

## **Technology Audit**

The MD and other directors of Burke Engineering have now identified the company's core competence and its non core components. As the MD you propose to now concentrate on the design and manufacture of valve systems, and feel that tool cutting, physical distribution, security, catering, cleaning, data processing, and legal services should be subcontracted initially. There may be other areas of activity that could also be subcontracted and you will need to continually review the issue. You are now continuing your policy of allocating resources in a concentrated and systematic fashion to those areas which will yield the best returns for the company you are determined to apply a new technique that you learnt in the United States, that of the technology audit.

The technology audit concentrates on work analysis in each department to define areas where new technology could substantially improve performance either in terms of productivity, (volume of output per employee) speed of response, motivation of employees (by the removal of repetitive and non specialised tasks), quality of output or safety of operation. Following a review of the subcontracting operations, it will enable you as MD to translate the operations that remain within the company into specific work units, and from that identify the types of individuals that will be appropriate for the new company direction and the level of skills that they will require. In common with subcontracting, it is an operational area that will need to be continually reviewed in relation to the needs of the business plan.

You have employed Carron Associates a firm specialising in this type of work to complete a report on the current Burke Engineering operation. Their approach has been to analyse each of the areas of the company by a combination of work study assessment (evaluating the time each particular task takes), diaries produced by employees in which they list all the various actions carried out during the day, and the modelling of the effects of new technology upon the performance of each of these main activities.

Carron Associates has divided its report into the main areas of the company and suggested technology that could be used to substantially improve the effectiveness of each section. You as J Franklin have to decide on the level of investment in each area, both (in relation to the overall cost benefits, but also on the effects that the changes are likely to have on the employees that will have to implement and use the new systems.

### **Design**

At present, as the background to the business clearly shows, all the design work is currently carried out manually. With the change towards a concentration on valve design and manufacture it is likely that not only will the volume of work in the design department increase but so will its complexity. Forecasts of work demand suggest that under the new plan total hours in developing designs will increase fourfold, the amount of time checking such designs will double as will the time involved in various reports both to clients and within the company. The details of the timing implications are listed in Table 14 in Appendix A.

Carron Associates have suggested that the introduction of computer aided design in this area of the organisation would have significant effects on reducing the amount of time involved in the design process, while at the same time substantially improving the quality of the finished designs. Computer aided design allowed the operator to explore how each component fitted together on the screen, to rotate the valve in any direction, and to

analyse the complexities of the manufacturing process that it would require. Much of the copying work that was done in the department was also considered to be extremely boring and this would be effectively eliminated with new technology.

A further time reduction would be achieved by removing the need to check the finished designs, and dealing with problems both within and outside the company, effectively removing the need to produce complex reports. The system could be introduced on its own (a so called 'stand alone' system) without the need to integrate it with other units, though if this integration occurred it would substantially improve the effectiveness of the entire operation.

Carron Associates estimated that the costs of providing the necessary hardware and software would be around € 25,000. It would take five weeks training to convert the more expert staff to the new system, or around 1,000 hours, in total, for the likely number of staff working within the design department. Central to the continuing and effective use of this new technology would be frequent meetings to maintain quality. You are committed to quality circles as a method of improving both quality and overall motivation.

## **Research**

Analysis of the research department shows that the section has been increasingly used to provide support for the design department. In the new business plan, this commitment will no longer be necessary. But the research department will still need to be involved in a limited way with the impact of new concepts upon existing designs. However use of the design department computer aided design would significantly improve the quality of the decisions that were taken and the speed at which they were implemented.

This new technology would also help in the preparation of reports. Because you as J Franklin are determined that the company will be a leader in the market, the business plan calls for a major increase in the amount of time that the department will devote to analysing data and market opportunities. Currently this is done manually with staff checking patents and journals for possible new market directions. Carron Associates have suggested that by linking up with a range of commercial databases, information would be substantially improved in quality with a considerable decrease in search times.

The costs of installing the hardware and software were estimated to be around € 10,000, and this again would be on a stand alone basis. Another major area of increase in work will be the testing of new materials and concepts. Currently very little is done in this area, and with a manual process the new plans would require an additional 30,000 hours work to ensure that the valve units met the higher quality standards that were necessary in the international market.

