

12 Project management

Introduction

12.1. In this chapter we first describe AEA's approach to project management (paragraphs 12.2 to 12.4) and then go on to review AEA's new corporate guidelines (paragraphs 12.5 to 12.10). We then turn to the identification of project failures and successes (paragraphs 12.11 to 12.19), the training of project managers (paragraphs 12.20 and 12.21), project software (paragraphs 12.22 to 12.25), progress reporting and commercial aspects (paragraphs 12.26 to 12.32) and the rewards for project managers (paragraph 12.33). Our conclusions and recommendations are provided at paragraphs 12.34 to 12.41.

AEA's approach to project management

12.2. The work that AEA does, for its customers, as research, or in its own capital investment programme, is largely done in the form of projects. AEA told us that, having successfully managed a significant number of major projects during the earlier years of its existence, the focus of AEA's activities during the late 1970s and 1980s moved towards open-ended research projects (eg to develop civil nuclear power). Some aspects of the project management discipline were given a lower priority because of the open-ended nature of work, with the result that certain skills in management of defined projects were lost. This resulted during the 1980s in some project 'failures', as well as a large number of substantial and successfully managed projects. The lessons learned from these experiences were incorporated into a major programme to introduce a culture favourable to success in project management and to institute appropriate control procedures, practices and management tools.

12.3. We asked AEA to illustrate the scale of the projects it managed. The results are shown in Table 12.1. At the end of March 1991 the value of work-in-progress in AEA was £24.6 million, split amongst approximately 1,900 projects. During the year ended March 1991 approximately 4,400 projects were completed, with a total value of £452.6 million.

TABLE 12.1 AEA: project work-in-progress and turnover, 1990/91*

Business	Work-in-progress at 31.3.91		Year ended 31.3.91	
	Value of projects £m	Number of projects	Value of projects completed £m	Number of projects completed
FS	2.0	124	14.4	272
D&R	3.9	193	31.2	448
RS	4.1	236	140.9	631
FUS	0.8	40	28.0	59
InTec	7.0	626	31.2	1,246
E&E	1.3	327	21.3	415
S&R	1.0	98	12.1	199
APS	1.0	96	10.4	178
AEAE	0.6	27	4.6	97
Corporate Business Services	-	6	0.7	17
Total businesses	21.7	1,773	294.8	3,562
Culham/Harwell	0.7	68	42.5	314
Dounreay	0.1	11	16.6	40
Risley/Windscale	0.4	59	18.5	405
Winfrith	0.1	15	35.0	96
CHQ	0.7	4	12.3	11
Corporate Treasury	0.9	1	32.9	5
Total sites	2.9	158	157.8	871
Total	24.6	1,931	452.6	4,433

Source: AEA.

*The numbers and values in this table have been derived from a number of sources within AEA and are intended only to give a broad indication of the scale of operations.

12.4. AEA acknowledged that during the last few years its success in project management and control had been variable. There had been successes and failures. AEA told us that there was a need for a more clearly defined framework of the basic requirements for successful project management. This would enable it to judge successes and failures against an agreed set of criteria. Consequently a Corporate Change Leader for Project Management had been appointed to produce a set of corporate guidelines laying down standard procedures and controls. These corporate guidelines had been reviewed by an outside consultant as well as by senior managers across AEA and were due to be issued and implemented by April 1992.

Corporate guidelines

12.5. AEA's corporate guidelines are to be issued in the form of a Requirements and Guidelines document comprising two main sections: a requirements section, which lays down standards (see paragraph 12.6) and covers the key factors in project management, and a section which gives check-lists of best practice, risk assessment, QA and contractor selection. The latter section also includes job descriptions and reporting procedures. The requirements section is intended to be mandatory for businesses and sites. Implementation of the Requirements and Guidelines is to be achieved by issuing them together with business-specific directives generated by individual businesses. If necessary, a third tier of project-specific documentation will be issued by business Chief Executives.

