Costing Networked Learning

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ABSTRACT
Costing methodologies applied to distance education in the 1970s pre-dated the development of online education and ALNs. Recently attention has turned to the costing of learning networks, though as yet little progress has been made. This paper draws on previous work in the field to develop an approach to costing learning networks.

KEY WORDS
Distance Education Costs, Distance Education Economics, Costing Online Education

I. INTRODUCTION

Until the late 1950s there was relatively little interest in the costs of education, and virtually none in the costs of educational technology. This failure reflected the fact that innovation in teaching methods was a largely marginal activity: as one early analyst put it, 'education's technology, by and large, has made surprisingly little progress beyond the handicraft stage' [1 (p.7)]. However, the rising demand for and escalating costs of education led to attempts within the newly developing sub-discipline of the economics of education to quantify both the efficiency of public expenditure on education, and the economic benefits of providing it [2, 3]. Educational technology came to be seen as a way of improving the efficiency of education through productivity increases. As a result analysts began to research into the costing of educational technology and the actual costs of distance education systems (for a fuller account of this work, see [4]).

Much of the early work undertaken under the auspices of the World Bank, UNESCO and USAID focused particularly on the costs and cost structures of educational broadcasting projects [5, 6, 7]. This work culminated in Orivel's widely-accepted costing methodology [8]. Within the UK Fielden and Pearson [9], under the auspices of the then Council for Educational Technology, focused on the costs of educational technology in general – and this approach was continued in the work of a group of experts – Ken Dixon, David Lancaster, Philip Pearson and Greville Rumble – convened by the (renamed) National Council of Educational Technology [10]. Meanwhile Rumble, drawing on his experience at the Open University, developed an approach to costing [11, 12, 13] that was shaped by his soft systems-based analysis of distance education [14 (pp. 61-2); 12 (pp. 15-17)]. His work on the analysis of costs in dual mode systems, undertaken at Deakin University [12] was later developed by that institution [15]. Rumble [16] summarises his position.

Recently a new generation of academics, interested in the impact of online learning on the costs of education, have begun to tread much the same path to study both the costs of particular online

systems, and to evolve their own understanding of a methodology by which to approach the task of costing such systems [17, 18, 19]. In addition, case studies of the costs of online learning often indicate to a greater or lesser extent the methodology underpinning their work (see, for example, [20, 21]).

II. COSTING ONLINE LEARNING

Several people have attempted to provide a framework for costing online learning. Boucher [18] identified the cost categories involved in ITATL (Information Technology-Assisted Teaching and Learning) projects as follows: courseware development costs; incremental capital and recurrent equipment costs; (marginal) costs associated with provision of appropriate resources; infrastructural costs; maintenance costs; user support costs; costs of adoption; access costs; security costs; replacement costs; institutional overheads; spillover costs (i.e. the costs and benefits that accrue to agents other than those originally involved in the decision to undertake an investment); and other miscellaneous costs not covered above.

Whalen and Wright [19, (pp. 28-9)] identify as capital costs the cost of the server platform and the costs of developing academic content including (1) instructional and media design, (2) the production of text, audio, video, graphics and photographs, (3) the development of authoring and delivery software or the cost of licensing commercial software, (4) the integration, modification, and testing of course content, (5) student and instructor training, and (6) course testing. Operational costs arise from the time students and instructors spend using the courses.

Bacsich et al [17, (p. 17)] reviewed the literature and, following a series of consultative meetings with users, suggested that there was 'general consensus' about the cost categories that should be used in analysing technology costs in education: these included human resource costs, production and delivery costs, development costs, equipment costs, consumables costs, facilities costs, and administration costs. They went on (p. 49) to define a three-stage course lifecycle model (planning and development, production and delivery, maintenance and evaluation), a stakeholder dimension (institution, student, staff), and an expenditure dimension (staff costs, depreciation, expenses, overheads) that would provide a framework for costing networked learning. Finally, their report (p. 58) offers as a conclusion to the task of costing online learning, a recipe for progress that draws on their own stakeholder dimension, the KPMG and JFC guidelines on management information used in the UK higher education sector [22], the US FLASLIGHT Project cost manual [23], classical costing work (from [16] and other unspecified sources), and further insights from their own study. Unfortunately, the outcome of this recipe remains unclear.

