems analysis problems encountered during a large computer application

By Norman Smith*

The paper sets out to describe problems of systems design, control and communication encountered in the course of a large computer application.

Introduction

Pinchin Johnson and Associates Ltd. is a leading paint manufacturer in Britain, supplying paint to industry and for domestic use. The Company has a number of sales divisions each specializing in sales to particular industries. Six years ago the Company had a total of ten sales divisions. Each sales division was largely autonomous, operated under a separate name, had its own forms and stationery, employed its own representatives and had its own order, invoice and sales ledger departments. A number of warehouses served each region of the country.

At this time there were nine factories, each tending to specialize in the formulation and manufacture of paints, varnishes, and lacquers for individual industries such as motor vehicles, ships, aircraft and domestic appliances. However, specialization was not complete, and, in practice, selling divisions found it necessary to place orders on every factory from time to time, and factories to place orders on each other. The problems involved in controlling production were many and difficult of solution by a set of formal rules.

In 1961, the management recognized that with the development of second-generation computers there was increasing scope for introducing computer processing to the Company to take over existing procedures and to provide more sophisticated management control information. Pinchin Johnson is a large member firm of the Courtaulds group of companies; thus it was possible to call upon the assistance of the Group Management Services department in carrying out a computer feasibility study. Because of the complexities of production control it was agreed that the area of investigation should comprise the data processing requirements of the sales divisions and of the accounting administration at Head Office.

The feasibility investigation

Initially, a systems analyst from Management Services (the writer) was asked to undertake a short feasibility survey to determine the specific functions within which more detailed investigations should be concentrated and the approximate savings in personnel which might result from the adoption of computer processing techniques.

Procedures were examined in outline at several sales divisions and discussions were held with a number of executives in the sales divisions and the accounting administration. Procedures varied slightly from division to division, but those set out in (a) to (e) below are typical of those in relation to home trade orders.

(a) Preparation of works orders

Customers' orders were received in the order department by letter, printed order form or notes of telephone conversations. Since they usually contained insufficient detail for factory purposes, they were vetted by order clerks who inserted customer codes, product codes and descriptive detail about customers' special requirements from each customer's file. The customers' orders were then sent to the order typists.

Order typists prepared factory order masters from the vetted customers' orders, and from these masters sets of production order copies were duplicated. The number of copies varied for different factories and types of product, but one copy was always sent to the costs department at Head Office, where *ad hoc* analyses were carried out as required.

The production copies of the factory orders were sent to the designated factories, and one copy of each order was filed in the order department. The order masters were sent to the invoice departments.

(*N.B.* In the above procedure the point at which credit control took place varied widely from division to division. However, each existing customer had a credit limit against which new orders were checked, and normal procedures were followed for establishing the credit status of new customers.)

(b) Preparation of invoices

When despatches were made against orders, despatch note copies of the factory orders were returned to the sales division. A further editing process now took place. Goods were supplied at the price ruling at the date of despatch. Therefore, it was necessary to check that the prices stated on the orders were still the current prices. Also, sometimes the exact products ordered could not be supplied because of changes in technical specifications of products, and equivalents were substituted. After this editing had been carried out, the despatch notes were passed to the invoice department.

Within the invoice department, comptometer operators extended each item on the despatch notes and entered the extensions and total values. Then they sent the

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despatch notes with the corresponding order masters back to the order typists, who typed the amounts onto the masters, marked order items not despatched "to follow", and ran off invoice copies which they returned with the order masters back to the invoice department.

The invoice department checked the typing and distributed the invoice copies.

(c) Posting the sales ledger

The sales ledger invoice copies were used as the posting media to each division's sales ledger.

Mechanized book-keeping was in operation in most divisions, with the ledger card as a copy of a "flimsy" statement. Statements were sent out monthly. Remittances were reconciled with the ledger but because of the volume of transactions and the fact that a single remittance might be made to cover receipts from several sales divisions, reconciliation was difficult and represented a continual problem for the Company.

(d) Preparation of sales statistics

The sales statistics invoice copies were sent to the sales statistics department at Head Office. The work of this Department was centred round a Powers–Samas 65 column punched-card installation, which included an electronic multiplying punch.