The installation of flexible manufacturing systems in the assembly areas would considerably reduce the time required for such testing, and enable the company to produce test units rapidly and to much higher quality. Flexible manufacturing (FMS) would enable the production plant to turn out small quantities of product without a high manual labour content as the machine would be under computer control. The installation of this equipment would be expensive. It would involve the purchase of a minicomputer costing around € 200,000 and a whole range of new lathes and milling machines, costing an additional € 150,000.

A further advantage of these systems would be to make this part of the shop-floor much

safer than it had been previously. The one fatal accident that had occurred in the company over the past five years had happened in this area, as had two of the serious injuries. The expenditure would be shared with the machining and assembly areas, and would provide a wide range of additional cost savings in these parts of the production process.

Though this FMS system could be installed in isolation in the production plant it would be much more sensible to combine the design and manufacture into a single computer aided design, computer aided manufacturing facility (CAD/CAM). The research department would also require substantially increased training in the new techniques, especially in decision making on new product development.

Here the additional time that would be involved could be substantially reduced by the use of expert systems as a training aid. Carron Associates listed two such expert systems in use in engineering companies which could be made purchased for € 10,000. Finally, you are determined that the research department should be more involved in day to day contact with the shop floor. This will mean the research department taking part in a greater number of quality circle meetings and discussions. The impact of all these changes and the time implications are listed in Table 14 in Appendix A.

## Foundry

Your early information was that the foundry is the most modern part of the Burke Engineering plant. You expect that Carron Associates will not be able to suggest many improvements in this area of the company. This is in fact the case. Though the amount of work for the foundry will substantially increase as a result of the changes in the business plan for casting and checking, there are few improvements that can currently be made to improve the productivity of the foundry.

You are concerned that the foundry is still a dangerous environment with two serious incidents over the past five years. The only worthwhile means of improving safety would be to install robotic arms to handle the molten metal. This would cost around € 50,000 and would also have the effect of reducing speed and productivity in the area.

Carron Associates do however inform you that the new generation of automatic foundries will be available within the next three years, and investment in this could substantially change the pattern of working within this area. You are committed as elsewhere to increasing the amount of involvement of foundry staff in the decision making process and to increase the level of training that each individual receives. All of these have the effect of increasing the overall level of working hours within the foundry.

The only improvement that Carron Associates could suggest was in the reduction of the existing dead time within the foundry while staff were waiting for material or tools. The application of a production scheduling programme would make this part of the factory and others function far more effectively. The cost of this would be relatively insignificant, and could be accessed by terminals throughout the factory.

The overall cost of terminal installation and the creation of a network throughout the factory is estimated at € 80,000. This network would be used by many departments and will be referred to in other analyses. The overall impact of the various changes upon the total hours worked in the foundry is included in Table 14 in Appendix A.

## Machining

With the change to valve manufacture it is likely that there will be a dramatic increase in all phases of machining from coarse to fine. Overall the plan calls for a doubling of working hours in the machine shop, though the introduction of production scheduling would reduce the overall figure by cutting the amount of dead time a current feature of the machine shop. The introduction of flexible manufacturing would reduce this by 90 per cent. As the quality of the work would be substantially improved, time spent on quality checks would disappear.

Carron Associates also found that much of the work in this area was considered to be boring and repetitive and the introduction of new technology was likely to substantially reduce this work component. In common with other areas of the company a greater time spent on training and meetings would be a necessary part of the new plan. The details of the current level of activity and likely future changes are included in table 14 in Appendix A.

### **Assembly**

Carron Associates also identified substantial potential improvements in the assembly process. They proposed that one of the major problem area that of component assembly should be subcontracted, while the introduction of suitable computer controlled devices could substantially improve the efficiency of the component installation. As a result of the greater quality that would be achieved, these changes would reduce the need for checking and quality control time. This equipment would cost around € 30,000 to install and the operatives would require around twenty days training to be fully functional. Such equipment would be separate from the computer aided manufacturing systems in the rest of the factory, and would therefore be another 'stand alone' system.

Assembly was considered to be the most boring and tedious part of the shop-floor work, and employees were particularly keen on seeing any change that would reduce the amount of time that had to be spent in this area. The increase in training and meetings would be to an extent offset by the introduction of production scheduling. The impact of new technology on the planned hours worked in the assembly section are listed in Table 14 in Appendix A.