In an early analysis of the costs of computer-mediated communications on an Open University course, Rumble [20] used a number of dimensions to calculate the costs of computer-mediated communications (CMC), including:

- A functional or 'technical' analysis identifying the costs of conception, development and production; transmission/distribution; reception; and administration (p. 151)
- The categorisation of expenditure into human resource costs, the non-staff costs of developing producing and delivering CMC (including course materials costs, student costs, tutor costs, tuition costs, network and central computer costs, telephone connect time, and overhead administrative costs), capital equipment costs, and the costs of space (pp.151 ff.)
- Annualisation of capital equipment costs (p.160-61)
- Annualisation of the costs of system development, course materials, and reusable materials costs such as packaging used in the despatch of equipment to students, over the planned six year life of the course (pp. 159, 161)
- The use of a proxy (shadow) rental cost to cover the cost of space used by the project (p. 160)

- Analysis of all cost inputs by constituency (stakeholder) involved – viz., the Open University, the UK Government (which had put money directly into the scheme), students, and tutors (p. 162)

What follows is an attempt to bring these disparate trends together using the approach discussed in Rumble [16].

Functional analysis

The systems framework developed by Rumble from the late 1970s on identifies two major *operating systems* (i.e. systems which contribute directly to the input - conversion - output processes of the business) within any distance learning systems, together with two other systems – a high level system regulatory managing the business, and another system (the logistical system) supplying the business with the resources it needs to function [16, (pp. 5-6)].

The first operating system, the *materials operating subsystem*, involves the design, production, distribution (or delivery) and reception of course materials to support an agreed academic curriculum of awards and courses (i.e. it covers academic programme, curriculum and course planning as well as the design, production etc. of the course materials that make up the courses). The *design* process incorporates curriculum planning, market research, the selection of media, and the definition of teaching and assessment strategies. *Development* covers the authoring of texts and scripts, the development of audio-visual materials and the design and development of computer-based learning systems of various kinds. It also involves editing and graphic design. The end result is the master copy for each item of teaching and assessment materials. Also included here is the development of ancillary material for students and tutors (e.g. tutor notes). *Production* is the production of multiple copies of materials (texts, audio-cassettes, computer software disks, etc.) from the master copies. *Distribution* is the process that gets these copies to their point of use. It may involve their physical distribution by post or courier, broadcasting, or electronic transfer. *Reception* involves the receipt of the materials at their point of use (the home or a local resource centre) by their user (the learner and their tutors).

The second operating system is the *student operating subsystem.* This recruits and enrols students; registers them on courses of their choice; collects fees and other payments; allocates them to tutors, local centres and examination centres; provides them with on-going advice; arranges for their assessment; arranges tutorials and other contact; maintains students' records; organises graduation ceremonies; and provides transcripts and references.

The *logistical system* procures and replenishes the resources required by the system (for example, human resources, finance, buildings and equipment, information). It encompasses the personnel, estates and buildings, maintenance, purchasing, management information, and finance functions, and includes that subsystem that recruits, inducts, develops, pays and manages the tutors. The *regulatory system* plans and manages the overall system, relating operating activities to each other, logistical activities to operating activities, and the activities of the organisation as a whole to its environment. This should also cover institutional evaluation.

Categories of expenditure [see 16, (pp. 7-8)]

By convention (and based on the work of the UK National Council for Educational Technology group [10]), expenditure is analysed into four categories:

- human resources
- premises and accommodation
- equipment and furniture
- stocks, supplies, consumables and expenses

Human resources cover staff on the payroll. Managers may want to draw a distinction between particular categories of staff (for example, academics/teachers, administrators, and support staff). The costs covered include the costs of salaries (monthly-paid) and wages (weekly-paid) and *all* the other costs involved in hiring staff. These *on-costs* include insurance payments, employment taxes, and staff benefits, etc. Consultants on short-term contracts may be included here, particularly if they are paid on a salary or wage basis. If not, they are shown as an expense.

Premises and *accommodation* normally covers the purchase of a building; the costs of putting up a building; rents; rates (a tax levied on the occupation or ownership of land); insurance of buildings and their contents; utilities (heat, light, water, power), waste disposal, telephone, fax, etc. - *unless* these are charged to a particular department and treated as an expense; repairs and maintenance (direct labour plus materials, or outside contractor charges plus management and supervision costs); grounds and gardens; porters; security; cleaning; and management and supervision of all these activities.

Equipment and *furniture*. Equipment is a fixed asset (as is land, buildings and furniture). It covers plant, machinery and tools and is distinguished from consumables in that it is expected to have a useful life of more than one year. Equipment and furniture is usually held on an inventory (a list of all the items owned by the organisation). Inexpensive items of equipment (such as staplers and computer disks) which may have a useful life of more than a year are treated as consumables.