A card was punched and verified for every invoice item and the statistical analyses set out in **Table 1** were prepared at each month end, showing quantity sold, sales value and cost value for every line printed.

Table 1

Sales Statistics Tabulations

ANALYSIS NO.	MAJOR SORT	INTERMEDIATE SORT	MINOR SORTS
I	Sales Area	Representative	—
II	Factory of Origin	Product Code	—
III	Representative	Product Code	—
IV	Customers Account No.	Sales Area	Trade Group
V	Trade Group	Sales Area	—

The overall totals on each analysis were built up to show the cumulative position for the current quarter and for the year to date.

A staff of about a dozen operators under a supervisor carried out this work, hampered to some extent because none of the invoice formats in use was laid out in such a way as to maximize punching speeds.

(e) Warehouse orders

Procedures in respect of orders supplied from the Company's warehouses from finished stock were con-

siderably simpler than the above but in every case invoice copies were sent to the division's sales ledger department and to the sales statistics department.

Export orders

For export orders much more complicated documentation was required. In view of this and the low volume of orders involved it was decided to exclude the procedures of the Export Division from further investigation.

Feasibility analysis

Over eighty personnel were engaged in the preparation of orders, invoices, the sales ledger and sales statistics.

Investigation was carried no further at the feasibility stage. Effort was now directed towards determining the form which a computer application might take. It was obvious that the earlier the stage at which a computer could be utilized the greater would be the advantages. The first suggestion was therefore that basic data about each order should be coded and punched into cards so that the computer could produce the factory order set. The principal objection to this was that the production function regarded a daily computer run to produce factory documentation as essential whereas the economics of computer operation indicated that weekly processing was desirable. The additional set-up costs involved in daily runs were sufficient to outweigh the advantages of using a computer to produce factory orders.

The next possibility was to prepare order masters on typewriters producing punched paper tape as a by-product. These tapes could be matched with similar tapes produced at the despatch stage, and the combined information used by a computer to produce invoices. The snags hinged round the fact that in order to identify the item despatched much of the information to be punched into the order tape would have to be repeated, and thus the advantage of punching this information at the order stage would be lost.

In view of this, it was decided that the starting point for the application would be the stage at which under the existing procedures despatch notes edited by the sales divisions were passed to invoice departments. This had the advantages of simplicity. It would not be necessary to instruct staff in many locations in a completely new system. The documentation might change, but the procedures prior to invoicing would be much the same.

The scheme envisaged at the end of the feasibility study was as follows. At the Company's sales statistics department at Head Office, all the 65 column card punches, verifiers, the sorter, the tabulator and the electronic multiplying punch would be replaced by 80 column card punches and verifiers. Despatch notes would be sent to the installation daily from all the Company's despatch points. A card would be punched for each item despatched, and also for each credit

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allowed on returns, for amendments to master files and for ledger postings. Weekly, these cards would be sent to a computer service bureau. The computer would assemble and print invoices, post invoice totals to a sales ledger posting file and each invoice item to a sales statistics file. There would be a weekly ledger posting run, and statements would be printed monthly. Sales would be analysed in different degrees of depth at weekly, monthly and quarterly intervals. It was envisaged that the existing punch and verifier operators could cope with the volume of input providing that document layouts were improved. The gross savings in staff were estimated at 42, and it was anticipated that the computer could provide far more management control information than would be available from a manual system.

The decision on feasibility

The feasibility study described above was carried out in December 1961 and January 1962. The conclusions reached were discussed at length with the Company's management, who considered that more detailed investigations were justified by the potential clerical savings, irrespective of the possible value of more sophisticated control data. The management did not ignore the value of such data, but obviously management are more easily persuaded of the benefits of computer applications that yield high clerical savings which can be measured in monetary terms, than when the benefits take the form of intangibles the value of which is a matter of judgment, even when the latter may be of greater importance in the long run.

The systems survey

It was now necessary to proceed to systems analysis which would culminate in the preparation of a detailed computer systems specification.