Standards for project management

12.6. The following standard requirements for a project are laid down in the Requirements and Guidelines:

- the establishment of a clear specification of the customer's requirements and the scope, time and cost of a project prior to contractual commitment;
- the definition of the criteria for project completion;
- an assessment of risk and its subsequent management;
- the fitness of the solutions offered, particularly those related to safety, for the customer's purpose;
- the clear definition of contractual arrangements with both the customer and subcontractors;
- compliance with the formal sanctioning/approval routes for undertaking projects;
- the formal appointment of a suitably qualified and experienced project manager with delegated accountability and authority;
- appropriate allocation of staff to the project;
- the definition of project-specific procedures and QA systems/programmes; and
- the clear definition and implementation of the project control functions.

Key staff

12.7. The Requirements and Guidelines recommend that each project should have a number of key staff: a customer representative who interacts with the client; a project manager who is appointed and overseen by a supervising manager; and a proposal manager.

12.8. The role of the proposal manager is to prepare the proposal; preferably he should also be the project manager designate. Where the project is very large and may involve, for example, overseas negotiations

foreign financing and/or high risks in unknown markets, drawing up the proposal itself may become a project in its own right. Appendix 12.1 sets out the duties of a proposal manager.

12.9. The responsibility for the success of the project is vested in the project manager and it is his duty to execute the project to cost and time and to the customer's satisfaction. Appendix 12.2 sets out the duties of a project manager.

12.10. Where large projects are multi-disciplinary a function manager may also be appointed to provide expertise in a particular part of the project. The project manager himself may, on large projects, require a small support team under his direct control.

Project failures and successes

12.11. AEA has formal procedures for assessing completed projects; these are described in Chapter 11. AEA has identified, using these assessment procedures, those areas of weakness leading to project failures, in particular inadequate project management. The weaknesses found relate to one or more of the following:

- an inadequate or changing customer specification;
- an inadequate response to the invitation to tender so that not all the points were addressed;
- partial failure to link together cost estimates, time-scales, risk management and contingency;
- a failure at the launch of a project to establish the full range of control procedures, especially in terms of a work breakdown structure;
- inappropriate appointment of project managers who were not fully trained in the discipline of project management;
- poorly defined responsibilities and accountabilities of project managers;
- failure to apply established QA procedures including contractor assessment; and
- (in the case of owned projects) poor investment appraisal.

12.12. AEA quoted, as examples, four projects in the last decade that were not delivered to time, cost or specification. They were:

- the COMPASS fusion experiment (1983-87);
- the Winfrith Radwaste Treatment Plant (1983-89);
- the Pluto AGR Test Loop (1981-89); and
- the Winfrith Treated Radwaste Store (1987) and Quality Assurance Unit.

These examples highlighted particular issues which are discussed in paragraphs 12.13 to 12.16. AEA told us that specific actions had been taken to prevent similar problems occurring.

12.13. The COMPASS fusion experiment suffered from escalating costs and an extended time-scale. It was essential that the design kept abreast of world-wide trends. This resulted in increasingly severe requirements for the performance of the potential machine. The project management, especially in the support areas, was inadequate to cope with these changing requirements and the additional need to interface with a complex financing system. Further problems were caused by the use of a remote (Italian) contractor for coil assemblies, the manufacture of which appeared to have been beyond the contractor's capability.

12.14. The Winfrith Radwaste Treatment Plant suffered cost and time overruns. It was found that project management was inadequate to cope with a number of problems including:

- changes in the regulatory environment;
- inadequate control and instrumentation design resources; and
- changes in site labour policy.

Accountabilities should have been more clearly defined and the staff should have been more experienced.

12.15. Delays in the PLUTO AGR Test Loop resulted in the customers cancelling the project before useful results were obtained. Cost and time overruns were again due to poor project management reflected in:

- imprecise specification;
- inadequate attention being paid to changing safety demands;
- underestimation of the technical difficulties involved in accommodating increasingly severe specification demands; and
- inadequate resourcing in the design areas.

12.16. Although also associated with waste handling at Winfrith, the problems of the Winfrith Treated Radwaste Store were entirely different from those described in paragraph 12.14. The project management was again inadequate but on this occasion the main failures were:

- the risks were not adequately assessed at the outset;
- the responsibilities of the project manager were not clearly defined;
- there was an unfortunate choice of main and subcontractors whose performance was very poor;
- there was an inappropriate choice of contract strategy; and
- there was a lack of control of technical functions.