Stocks, *supplies*, *consumables* and *expenses.* Stocks, also called "inventory", are holdings of goods and raw materials and components, work in progress (i.e. partially completed stocks), or finished goods (i.e. completed manufactured goods held for sale). Course texts and cassettes are examples of stocks, as is paper prior to its use in books. Supplies is material used in production for which it is impossible or not worthwhile determining the amount attributable to each unit of production. Examples include cleaning materials and lubricants used for machinery, and ink for printing. Consumables are materials used by the organisation but not incorporated into its products (for example, office stationery). Expenses are the cost of something other than materials, supplies or labour. Examples include travel and postage costs.

Some of the costs identified here are revenue costs, others are capital costs. For the purpose of any comparative cost analysis, expenditure on capital needs to annualised or depreciated.

Revenue and capital costs [16, (pp. 42-50)]

Costs behave in different ways, and cost analysis need to take account of this. Revenue (or operating) costs are the costs that are spent on items that provide a benefit during the current accounting period – and hence are consumed. Salaries, wages, supplies, consumables and expenses all fall into this category. Capital is expenditure on something that provides a benefit that will last longer the current accounting period. The accounting period is normally a single year. Capital therefore encompasses expenditure on buying (not renting) buildings, furniture, and equipment, all of which have an expected life of greater than one year. Capital items last for several years, but their value is in effect 'consumed' year by year as the item wears out. Depreciation refers to the amount of the facility 'consumed' each year. Accountants have not settled on one specific approach to depreciation, not least because every approach in the end is arbitrary. When costing programmes, capital expenditure is usually spread across the expected life of the good: the expected life of a building may be taken to be 50 years (unless the building is a temporary one), that of furniture or a vehicle as 10 years, that of other equipment from 3 to 5 years. Clearly the length of life chosen reflects the expected rate of 'consumption'. However, depreciation is not the only cost involved here. The undepreciated portion of a capital good represents an investment in resources that *could* have been used in other ways. Economists argue that the opportunity cost of capital – that is, the forgone income opportunities that have been 'lost' by using the money to buy facilities – needs to be built into the annual costs of the system if comparisons between the costs of different projects are equitable. This is done through the annualisation factor:

$$a(r,n) = [r (1 + r)^n] / [(1 + r)^n - 1]$$

where $a(r,n)$ is the annualisation factor, n is the life of the capital equipment, and r is the prevailing rate of interest [see 16, (pp. 42-50)]. Any capital cost will therefore need to subject to the appropriate calculation. The value of two key factors in this calculation are based on ultimately subjective judgements. The first is the length of life of the capital good; the second is the interest rate chosen. Both factors will have a considerable effect on the annualised value of the goods written into the costs. Generally accountants will take a conservative approach in giving a value to these factors – that is, they will give a value that tends to over-estimate rather than underestimate the costs of capital.

A key issue for those costing educational technology projects that involve the development of learning materials and administrative or other systems is whether or not these costs should also be treated as capital costs. In practice the development of such outputs (a course, course-related software, a website, an administrative system) involves the consumption of resources – both capital and revenue – to develop a product or facility that has a useful life of from more than one year to perhaps many years. Should this be regarded as capital cost and annualised in the same way that buildings, furniture, and equipment is? Moreover, if a course or system is partially redeveloped at some stage in its life, these redevelopment costs may also have a lifetime (though a shorter one) to the end of the course. Should these costs also be taken into account?

There are clearly strong arguments for spreading such costs across the life of a course – particularly where the funds used to develop the systems are one-off moneys allocated for this purpose, rather than recurrent revenue expenditure on the salaries etc of staff who have been temporarily allocated to a project; and similar arguments can be used in respect of the development of systems supporting teaching and learning. On the whole I incline to the view that such costs should be annualised in order to make a fair comparison with the costs of conventional education, where many of the costs of putting on and gradually adapting a course are part of the recurring labour costs of presenting the course. Thus course materials written at the beginning of a course designed to have an expected life of 6 years would be annualised over 6 years, while materials written during the course life would be annualised over the remaining life of the course (e.g. materials written in year 3 for presentation in years 4 to 6 would be annualised over 3 years).

Variable, fixed, direct, and indirect or overhead costs [16, (pp. 21-42, 51-64)]

Resources (human resources, consumables, capital items, etc.) are used to produce outputs, or to sustain the overhead functions of a business. In distance education one can think of the outputs as being some kind of academic output from the materials operating sub-system, such as an academic programmes leading to an award (e.g. BA in Art History, MBA), a course (Strategic Management course), or some kind of course-related measure of output such as credit hours; items of learning materials (texts, CD-ROMs, etc.); a learning event (e.g. a tutorial); or, from the student operating sub-system, some kind of student-related output (a taught student, a graduate). There may also be intermediate outputs (the manuscript of a text, a trained tutor).