Pinchin Johnson wished to play an active part in designing the system. They did not want to be put in the position of having to accept or reject a system designed by outsiders. Therefore, they took a decision to appoint one of their senior accounting executives to act as Company "watch-dog" over the application. This decision probably contributed more to the success of subsequent work than any other single factor. The executive concerned was Chief Accountant of a division of the Company and Cost Controller for the Group. It was agreed that investigation would be undertaken by Management Services who now attached a second systems analyst to the project. It was also agreed that contacts within the Company would be arranged initially by the accounting executive appointed to look after the application. He would make decisions on points of principle and detail as they arose in the course of the investigation, either on his own initiative, or after consulting his colleagues. This simplified the task of investigation considerably. One of the major problems in designing new systems is usually to reconcile the

incompatible requirements of a number of executives. In this case, in effect the Company resolved these difficulties internally. Individual executives might frequently present the systems analysts with divergent requirements, but if these could not quickly be resolved, there was a senior executive charged with the responsibility of reaching agreement among his colleagues. Thus the main task of the systems analysts was to design a system capable of meeting the Company's requirements. As a result, investigation proceeded faster than would normally have been expected. Procedures were examined in detail in four typical sales divisions, and discussions were held with executives throughout the Company on their requirements as regards computer output. By the end of April 1962, it was possible to prepare a systems specification which the top management could use as a basis for making a final decision on whether to proceed. The main features of the system proposed are outlined in the following sections.

(a) Preparation of works orders

It had been agreed that the application should start at the stage where despatches were invoiced. This would involve punching details of each despatch as shown on the despatch note. However, the latter was a copy of the works order master. Thus, it was necessary to design a new works order set which could be used throughout the Company's divisions, and which was laid out to maximize punching speeds for data recorded on the despatch note copy. A suitable revised order master and works order set was designed and agreed by the Company. Because of the simplification achieved an incidental benefit was that the costs of works paperwork was reduced. To facilitate computer processing the Company agreed to introduce a new product code, and to revise its customer coding method. These codes were to appear on the works order master and hence on the despatch note which would then contain all the variable data needed by a computer to produce an invoice.

(b) Preparation of invoices—punching

As stated previously, the intention was that despatch notes and credit notes should be sent in daily batches from each factory and warehouse to the Company's Head Office where details would be punched at the re-equipped punched-card installation. Since this department would no longer produce sales statistics its title would be changed: (it is referred to hereafter as the punched card department).

Bearing in mind the volumes of data to be processed it was thought that efficient operation of the system would depend on early detection of invalid data. Hence, each batch would be pre-listed on sales volume, product price rate, and three other quantity fields by a comptometer operator at the despatch point. Product and customer codes would have check digits attached. On receipt by the punched-card installation each batch

would be briefly examined for obvious errors, and details of the batch would be entered in a control book. Then cards would be punched and verified for each item despatched. (**Table 2** illustrates the amount of detail which could be required.)

Table 2

Summary of Despatch/Credit Card Layout

FIELD DESCRIPTION	COLUMNS	NO. OF COLUMNS
Batch number	1–2	2
Card class	3	1
Entry type	4	1
Debit or credit	5	1
Factory order number	6–12	7
Date of despatch/receipt	13–16	4
Despatch point code	17–18	2
Account number	19–24	6
Delivery address code	25–26	2
*Extra invoice set signal	27	1
*Discount code rate	28–29	2
*Representative number	30–32	3
*End use code	33–34	2
Product code	35–43	9
Number of packages	44–46	3
Package size	47–51	5
Quantity	52–55	4
*Number of returnable drums	56–57	2
*Charge per returnable drum	58–61	4
Method of extension required	62	1
Product price rate	63–67	5
*Sterling field	68–74	7
*Carriage charge	75–78	4
Blank columns	79–80	2

Fields marked with an asterisk (*) were optional to be punched if required.

Finally, the cards for each batch of despatch notes would be passed through a non-printing tabulator, to show the accumulated totals for the punched card fields corresponding to the despatch note prelisted batch totals. During the weekly input run the computer would again accumulate these fields to ensure that no cards were lost prior to the run. Similar controls were designed for other forms of input.

(c) Preparation of invoices—processing

As a preliminary, the two master files would be updated. Then despatch (and credit) cards would be read by the computer, edited, and written to magnetic tape. Editing would include verifying check digits on product and customer codes, and calculating totals for control fields on the cards. These totals would be printed for comparison by the operator with the list of batch totals submitted by the punched card department. The latter check would ensure that all cards were input, and that none were omitted or read twice.