### **Inspection**

The improved quality achieved by the investment in flexible manufacturing systems would significantly decrease final inspection. With the increased level of valve manufacture it was forecast that the need for packaging would increase three or fourfold. Investment in automatic packaging equipment could significantly reduce this at a cost of € 45,000, a system that could also be introduced separately from the rest of the proposed equipment. Increases in training and meetings would also have the effect of increasing overall demands in this area and are listed in table 14 in Appendix A.

### **Maintenance**

The impact of the new manufacturing systems would also have an important effect in reducing the level of routine maintenance. The likely changes are shown in Table 14 in Appendix A.

### **Warehouse**

Currently three individuals were employed moving product within the production area. The vast percentage of this time could be replaced by the installation of conveyor systems to move valves within the factory. Carron Associates estimated that remodelling the production process in this way and installing conveyor systems would cost in the region of € 50,000. This system could be independent of all other proposed changes.

Within the warehouse many things could be improved by the use of relevant technology. First, manual stacking could be replaced by the use of fork lift trucks with the installation of racks in the main body of the warehouse. This would substantially reduce the labour content for a relatively minor cost of € 20,000. Further automating the warehouse was possible but this would involve a much greater investment of around € 250,000. The use of fork lift trucks would also substantially increase the speed of the loading process.

Currently the manual stock control system was very labour intensive, and could be significantly improved by the introduction of a computerised stock control system which could link up with the finance and production departments to provide continual and up to date stock and despatch data. The cost of the programme was relatively low at € 1,500. This programme would also effectively remove the need to produce reports, a time consuming process under the current regime. The use of the production scheduling system introduced in the manufacturing plant would also reduce the amount of dead time within the warehouse.

These new systems would require substantial increase in the amount of training. This could be reduced by the use of one of the existing expert systems for warehouse management which could be purchased for around € 5,000. In common with other areas of the company, you are determined that the warehouse staff should be more closely involved in the running of the company and have insisted that time is laid aside for their involvement in quality control discussions. The impact of all the changes forecast in the business plan are listed in Table 14 in Appendix A.

## **Finance**

As Burke Engineering MD, you have already decided that the data processing of the company accounts and pay should be subcontracted. Carron Associates also have investigated the remaining activities of the finance department and reported that there could be major improvements in most areas, even though the work load envisaged by the plan is likely to significantly increase with the greater number of customers the firm will have.

Substantial improvements were possible in invoicing, payments, reports, data collection and analysis (including costing function which had been previously a joint responsibility with the production department), and the preparation of reports. Various integrated systems could be introduced as part of the network system with an additional software cost of € 5,000.

In common with other areas of the company, these changes would involve the need for substantial training and this combined with the involvement of the finance department in work progress meetings would mean that the pattern of hours worked would be very different in the future. Details of which are listed in Table 14 in Appendix A.

## **Secretarial**

As MD you have been worried by the large numbers of secretaries in the administration area, and are determined in the long term to encourage management to handle the bulk of their own correspondence by the use of their own keyboard systems. As an initial step Carron Associates have shown that there could be substantial improvements in the use of secretarial time by creating a central typing and filing pool available to all. Management would use tape machines for all dictation which would then be completed on word processors linked to the central system, enabling any corrections to be simply and rapidly completed. The introduction of this system would be relatively inexpensive at € 10,000.

Installation of auto dialling telephones for all key executives would reduce the need for secretarial involvement in this area leaving two girls on the switchboard to handle all non routine telephone calls. The likely forecast demands on the secretarial services and the impact of new technology are listed in Table 14 in Appendix A.

### **Technical Support**

This has been identified in the business plan as one of the key areas in which Burke Engineering is weak. With the concentration of the company in the valve sector the work load for technical support will rise. Technical support engineers will be making much longer journeys as a result of the increase in the amount of business that the company is likely to be developing in Europe.

The introduction of personal computers with journey planning software can improve journey efficiency by an estimated 10 per cent. Such personal computers will also be important in producing reports and the requirements for follow up action. The appropriate software could be used to significantly speed the completion of reports which could be transferred back to the company using the telephone system. Such software would substantially reduce the amount of time that was needed for the completion of reports or sending the material back to the company. The overall cost of providing such support would be around € 10,000.

In the technical support department there was also likely be a substantial increase in the amount of time spent on site, to advise, install and modify valves to particular customer requirements. Such installations and service problems could be improved by one of a number of software systems and associated diagnostic equipment.