Expenditure that can be readily attached to an operating system output (however defined) can be regarded as a *direct cost* of that output. Thus the fee paid to a tutor for correcting an assignment is a direct cost of the assignment marking process but also a direct cost of the process of teaching/assessing students. Expenditure that cannot be readily attached to an operating system output is, in traditional management costing systems, treated as an *indirect cost*. Indirect costs are also often referred to as *overhead costs*. In traditional management costing approaches, it is the relationship between the expenditure and the operating system output, and the traceability of the cost to that

output, that determines whether something is a direct or an indirect cost. Thus while tutor fees may be readily attached to students, the salaries of those who manage tutor records, which cannot be readily attached to the output, may be regarded as an indirect cost. By definition, expenditure on supplies is never anything but an indirect cost.

In traditional management costing systems, the direct costs of an output are calculated, and then the indirect costs are allocated across the output to determine the 'cost' of the output. In manufacturing systems, this allocation is usually done on the basis of some kind of relatively easily measurable factor such as the direct labour hours consumed by a product, or the direct machine hours required to produce a product. Similar approaches take place in education when overheads are spread across some kind of output measure such as 'enrolled students'. However, as Johnson and Kaplan [24] showed, this seriously distorts the costs of products, as well as taking management attention away from the factors that cause overhead costs to arise. Activity Based Costing – which seeks to identify the drivers that push costs – was developed in part to correct for this problem.

The idea of direct costs is nevertheless a powerful one. Because the direct costs are attached to units of output (marked assignments, delivered tutorial hours, student course enrolments, etc.), it follows that increasing or decreasing the level of output will lead to an increase or decrease in that particular area of expenditure. Such expenditure is referred to as a *variable cost*. Costs that do not increase or decrease with the level of output are referred to as *fixed costs*. Fixed costs tend to be regarded as overhead costs. In fact of course, overheads may be fixed within a certain range (e.g. 50,000 to 70,000 students) – known as the *relevant range*. (See 16, (pp. 21-31)].

These concepts, and the relationship between them, are used extensively in modelling costs (notably in cost-volume analysis, and in the analysis of average costs and break-even analysis [16, (pp. 32-41)]. However, there are problems with such models, not least because the models work on the assumption that the direct costs of one particular output (say, a CD-ROM, or a student-course enrolment) will be the same as the direct cost of each other similar output – and, as noted above, this just is not the case.

Contributors and hidden costs

Finally, there is an important distinction between the costs of a system as a whole, and the costs reflected in a budget. Most institutions are only concerned with the costs that are reflected in their institutional budget. However, there may be many contributors to the costs of the system as a whole. In particular, there may be the costs:

- paid for by the institution's budget
- paid for directly by another institution (e.g. an aid agency, or agencies which bear costs providing resources that are 'free' or heavily subsidised)
- paid for by employees – for example, staff who provide their own tools, or tutor's who incur expenses that are not fully met
- paid for by the students (e.g. purchase of computers, textbooks, expenses for stationery, travel to tutorials, connection to the Internet, etc.).

The tendency to off-load costs from the institution to the student, and to 'forget' about inputs from other contributors, can seriously distort comparative cost studies. In any comparion between the costs of different approaches, non-institutional budget costs are an important element that need to be taken into account – which is why Rumble [20], in his study of the costs of introducing CMC at the Open University, specifically identified the resource inputs made by the University, the UK government, tutors (in unrecovered expenses), and students (in equipment and expenses), in order to derive a whole-system cost rather than an institutional cost for the project.

Where goods and facilities are provided 'free' or at a subsidised (i.e. non-commercial or non-market rate), there may be problems with making comparisons between the costs of one system and the costs of another. In such circumstances economists often make use of *shadow prices* to equalise the playing field.

Summary of approach

The basic building blocks of the analysis can now been drawn together. The costs of any system can be analysed as follows:

(a) *by expenditure category* (human resource or staff costs, premises and accommodation costs [with capital costs annualised], equipment and furniture costs [also with capital costs annualised], and stocks, supplies, consumables and expenses),

(b) *within functions* (materials operating subsystem, student operating subsystem, regulatory subsystem, logistical subsystem) and sub-functions (e.g. in respect of the materials operating subsystem, academic programme and course planning and the design, development (including redevelopment/updating), production, distribution (or delivery) and reception of course materials; in respect of the student subsystem, recruitment, enrolment, course registration, collection of fees and other payments, student-tutor allocation, local centres and examination centre allocation, on-going advice, assessment and examination, arrangement of tutorials and other forms of contact, maintenance of records, organisation of graduation ceremonies, and provision of transcripts and references; in respect of the logistical subsystem, functions such as personnel, estates and buildings, maintenance, purchasing, finance, and management information; and in respect of the regulatory subsystem, high-level management, planning, and institutional evaluation),

(c) *and by contributor* (e.g. the institution's own budget, partner institutions' inputs, direct government inputs, aid agency inputs, staff inputs, and student inputs).