Next, the input magnetic tape of valid card images would be sorted to product code order and passed against a product master file (see **Table 3**). The data stored in this file against the matched product codes would be incorporated in the input records.

Table 3

Data Stored in Product Master File

1. Product code (including product group code).
2. Product description.
3. Product standard cost.
4. Unit of measure code (indicating whether product sold in gallons, pounds, yards, etc.).

Thereafter, these input records would be sorted to customer code order and passed against the customer master file (see **Table 4**). Here relevant information would be incorporated in the record and invoices assembled.

Table 4

Data Stored in Customer Master File

1. Customer's account number.
2. Name and invoice address.
3. Name and statement address (if different from above).
4. Delivery address codes and delivery names and addresses (up to 100).
5. First two letters of customer's surname (for sorting statistical analyses).
6. Representative number. ⎰ But these could be over-
7. End use code. ⎱ ridden by data punched into the Despatch Card.
8. Settlement terms.
9. Computer credit limit.
10. A signal to identify accounts selected for regular statistical output.
11. A signal to identify accounts for which an extra invoice set required.

Items would be extended in accordance with one of four methods, charges would be made for containers where appropriate, and invoices would be totalled, trade discounts being calculated (if applicable) from a look-up table. The Company had agreed to the use of a common stationery for all sales divisions. Two print image tapes would be created and from these invoices could be printed two-up.

Two points are worth noting about the above brief summary of the invoicing routine.

Firstly, at the start of the investigation, it was widely supposed that invoice extension was a matter of multiplying quantity times price. This did not prove to be the case. Sales were made in a number of units of measure, of which the most common were liquid (gallons and pints) and weights (lbs. and oz.). The unit of sale varied (e.g. per package, per pint) and a variety of pro-

visions had to be made for special products and special circumstances. Invoicing is often not as easy an application as it looks at first glance.

Secondly, it took more time to reach agreement that invoice stationery should be standardized throughout the Company than it did to reach a similar decision on works order documentation. This is not surprising. The effects on the customer of changes in stationery have to be carefully considered by those responsible for sales. It was in dealing with this sort of difficulty that the advantage of having a senior executive of the Company specifically responsible for the application was very marked. It is much easier for a Company executive to assess the merits of the arguments advanced and to argue out a decision with his colleagues than it is for any outsider.

(d) The sales ledger

At the end of the invoicing routines the computer would post invoice (and credit note) totals to a ledger posting file. Thus most of the data required to post the sales ledger was already on magnetic tape at this stage. However, details of cash postings and journal vouchers would still have to be sent to the punched card department for punching. Controls followed a similar pattern to those for despatch notes.

It was also planned to incorporate a reconciliation scheme into the system. This would be essential if the computer records of sales ledger transactions were not to expand continuously, resulting in ever increasing processing times. The intention was to give sales ledger clerks the facility to specify either (i) that all items should be reconciled up to a given date; (ii) that stated items were to be reconciled.

Internal reconciliation of the ledger by the computer was considered but for various reasons was rejected as unworkable for the Company, though it was recognized that this was the ideal solution to the problem of reconciliation.

There was to be a weekly ledger posting run during which all transactions were to be posted to the appropriate ledger accounts, and reconciliations made as specified. All customers were to be assigned computer credit limits (lower than the real credit limits) and it was planned that each week the computer would print a list of customers whose computer credit limits had been exceeded. This would call the attention of sales ledger staff to these customers before their real credit limits were exceeded, and it would thus facilitate credit control.

At the end of each month, statements would be printed two-up, with separate statements for "goods" and "container" accounts. A copy of each statement would form the sales ledger. In addition to statements the computer would also print a list of all items outstanding on each account. That is, it would print a break-down of opening balances. It was thought that this would assist reconciliation of the ledger considerably, since it would render unnecessary any reference to previous months' transactions in the ledger.

(e) Preparation of sales statistics

The range of sales statistical tabulations which could be produced by the 65 column punched-card installation was limited because of the time required to sort and tabulate. With a computer those times could be shortened considerably and thus it was possible to provide far more information. Statistics produced by the punched-card installation were also limited in regard to calculation because of the restricted facilities available. Moreover, output had to be in customer account number, product number, or other code order. It was not possible to print descriptive information. When it was made clear to executives that they could specify virtually any form of analysis of sales, an almost insatiable demand for more and better statistics was revealed. The senior accounting executive of the Company watching over the application had to resolve the conflicting requirements, and the systems analysts were forced to stress continuously the difficulties which executives would face in absorbing all the information requested. Finally, the Company decided that nine statistical analyses of sales were necessary.