12.17. Five examples of project failures in major revenue and capital schemes due to inadequate investment appraisal are described in Chapter 11. Current practice on such schemes is to appoint as project manager someone from the business or site department which will be the ultimate user of the facility. The project manager and the clients' representative will occasionally be one and the same.

12.18. AEA also quoted several examples of successful projects to illustrate common success factors. The examples quoted were:

- (Alpha) beta gamma waste management at Harwell Building 462 (1987);
- Atomic Weapons Establishments contractorisation bid (1990);
- Continuous Wave Deuterium Demonstrator (1988);
- Dungeness-B Single Channel Trip project (1989);
- Snorre Tension Leg Platform Inspection (1990);
- Dounreay Cementation Plant (1983-89); and
- Spinning Cylinder project (1983-86).

12.19. AEA told us that the skill, experience and determination of the project manager, together with his use of IT for cost control and progress monitoring, were the outstanding common factors.

Training

12.20. AEA's past experience raised the issue of training in project management. The number of project managers required is very large (as can be seen from Table 12.1). Projects vary in size from tens of thousands to several million pounds and the skills of the manager need to be matched to the job. AEA told us that, typically, a project manager would be in the middle-management grades, PMG 1/2. Opportunities for staff to manage the largest projects would be relatively rare. We asked AEA to provide us with an illustration of the levels of training achieved in AEA. Table 12.2 indicates that out of about 800 staff who managed a project in 1990/91 about 300 had received some formal training in the previous three years.

TABLE 12.2 Number and recent formal training of project managers*

	<i>Number employed at 31 October 1991†</i>			<i>Number trained at 31 October 1991‡</i>		
	<i>Senior</i>	<i>Mid</i>	<i>Junior</i>	<i>Intro</i>	<i>Advanced</i>	<i>Other</i>
FS	7	22	10	19	-	1
D&R	23	64	57	50	3	-
RS	15	65	100	44	28	1
FUS	2	6	3	2	-	-
InTec	10	65	44	47	-	1
E&E§	10	100	50	10	-	-
S&R	3	16	19	3	-	6
APS	3	28	15	16	1	-
AEAE	7	8	10	22	1	1
CHQ/CDD	6	-	-	9	3	-
Culham/Harwell	-	2	4	1	-	-
Dounreay	3	2	5	26	2	6
Risley/Windscale	4	13	13	14	1	3
Winfrith	3	7	2	10	-	-
Total	96	398	332	273	39	19

Source: AEA.

*Most project managers are responsible for more than one project.

†Senior = +£1m; Middle = £100,000-£1m; Junior = £50,000-£100,000.

‡The first two columns show the number of people attending the new three-day basic and four-day advanced project management courses. These include a number of staff in some areas not described as 'project managers' as such. The third column covers some other formal project training in the years concerned, but the information may not be complete.

§The total for project managers in E&E includes 80 from ETSU. The turnover associated with these project managers is not part of the overall E&E turnover.

12.21. As part of AEA's management training and development programme, two formal training programmes have so far been designed with the aid of external providers, tailored to meet AEA's specific needs. The basic project management programme lasts three days and has so far been attended by nearly 275 staff. The advanced programme lasts four days and has to date been attended by 39 staff. The AEAE business told us that it expected to send all its potential project managers of PMG 3 grade (about 150 staff) on the basic course and about a further 50 staff on the advanced course. This programme should take about three years to complete. Both courses are given by consultants, with an introduction by AEA's Corporate Change Leader for Project Management. Further off-the-job programmes covering more specialist aspects of project management are in preparation.

Project management software

12.22. The ACOST report recommended that 'the potential for the use of common software, techniques and environment for project management should be investigated'. Prior to the ACOST report a preliminary study into which project management software package would be most appropriate, in particular to D&R, was undertaken at the request of the Corporate Change Leader for Project Management.