III. WHAT KINDS OF COSTS ARE INVOLVED?

If this provides a framework for the analysis of the costs of online learning, the next issue must be, exactly what kinds of costs are being identified, and how should they be treated? A problem here is that the way costs are treated in one system will for quite valid reasons not necessarily be true of another. Nevertheless, the exercise of identifying cost categories seems valuable at this stage – if only to help analysts involved in the costing of online learning identify costs within their own systems. In undertaking this exercise I have trawled through as many documents as I could identify (some of which are referenced in the paper), testing and adding to my own schema. What is clear from the documents is that different analysts:

- Have very different ideas as to what online learning actually is – varying from those who see it in terms of access to materials and to assessment schemes that favour multiple choice formats, to those who stress the communicative and constructivist nature of the dialogue that can occur between teacher and students, and among students.
- Lack agreement on the costs that should be taken into account. This is particularly the case with regards to overhead costs (i.e. the costs analysed here within the regulatory and logistics sub-systems) which are, in general, ignored.
- Employ very different labels or terms to describe what they are costing. This reflects jurisdictional and linguistic differences in terminology, local institutional practice, and personal preferences.
- Aggregate or disaggragate costs in different ways.
- Employ a variety of frameworks to give coherence to their work.

The analysis that follows (Annexes 1 - 4) look at the costs of online learning, using a functional approach as the primary thrust of the analysis, to distiguish between regulatory (Annex 1), logistical (Annex 2), materials (Annex 3), and student (Annex 4) subsystem costs. Within each of the tables that make up these annexes, column 1 of the table provides a brief description of the kind of expenditure involved, and this is then categorised (column 2) by expenditure type, viz. human resource (staff), buildings and accommodation, equipment and furniture, stocks, supplies, consumables and expenses. Finally, in column 3, there is a series of notes on the treatment of these costs and the source of contribution involved. The items of expenditure identified should be regarded as illustrative rather than definitive.

The way the information presented has been structured should also not be taken as definitive – it represents my approach – and individual analysts will wish to adapt it to their own purposes. Equally, while I have tried to be inclusive in my approach, I am conscious that there may be areas of cost that have not been identified either in sufficient detail, or at all. However, the attempt to be inclusive does raise important issues about the scope of any costing project – that is, just how wide a range of costs should be included? Within an institution, this revolves largely around issues to do with the treatment of overhead costs, but there are wider ramifications – notably, the contributions made by other stakeholders including students and staff (particularly pertinent if time and expenses are not fully reimbursed). Any study that seeks to compare the costs of one system with another (say, the costs of networked learning with traditional teaching, whether within a single institution or across institutions) should take a full-cost approach. Where this is not done, the comparison risks being misleading.

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Annex 1: Regulatory sub-system costs

Expenditure descriptor	Expenditure category	Comments
High level decision making to embark on online learning		
Decision-making	Staff (operating costs) – though consultants might be classed as an expense.	Overhead management time – often difficult to identify. Much depends on the context – the time spent enabling a group of enthusiasts to develop a project will be very different to that required to set up a new virtual institution. Organisation that have networked learning as just one aspect of their overall operations will need to identify what proportion of their overhead regulatory system relates to this side of the business. What seems clear is that the development of an information technology strategy that encompasses networked learning, and the management of change arising from a decision to adopt networked learning, will require considerable time and effort [25, 21] . Appointment of a project leader/researcher would be a direct cost of high level decision-making. The costs of consultants may be regarded as a human resource cost, or as an expense. The costing will need to take account of full staff costs (i.e. salary + benefits).
Expenses related to high level decision-making (e.g. costs of study tour to existing virtual universities)	Expenses/ consumables	Non-staff costs are probably difficult to trace where the decision is marginal to the ongoing concerns of an institution, but will be much more significant (and therefore easier to trace) if setting up a new institution or department.
Institutional evaluation/quality assurance		
Evaluation and Quality Assurance	Staff cost	Some analysts (e.g. [17]) build evaluation into the course lifecycle model. The approach here purposely separates evaluation from the operating sub-systems involved in designing, producing and delivering materials, and supporting students – in part because structurally these two subsystems produce distinct outputs of materials and 'leavers' (both successful students who graduate or unsuccessful ones who drop-out) that ultimately have to be related through a 'cause-effect' (course-study) relationship; and in part because taking evaluation out of the course subsystem underlines the need for its independence.
Expenses	Expenses/ consumables	E.g. survey costs, report production and dissemination costs, etc.