In these analyses, selling margins replaced cost values. The 65 column equipment had been restricted to calculating the latter, but the only purpose was to permit subsequent calculation of margins. It was also possible to show the year-to-date cumulative build up for every line printed. This was a considerable step forward as compared to the statistics produced by the punched-card installation. Two completely new analyses related to sales by package size. It was thought that these would assist both the sales divisions and factories in future planning.

The Company were insistent that in analyses in which customers names were output, then these should be in alphabetic order. (This was a considerable advance over the punched-card tabulations in which customers were printed in account number order.) It was argued that a completely alphabetic sort by the computer would be impractical, and a compromise was reached. All customer output would be presorted on two letters to be designated by the Company (usually the first two letters of the surname). Within this, the order would be account number.

Another new facility offered was that of selecting important customers for regular statistical output. A moveable signal identified these customers. The intention was that sales in respect of other customers would be grouped. The significance of this facility was that it would reduce the total volume of statistics to be presented to executives for their appraisal.

Consideration of the proposals

Top management considered the report in which these proposals were made, and accepted them. A major factor in this decision was undoubtedly that the proposals embodied the requirements specified by the Company's own executives, agreed by them in advance. It was not

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a report setting out what an outside body thought the Company's requirements should be. The benefits both in clerical savings and in the provision of better control information were also accepted by the Company's executives. The scheme had the tremendous initial advantage of being "their" scheme.

Programming

Group Management Services was asked to assist in implementing the scheme. Two computer service bureaux were asked to quote for the work and the quotation of the Honeywell London Service Bureau was accepted. It was agreed that their H 800 computer should be used and that programs should be written in FACT language by the Service Bureau programming staff. FACT was a relatively new language in this country at that time and it was believed that only by making use of Honeywell's own knowledge could the writing of the programs in a reasonable time be guaranteed. During program writing Company staff asked for many minor additions to computer processing requirements. In the writer's experience this is a cross which has to be borne by computer staff. As executives continue to think about their requirements, and their knowledge of the capabilities of computers grows, so they request changes which test the ingenuity and patience of the systems analysts and programmers. When many such changes are made the whole application is put in danger if the overall consequences are not carefully thought out and minuted by the systems analysts to all concerned. A successful application has to be controlled very closely by the systems analysts responsible for design and implementation. Slapdash methods are likely to result in an application which never gets beyond the parallel running stage.

Programming for the application was completed within seven months by a team of Honeywell programmers. Concurrent with programming the Company was making preparations for the change-over. The information about products and customers to be stored in the computer's master files was transcribed on to standard input forms. Punched-card service bureaux were employed in converting this information to punched cards. All the documentation was prepared and staff instructed in the revised procedures. Arrangements were made for a parallel run in respect of invoicing and sales ledger with one of the Company's sales divisions. If this was successful, the relevant work of this division would be taken over by the computer in the following month. Thereafter, at least one division would transfer its invoicing and sales ledger to the computer each month until the take over was completed.

Parallel running

The parallel run began exactly one year after the start of the feasibility study. Daily, the selected sales division sent a batch of invoices to the punched-card installation. In addition to the normal controls, these invoices were pre-listed on total value. After each weekly run, the computer produced invoices were compared with those produced by the sales division and reconciled on total value. The principle was that the total value of the sales division's invoices should be equal to the total value of the computer-produced invoices plus the value of the despatches rejected by the computer because of failure to meet editing conditions. Several residual errors in the invoicing programs were detected as a result of this exercise. At the end of the month a similar exercise was carried out to reconcile the sales division ledger with the computer statements. Now the vital decision was taken to "drop off" the manual system in respect of this selected sales division. From this point on each month new divisions transferred their work to the computer. Within six months the scheme was completely operational.