Carron Associates estimated that the total investment in this area would be around € 20,000 which would lead to a 50 percent reduction in the time required to find faults and revise systems. As with the other departments, you consider that it is important that the technical support department is more involved in the day to day running of the company and that training is substantially increased, though this would mean an expansion of the work load. It was possible that the introduction of expert systems could have the effect of reducing the training component; Carron Associates (estimated that an investment of € 15,000 could reduce training times by 20 per cent.

As technical engineers were moving from one clearly defined site to another it was not thought appropriate to provide them with portable telephones, but the use of a telephone paging system would probably be cost effective at around € 40 per employee per year. The implications of the new business plan and the effects of new technology are all included in Table 14 in Appendix A.

## **Sales**

The substantial forecast increase in customer numbers suggested that the amount of time required for selling would rise substantially. The most important component of this would be a major growth in the amount of sales force travel time. The introduction of personal computers with journey planning programmes could improve the efficiency in this area by around 10 per cent. As customer numbers rise, so too will the required level of preparation needed for sales calls.

The new information system that the company was developing would improve sales calls efficiency, should the company be prepared to spend an additional 8,000 in creating the appropriate database management system for the sales force. Such a system would also have the effect of improving the amount of time that was spent in sales callage by defining more accurately the objectives of each sales call.

Carron Associates suggested that the introduction of video display systems could substantially improve the quality of the sales presentation at relatively low cost, around € 5,000 for the entire sales force. The reporting system proposed for the technical support team could also be introduced for the sales force to speed orders and completion of reports. Modifying the system designed for the technical support department for sales representatives would only cost around € 1,500, whereas a totally new system would have approximately the same cost as that proposed for the technical support department, around € 10,000.

Providing the sales force with portable telephones would further potentially improve their efficiency. However the fixed costs per line and the cost of calls would both be high, with an average expected cost per sales representative of € 1,200 per annum. A lower cost alternative of a telephone paging system would only cost around 40 per annum, per employee. The proposed changes in the work load of the sales force and the effects of new technology are listed in table 14 in Appendix A.

## **Marketing**

The work load of the Marketing Department was also likely to increase as a result of the proposed company specialisation in valves. There would be a considerable increase in the amount of travel, research and the preparation of reports. Again, the introduction of new technology could substantially improve efficiency. The amount of time spent on the preparation of reports would also be substantially reduced by the use of terminals and appropriate software. All major items of information that were going to a wide audience, throughout the company and to outside contacts, could be produced on a desk top publishing system. Customer relationship management software would also help to identify trends within customers and manage customer development.

The cost of the relevant hardware and software to support the Marketing Department in this area was estimated at € 20,000. The effectiveness of the Marketing Department could also be improved by using journey planning systems, which were already under consideration for the Sales and Technical Support departments, and by providing access to the on line databases purchased for the Research Department. To enable the department to use this support equipment effectively, there (would have to be an investment in training and in common with the other departments, you consider that involving the Marketing Department in company planning and discussion meetings will be essential.

## **Management**

With the changes in the business plan, you foresee that management in the new organisation would need to be far more involved in planning and control, and less involved in nonessential meetings and interoffice communication. The use of expert systems would significantly reduce the amount of time involved in planning; such software would be available for around € 12,000. Additional software would improve the control over finances and project completion. Most of this would not be an additional cost over the proposed existing networked system, though it would require a further € 3,000 for additional terminals.

Communication within the office could be significantly increased by the introduction of electronic mail, which would further reduce the demand on secretarial time, helping towards the long term aim of removing secretaries. This and more sophisticated telephone systems with preset numbers and re dialling facilities combined with an answer phone facility would, for an estimated € 2,500, enable the management team to receive messages at any time of the day or night. Video conferencing facilities would reduce the need for some meetings at a cost of € 1.500 for the three computers involved with access to high speed lines.

As management would be spending a considerable amount of time away from their desks, you must decide whether to invest in portable telephones, or follow the decision that had been provisionally made for the sales force and Technical Support Department of providing telephone paging systems. The use of word-processing and desk top publishing systems would greatly increase the effectiveness of report and document production these facilities would be part of other departments requirements and, therefore, would not necessarily involve additional cost.

## **Action**

What technology should you as J Franklin introduce? How can you assess the priorities within the organisation?