Annex 2: Logistics sub-system costs

Expenditure descriptor	Expenditure category	Comments
Web-site development costs		
Overall web site costs	General comment	A Gartner Group report suggests that e-commerce web sites are harder than expected to build, with costs of US$1 million on average – and that this cost is likely to increase by 25% per annum over the next 2 years. Of this cost, 79% is labour-related, 11% hardware, and 10% software [26]. Few cost studies of on-line learning appear to cost the development of the web site at anything like this level of expenditure. This must be a cost in the development of a virtual university. In mixed modes institutions, only part of these costs would now generally relate to the development of an online learning capability.
Web site development staffing costs (e.g.) - Internet specialists - Graphics/Internet designer	Staff cost (though consultants might be classified as an expense)	As suggested in the Gartner Group report [26], staff costs put into web site development can be significant.
Staff computers purchase Software purchase	Capital	Annualise: most commentators use a 5 year life but this may be optimistic. Leach and Smallen [27] found the typical annualisation period to be between 3 and 5 years. Software may well have an even shorter life.
Staff computers repair	Expense	
Web site implementation General comment	All cost categories	Generally the full costs of networked services are not as yet reflected in the annual operating budgets of organisations, nor are the costs of maintaining services (e.g., repairing desktop computers and printers) [28].
Domain name registration	Expense	
Learning Platform Software License Fees, and	Capital	Initial cost
Upgrade costs	Expense	Annual update at 10% [29]. Whalen and Wright [29] show wide variation in the cost of licenses from Canadian $3000-175,000
Network server	Equipment	Annualise over lifetime. Many commentators suggest a 5 year life but Leach and Smallen [27] found the typical annualisation period to be between 3 and 5 years. Actual system cost studies suggest wide variation in costs allowed for this.
Network costs – access to Internet	Expense	
Buildings and accommodation (main offices etc.)		
A range of costs involved here including: Purchase of land	Capital or expense	Capital costs will need to be annualised. The actual construction cost of a building may be known (but if in the past, should be brought up to present day values), or

Construction of a new building Purchase of an existing building Refurbishment cost of an existing building Rental of office accommodation		may be estimated (using the average building cost per square meter/foot for that type of building). The life-time of buildings is debatable but probably ranges from 5-10 years (temporary buildings) to 50 (permanent buildings). Smaller projects utilising a few rooms within an organisation might be charged a proportion of the total building costs, based on floor space as a proportion of all space. Alternatively a shadow rental cost could be used, based on commercial rents payable in the area. Generally space costs are driven by the number of staff working from an office complex, together with space for consultants' workstations; home-based workers will use their own space and in that sense not be part of the space calculation. However, any comparative study should put a cost on home office space.
Buildings and accommodation: running costs including rates (i.e. tax levied on the occupation or ownership of land); buildings and contents insurance; utilities (heat, light, water, power, waste disposal); telephone, fax, etc (rental and usage); repairs and maintenance (direct labour plus materials, or outside contractor charges plus management and supervision costs); grounds and gardens; porters; security; cleaning; management and supervision of all these activities	Stocks, Supplies, Consumables and Expenses	These items are either treated as a general overhead expense, *or* they are charged to particular departments and treated as a departmental expense. Where they are treated as a general overhead expense, some proxy measure may be used to allocate these costs out to departments (e.g. floor space measures, staffing levels) In systems where online learning is only part of the activity some kind of measure will need to be used to allocate a proportion of the general expenses to the online operation.
Intranet cost (main offices) Start-up capital costs (new PCs, network connections for PCs not currently networked, servers and server software, and software applications whether developed in-house or purchased	Capital	An intranet may exist but if not capital equipment costs will be incurred establishing it. Capital costs will need to be annualised. Leach and Smallen [27] found the typical annualisation period to be 5 to 6 years. However, some of the equipment will be subject to annual upgrading, repair, etc. Software applications are likely to have a shorter life and require upgrading more regularly.
Start-up costs (e.g. design consultancy costs, costs of in-house designers and technical support staff, training costs)	Revenue expenses and staff costs	
On-going revenue costs (e.g. editorial and design staff, technical personnel, etc., on-going consultancy, promotion, training, maintenance of bespoke applications)	Revenue staffing costs and expenses	