Benefits achieved

The Company's sales ledger was centralized on its Head Office, with a considerable saving in personnel overall. Invoicing had ceased to exist as divisions transferred this function to the computer. It had not proved necessary to expand the punched-card installation staff. All the forecast savings in staff had not been made at this stage because of the enormous volume of work involved in the changeover. However, once the new system was working efficiently it was possible to concentrate on achieving savings. In practice there was no redundancy, the problem being solved by staff transfers and natural wastage.

Systems re-study

After a few months, when it was established that the computer system would operate smoothly, plans were made to transfer the work to a Honeywell 400 computer newly installed by the parent Company, Courtaulds Ltd., to replace their NCR 405 computer. The opportunity was taken to restudy the system in the light of experience. The principal improvements decided upon were as follows.

(a) Controls

There was a need to improve controls. Those upon input were satisfactory except that if the single totals printed out by the computer as the sums of the controlled fields on the punched cards did not agree with the pre-listed totals it was difficult to pinpoint errors. Therefore, it was decided that the computer should accumulate and print individual batch totals. Output controls had originally been negligible. Experience proved this to be a hazard. Therefore it was decided that the computer should repeat the accumulation of quantities in controlled fields and print out the totals at the end of each pass and also at the stage of creating print image tapes.

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(b) Account numbering

Some customers had accounts with several sales divisions. Under the system operating prior to the use of a computer these customers had received separate statements for each sales division. This procedure had been incorporated into the original computer system. As the change-over was to be gradual no other procedure could be followed. However, once the sales ledger was centralised, there was a clear need for these customers to receive one statement in respect of all their dealings with the Company. Therefore, it was agreed that the computer master customer file should be split into two files, a master invoice file and a master ledger file (see **Tables 5** and **6**).

Table 5

Date Stored in Master Invoice File

Customer number.
Ledger account number.
Invoice name and address.
Delivery address code.   } up to 100.
Delivery name and address.

Representative's code number.   (these could be over-
End-use code.   ridden by despatch
                                 card).

Extra invoices signal.
First two letters of surname.
Regular statistical output signal.

Table 6

Data Stored in Master Ledger File

Ledger account number.
Statement name and address.
Credit limit.
Settlement terms.
First two letters of surname.
All unreconciled ledger postings.

As part of the invoicing run, during the pass against the customer file, the appropriate ledger account number would be incorporated in each input record. On the subsequent ledger posting run, invoices would be posted to this ledger account number. This new facility would make it possible not only to despatch to a large number of delivery points, and to invoice any number of branch offices, but also to post these invoices to any other selected ledger accounts.

(c) Reconciliation

As stated previously, the original concept had been that the computer would store all ledger postings until they were reconciled, and that a cash receipt would reconcile either all items prior to a certain date or selected items. In practice this system imposed too heavy a burden on the sales ledger clerks. In the revised system it was proposed that a cash receipt would pay:

     (i) the balance as at a certain date;
or (ii) the balance as at a certain date; *plus* indicated items;
or (iii) the balance as at a certain date; *less* indicated items;
or (iv) selected items, listed individually;
or (v) all items except those listed individually.

(d) Invoice and statement layout

Because the H400 computer printer printed across 120 print positions as compared to the 160 provided by the Honeywell Service Bureau H800 computer, two-up printing of invoices and statements ceased to be feasible. Therefore, these documents were redesigned to minimize the additional printing time which would result. The H800 invoices had, *on average*, 12 lines and were printed two-up. However, since the parallel invoices very often did not contain an equal number of product items in practice two invoices required about 15 printer lines. The redesigned H400 invoice had, on average, 10 lines, so two invoices required 20 printer lines. The above ignores the time required to skip over unprinted portions of the invoices, therefore it understates the comparative advantage of two-up printing, though only slightly.

(e) Sales statistics

Finally, the sales statistical output was revised. Experience of using a computer had demonstrated not only the range of statistics which could be obtained, but also the volume of paper which a high speed printer could generate. Attempts were made to reduce the frequency of the larger returns and to improve the effectiveness of the returns generally. In particular, quantities despatched, which might be expressed in a variety of units of measure were converted to a standard unit of measure by the computer during the statistical runs.