12.23. Part of the FIS specification (see Chapter 5) was that there should be an interface with specific project management software packages; the criterion for choosing appropriate packages was that each package had to be used on more than one site and by more than one business. Artemis, Hoskyns PMW and Microsoft Project for Windows were identified, together with a need to interface spreadsheets which were Lotus-compatible.

12.24. However, when FIS is fully operational as from April 1992, the arrangements will permit a variety of project management software packages to be linked to FIS. The responsibility for developing the correct interface with FIS rest with the businesses. AEA told us that, for a variety of project management-related reasons, the flexibility offered by the file transfer arrangement from FIS to the various project management packages was the best solution for AEA. As part of the new framework for project management, AEA indicated that it intended to limit the number of software packages to four or five.

12.25. Frequently AEA is supplying only part of a customer project and is required to use the same software as the customer. The present financial systems provide information later than project managers require and consequently duplicate systems for recording financial information are common; this in turn leads to many problems of reconciliation.

Project progress reports

12.26. Businesses use a variety of ways to report progress on individual projects and how well the business is doing as a whole. Achievement of milestones is a common method of control, as illustrated in Table 12.3. This method, as employed in the RS business, shows the performance on HSE levy projects in total. Further subdivisions, by technical area, by business and by individual project manager, are also available. This is supported by more detailed schedules, reporting on particular milestones. (See also Chapter 16.)

TABLE 12.3 Milestone summary for HSE levy projects in 1990/91

	AGR	GNSR	PWR
Total number	67	77	228
% met on time*	61	45	63
% met within 3 months	73	56	73
% met in year	73	66	83
% met by 1st quarter 1991/92	75	82	82

Source: AEA.

*Met on time has been interpreted as met within one month of the specification.

Note: AGR = advanced gas-cooled reactor; GNSR = general nuclear safety research; PWR = pressurised water reactor.

12.27. The AEAE business, which is organised on a project basis, employs a method more orientated towards assessing a project manager. Quarterly reviews of a project manager's performance are carried out by the executive responsible for projects. Reports are prepared showing the number of projects under review and an overall success rate is measured by the number of 'exceptions', ie errors or delays, to the projects under review. Table 12.4 shows an extract from a managerial review. These reports are aggregated to give a success rate for the whole business as shown in Table 12.5.

TABLE 12.4 AEA: project review summary

Project value £'000	Number of projects		Exceptions number		Comments
	Direct	Indirect	Direct	Indirect	
Over 200	1		1		Supernoah Rig (PFR 1929)
50-200	2		1		D2670 New Fuel Store
Up to 50	<u>49</u>	<u>37</u>	<u>1</u>	<u>2</u>	
Total	52	37	3	2	
Grand total	89		5		Overall success rate 94%

Source: AEA.

Note: Exceptions = errors or delays-see paragraph 12.27; direct = projects managed within the Project Team; indirect = projects managed within the Technical Executive.

TABLE 12.5 AEA: quarterly progress report

Project value £'000	Number of projects		Exceptions number		Comments
	Direct	Indirect	Direct	Indirect	
Over 200	33	3	7	0	Success rate 80%
50-200	43	2	6	0	Success rate 87%
Up to 50	<u>474</u>	<u>91</u>	<u>9</u>	<u>5</u>	Success rate 98%
Total	550	96	22	5	
Grand total	646		27		Overall success rate 96%

Source: AEA.

Note: Exceptions = errors or delays-see paragraph 12.27; direct = projects managed within the Project Team; indirect = projects managed within the Technical Executive.

12.28. Recommended in the Requirements and Guidelines is a method called 'earned value'. In summary this is a method of measuring performance on a project at all points during its lifetime on cost grounds and as to timeliness. A more detailed description is provided in Appendix 12.3 and an example in graphic form at Appendix 12.4. (See Chapter 16 for a fuller discussion of AEA's project performance.)

12.29. AEA told us that it regarded the monitoring of a project as primarily the responsibility of the businesses and their project managers. There had been examples of project failures as a result of too-close supervision of the project manager and his consequent abrogation of responsibility. On the other hand large and important projects were sometimes the subject of direct reporting to the AEA Chief Executive. AEA was not planning to monitor projects at Board level.