Furniture (main offices)		
Furniture	Capital	Distinguish between the cost of dedicated staff workstations (linked to staff numbers) and the costs of shared workstations/common furniture – spread across staff.
Local centre/training centre		
Accommodation	Expense (conceivably a capital cost)	Systems that provide telelearning centres will incur accommodation costs – with the accommodation usually rented, though purchase is a possibility. There will also be the associated running and maintenance costs of each centre in the system.
Equipment and furnishing	Capital cost (equipment and furniture)	A telecentre will need desks, chairs, storage cupboards, shelving (for a small library) as well as equipment (server, several PCs, printer(s), fax, photocopier, telephone, etc.) – together with the associated wiring.
Staffing	Staff cost	Technical and security staff
Consumables and expenses	Consumables and expenses	
Equipment replacement	Capital (funded from revenue)	Simple depreciation does not allow sufficient money for replacement of equipment. Ritschard and Spencer [30] argue that the theoretical replacement cost is the average cost per machine times the number of machines to be replaced. They suggest that annual provision for replacement of computers needs to run at 61% of the theoretical replacement cost. Provision for upgrades of equipment that will not be replaced like-for-like requires an additional 8% of the theoretical budget. Another 6% needs to be set aside for unplanned replacements and unforeseen contingencies; a further 20% budgeted for new staff positions; and another 5% for 'out-of-cycle' changes and upgrades.
Insurance of equipment	Expense	
Digitised courseware / general library – development and running costs		See [31] for a case study
Scanner	Capital	Annualise
Computer (document storage)	Capital	Annualise
Software	Capital	Annualise
Maintenance of equipment	Expense	
Replacement cost of equipment	Capital	Annualise (see comments on replacement budgeting above)
Technical staff to create and maintain record – document scanning, indexation, etc., and to maintain system/equipment	Staff costs	Salary and on-costs (benefits)

Marketing costs		
Marketing staff	Staff costs	Salary and on-costs (benefits)
Marketing budgets	Expenses and consumables	
Shared central costs		
E.g. costs of personnel, purchasing, financial management, accounting, and audit, etc.	All cost types	In dual mode systems, a proportion of these overhead costs would need to be apportioned to the networked learning 'enterprise', and the rest to other business objectives.

Annex 3: Materials sub-system costs

Expenditure descriptor	Expenditure category	Comments
Materials – general comment	General comment	Internet courses may involve a wide range of media including a brief course outline (syllabus) linked to existing textbooks; texts (content) online; texts + reference materials; images; audio; video; simulations; virtual reality. The media choice exercised by the course developers will have considerable impact on the development and production costs of a course [32]. Since materials are usually developed to last several years, there is an argument for annualising the costs of the materials over the life of the course. Exactly what is covered by materials will vary from system to system. Materials may relate quite specifically to a course – that is to the subject being studied. However, there may be other course-related materials that are of a more administrative nature – information on rules and regulations relating to the course, information on examination arrangements, etc. Such materials properly constitute a cost of a particular given course. There may also be other materials that are sent to all the students registered on a group of courses – in which case the cost of these materials would need to be apportioned across the courses (or course enrolments). Not all materials need be supplied direct by the institution. In some cases students will be asked to buy commercially available textbooks, videos, software, etc. These costs are properly a cost of the course – but incurred by the student. Any full-costs course costing would need to recognise such costs.
Staffing		
Cost of staff time spent on developing materials - instructional design - content development - text authoring - software development - multimedia design and production - course specific software development - content integration and testing - post-test modification costs - training	Human Resources	The actual amount of time involved in developing courseware varies significantly depending on media mix [32], and on whether the course is offered as an asynchronous or synchronous course – with the former being much more expensive [29]. How jobs are packaged varies considerably. In many large-scale distance teaching institutions there is a division of labour between those who develop materials, and those who teach. Development roles may also be distinct, with divisions between, for example instructional design, content development, content editing, graphic design, etc. How staff is hired varies. Some systems use core staff on full-time salaries with benefits; others use consultants paid by the manuscript/product. In a dual mode system, the preparation of online materials may be regarded as an extra duty, attracting additional payments/ compensation (overload pay) (Schifter [33] reported 55% of respondents agreeing this