Some difficulty had been experienced by the Company in deciding which were the first two letters of each customers surname. In practice, the decision was usually taken by junior clerks and this could result in statistics appearing in tabulations at the most improbable points in the alphabet. For instance, British Railways, Southern Region, might be allocated "SO" or "SR" rather than "BR", while Western Region, BR, might be allocated the correct letters. A.B. Metals might be allocated "AB" and XY Metals might be allocated "ME". The Company decided to continue with this method of sequencing output, because it avoids the necessity to cross-reference account number to Company name, but the expedient has definite drawbacks.

Re-programming

Programming did not now become the responsibility of the Group Management Services systems analysts associated with the project, although operation and

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programming of the computer was a function of this department. The reason was historical.

The first computer installed by Courtaulds Ltd., in 1958, was a NCR 405, programmed in machine code.

In view of the complexities of programming the decision was taken at the time that programming and systems analysis were to be separate functions. This is not to say that systems analysts were necessarily ignorant of programming, but programming courses in their case were intended to provide an "appreciation" of programming rather than to serve as a foundation on which to build programming skills. Broadly, this division had been maintained since, except for isolated projects where the systems analyst had previously been a programmer.

The application was, therefore, programmed by a team of Management Services programmers led by the Chief Programmer. The latter wrote the invoicing programs, and another senior programmer wrote the sales ledger and file update and transfer programs. Two more junior programmers also worked on the team, one writing all the sale statistical programs, while the other wrote all the input editing programs. Numerous minor alterations to the programs were requested by executives of Pinchin Johnson and Associates, Ltd., as programming proceeded. Thus, co-ordination of the project was again a major responsibility. A written specification had again been prepared, and all interested parties had a copy of this. All amendments were discussed and minuted, so that the specifications could be kept up to date. Even so, misunderstandings still arose, as they must when any communication of ideas takes place. However, it is not suggested that the whole task of programming should be undertaken by the systems analyst. In this case programming occupied four men for nine months (i.e. three man years). The work would not have been completed to this day if pro-

gramming had been an additional responsibility of the systems analyst.

The second parallel run

In one sense, the second parallel run presented a greater problem than the first in that the work had to be transferred as a whole. It was not possible to conduct a parallel run on a pilot basis. On the other hand, because the transfer was to be made between computers, reconciliation of output was easier. In fact, the parallel run proceeded smoothly, and after a month the decision was made to accept the accuracy of the new programs and "go live" on the new machine.

Updating of standard costs

Up to the present time no further changes have been made to this application. However, once confidence had been acquired by the Company in the capabilities of computers (following the original implementation of the application), other applications were designed, among them a cost accounting application. This would require an article in itself to describe, but the major feature is that the computer is used to calculate standard product costs. Master files are held for intermediate and final products, broken down into their material constituents. Standard material costs are stored in a look-up file, and regular runs are undertaken to cost new products. When standard material costs are changed, the master files are updated and new standard product costs calculated for all products. By passing the master final product cost file maintained for this application against the master product file maintained for the invoicing application, it is possible to update the standard product costs stored in each record of the latter in a single run. Thus, real integration of data processing functions has been achieved.

Correspondence (*continued from p.* 229)

frequently been confused with programming, whereas the two bear much the same relationship as ledger-posting to accountancy and multiplication tables to mathematics.

The distinction between programming and analysis is primarily that the former is a technology relevant to the whole field of computer usage whilst the latter is confined to more specific areas of application. The analyst, therefore, is a specialist in one of many fields, for example, mathematics, production control, message switching or management information. His main skill is related to the discovery of required inputs and outputs, the essential constraints of the problem and the other procedures surrounding the computer implementation. In these terms, the title Systems Analyst is singularly inappropriate.

The exact role of these different skills should not, in a well-run installation, be of great importance. A complex computer project necessarily demands a team effort. Such a team should be made up of a competent programmer, an

analyst familiar with this type of work, and someone already engaged within the application. The team should direct the project from start to finish, further staff being assigned to them as necessary, and once formed they should learn from each other and act in concert.

Although we come from widely different disciplines, we are today proud to describe ourselves as professional programmers. Programming can be regarded as the realization of the potential which distinguishes computers from all other machines. We hope that youngsters entering this field will not be diverted by the inflated titles currently so fashionable and that many of them will take the time to find out the scope and career possibilities to be found in programming.

<div align="right">

Yours faithfully,

A. d'Agapeyeff
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