Commercial aspects

12.30. One of the main criticisms levelled at AEA has been its lack of a commercial approach toward getting paid for its work, as evidenced by complaints of slow invoicing and contract administration defects. AEA acknowledged that there were problems in these areas. The split of responsibility between businesses triggering off the invoicing cycle and sites having responsibility for invoice production had led, on occasion, to delays.

12.31. The present financial system runs behind the project management reports and project managers find it necessary to devise their own methods of producing up-to-date cost information on project reports. APS told us, for example, that on one project a parallel set of time records had to be kept to satisfy the client's needs for a timely report. AEA stated that the new FIS would enable project managers to interrogate the system on a daily basis, and it expected that all information would be available six working days after an accounting period end.

12.32. AEA considered that full responsibility for invoice production, despatch and payment should rest with the project manager. At present this happens only in the APS business. The project manager's terms of reference in the first draft of the corporate guidelines referred only to 'initiating the arrangements for payment'; however, during the course of our inquiry AEA agreed that this was insufficiently precise and confirmed that the Requirements and Guidelines as issued would recommend that the project manager should be responsible for ensuring that payment was received. It is planned that the invoice-writing package within FIS will be used extensively, since AEA invoices are by the nature of projects very detailed and disparate in form. AEA considered that the interface between the software for project management and that for invoicing should preferably be made at the proposal stage of a project.

Rewards for project managers

12.33. It is clearly in the interests of AEA that its projects are successful in satisfying both the customers' demands and its own required levels of profit. The financial incentive for a project manager to do well is a favourable annual salary review which, however, may take place up to a year after project completion. AEA told us that it intended to define the rewards for project managers much more rigorously and would make sure that bonuses were tied to successful projects.

Conclusions and recommendations

12.34. AEA recognises that its success in managing projects has been variable and it recently appointed a manager with responsibility for producing corporate guidelines laying down standard procedures and controls. The resulting Requirements and Guidelines document is comprehensive and represents a sound basis for improved project management. Successful project management is crucial to AEA's operations. We conclude that AEA has attached insufficient importance to project management in the past.

12.35. We recommend that AEA should issue and implement its Requirements and Guidelines document, as planned, by April 1992.

12.36. AEA's current practice for capital expenditure projects is to appoint a project manager who is a member of the business or site department which will be the ultimate user of the project. The project manager and the client's representative will occasionally be one and the same. In such cases the person who will be accountable for the scheme's meeting its objectives and for its completion to time and cost is also the person responsible for monitoring the achievement of the client's objectives. However, a project manager who is a member of the business or site department is less likely to have either the technical expertise or the experience associated with successful construction and engineering projects. We conclude that it is prudent to ensure that there is a separation of client and project management and advisable that project managers have the technical expertise and experience necessary for successful management of capital expenditure projects.

12.37. We recommend that, from September 1992, with respect to new capital expenditure projects of more than £3 million (the level above which separate sanction is needed from DEn) the project manager should be independent of the client's representative and should have the technical expertise and experience necessary for the successful management of capital expenditure projects.

12.38. The history of site-based systems development, coupled with businesses' independent needs for a variety of project management software, has led to a multiplicity of systems. AEA's approach is to allow businesses to develop their own interfaces to FIS from their own choice of software package. This could result in unnecessarily increasing the requirement for training and in reduced flexibility in the transfer of project managers between businesses.

12.39. We conclude that the large number of different project management software systems in use in AEA results in some loss of efficiency and effective management by making overall programme management more difficult, impeding the transfer of project managers to other parts of AEA and unnecessarily increasing the requirement for training.

12.40. We recommend that, by July 1992, AEA should review the available project management software systems and that the number of similar packages in use should be reduced except where systems are specifically required by customers.

12.41. AEA acknowledged that invoicing delays occurred and that there were weaknesses in contract administration. Under the new business regime closer attention will be paid to the need for better contract administration and prompter invoicing because the project manager will become responsible. Although the draft terms of reference for a project manager originally referred only to 'initiating the arrangements for payment', during the course of our inquiry AEA agreed that this was insufficiently precise and confirmed that the Requirements and Guidelines would make the project manager responsible for ensuring that payment was received.