		happened often or sometimes). Overload pay varied from $0-15,000. Or staff may be relieved of other duties (release time) ([33] reports 69% of respondents to a survey saying that this happens often or sometimes.) This may well represent an additional cost to the employer if this time has to be replaced. Remuneration may also come in other ways – for example, a share in royalties on sales of material [34, 33]. In the US, Schifter [33] found no standard approach to remuneration.
Staff equipment	Equipment	Some systems may purchase computers and software to enable staff to teach online (70% of Schifter's [33] respondents reported help with computer purchase, and 84% with software purchase); other systems expect staff to provide their own equipment.
Staff expenses arising during development of materials	Expenses	The extent to which development staff have their ISP costs met varies (55% of Schifter's [33] respondents reported that this happened).
Copyright clearance	Expenses	Third party copyright can be a significant expense – so much so that some systems may decide not to use any third party material at all [35].
Materials production Production costs - text production - audio production - video production - graphics production - software production -	Staff costs, Stocks, Supplies, Consumables	e.g. costs of producing a CD-ROM for delivery to each student on a course
Developmental testing of course - payments to course testers - general running costs of developmental testing	Expenses	
Materials – annual revision (maintenance function)		
	Staff costs Expenses	As for original production costs. The degree of remake may vary, but some revisions – for example, the development of new assignment and examination questions, may be a regular feature of course maintenance.
Materials delivery Distribution of courseware (e.g. CD-ROMs, user manual, etc) to students	Expense	Postage, courier, etc costs arising from the distribution of physical goods. On-line delivery costs of 'ethereal' goods as per digitised courseware details in Table 4
Materials reception		
Any costs incurred by those receiving the materials	Expense	This could include the costs of students equipping themselves with computers in order to access online materials – but see Annex 4. It could also include the costs of buying courseware etc.

Annex 4: Student sub-system costs

Expenditure descriptor	Expenditure category	Comments
Student system access		
Computers/printer	Equipment	Relatively few institutions now provide students with computers and most analysts (e.g. [19, 21]) assume that students will be responsible for providing their own equipment. Institutionally this then becomes a non-cost, but it remains a 'full-system' cost and should be taken into account for comparative costing purposes. Student's equipment may be set annualised over 5-6 years, though this may be optimistic.
Insurance costs (on equipment)	Expense	
Software	Capital	The initial cost of common software is bundled in with machine purchase – but 'specialist' software may need to be purchased. This is a capital cost but it would be unwise to assume that the software will last as long as the computer. Students may well need to budget to upgrade software.
Student access to Internet	Expense	Includes any payments to an ISP and/or connection charges for time online; also needs to cover increased energy costs.
Equipment repair costs	Expense	
Opportunity costs		
Cost of student time	Opportunity cost for all students, but staff cost for firms	This is a real opportunity cost to employers, and also to the self-employed, who could be doing productive work rather than spending time in training. Given the suggestion that online courses compress the time required to undertake training, there is an argument in any cost comparison exercise for placing a value on every student's time. Whalen and Wright [29] – in their costing of Bell Online – did take the cost of student time into account.
Tuition		
Tuition	Staff or expenses	Payment for teaching students online varies. In some systems permanent full-time staff may teach on courses (or on certain courses), while in other cases staff may be hired by the hour to teach online. Part-time staff are used extensively in large-scale single mode distance teaching systems where there is a division of labour between those who develop materials, and those who support (tutor) students learning from the materials. In US dual mode systems, labour substitution – arranging for the teaching of online students to be done by cheaper doctoral students, or even cheaper Teaching Adjuncts, rather than more expensive faculty, is commonplace. Staff often believe (and most analysts have therefore reported) that tutoring online takes more time than face-to-face teaching, and that as a result, because

		this is not recognised in workload calculations, they are paid less for the work they do (see [32, 36, 37]). Where staff teach in a dual mode system, teaching online may be regarded as part of normal duties; or it may be regarded as an additional (new) duty which releases staff from other teaching duties (release time) (59% of Schifter's [33] respondents said staff were often or sometimes given release time); or it may be regarded as an additional duty for which staff are paid overtime (overload pay) (61% of Schifter's [33] respondents reported this happened often or sometimes). Overload pay ranged between $0 and $8000. Institutions may restrict enrolments on online course in order to contain the impact of online teaching on staff time (which has implications for costing exercises looking at the impact on costs of expansion).
	Expenses	The extent to which tutorial staff are paid expenses varies enormously: some staff may be paid a notional amount to cover expenses (e.g. ISP and connection charges, printing/paper costs for printing out conference messages, etc.) 48% of Schifter's [33] respondents often or sometimes had ISP costs covered.
	Equipment	66% of Schifter's [33] respondents often or sometimes had computer equipment purchased; 78% reported the same with respect to software. Turoff [38] assumed that staff would have their own machines.
Student/Tutor Helpdesk Staffing	Staff costs	Leach and Smallen [27] estimate that staffing the typical Helpdesk represents between 7 – 12% of the total central IT staff. Call centres may well have less expensive front-line staff to handle routine queries, together with a referral system to faculty where this is necessary.
Call costs	Expenses	Some help desks provide students with toll free access.