



INSIGHT :
**A Model for Evaluating
the Costs and Benefits of ICT
in Teaching and Learning**

David Nicol, Nigel Kay , George Gordon and Michael Coen
With the Assistance of Caroline Breslin

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Contact Details

Further Information on any aspect of the Insight Model can be obtained from

The PRedICT Unit

Alexander Turnbull Building

University of Strathclyde

155 George St.

Glasgow

G1 1RD

Telephone : 0141 548 3527

E-Mail : m.coen@mis.strath.ac.uk

Web : <http://www.mis.strath.ac.uk/predict/index.html>

Dr. David Nicol

Centre for Academic Practice

Graham Hills Building

50 George Street

Glasgow

G1 1XP

Telephone : 0141 548 4060

E-mail : d.j.nicol@strath.ac.uk

Web : <http://www.strath.ac.uk/Departments/CAP/>

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<u>1</u>	<u>INTRODUCTION</u>	4
1.1	<u>Background</u>	4
1.2	<u>Summary of Progress to Date</u>	4
<u>2</u>	<u>COST CENTRES AND COST APPORTIONMENT</u>	8
2.1	<u>Introduction</u>	8
2.2	<u>Identification of Cost Centres</u>	8
2.3	<u>Costing Approach</u>	9
2.4	<u>Types of Cost</u>	10
2.5	<u>Allocation of Costs to Cost Centres</u>	13
<u>3</u>	<u>IDENTIFICATION OF BENEFITS</u>	15
3.1	<u>Introduction</u>	15
3.2	<u>Problems in evaluating benefits</u>	15
3.3	<u>A Framework for the Analysis of Benefits</u>	17
3.4	<u>Benefit Types</u>	17
3.5	<u>Benefits derived from Activities</u>	20
<u>4</u>	<u>EVALUATION MODELS</u>	22
4.1	<u>Types of Evaluation</u>	22
<u>5</u>	<u>ADVANTAGES OF THE INSIGHT MODEL</u>	26
5.1	<u>Planning</u>	26
5.2	<u>Decision Making</u>	26
5.3	<u>Audit and Control</u>	26
<u>6</u>	<u>OUTSTANDING ISSUES AND FURTHER DEVELOPMENT</u>	26

1 Introduction

1.1 Background

The original ‘Insight’ proposal from the University of Strathclyde, presented to JISC (The Joint Information Systems Committee) in June 1999, was aimed at understanding how ICT (Information and Communication Technology) is organised and managed within higher education institutions and finding ways of improving the cost-performance relationship of ICT usage. The strategy was to identify the principles that govern the use, organisation and management of ICT and from this to develop an evaluation model and associated tool-set through which cost-performance relationships could be identified, measured and compared.

The proposed programme of work included:

- investigating the measurement of the usage of ICT services and apportioning costs to value-added activities based on that usage.
- studying ways of determining the total cost of ownership of ICT infrastructure and apportioning these costs to value added activities on the basis of usage.
- identifying the benefits of ICT usage and developing ways of measuring (evaluating)
- finding ways of relating costs and benefits of ICT usage to each other.

Following the receipt of funding from JCALT (JISC Committee for Awareness, Liaison and Training) the University of Strathclyde convened a project team to further the aims of the Insight Initiative. Members of the team are:

- Nigel Kay, Director of Information Strategy
- Prof. George Gordon, Director of the Centre for Academic Practice.
- Dr. David Nicol of the Centre for Academic Practice.
- Michael Coen of the PReDICT Unit, Information Strategy

Assistance on the project was provided by Caroline Breslin of the PReDICT, Information Strategy

1.2 Summary of Progress to Date

1.2.1 Refining the scope of Insight

It was not envisaged that the aims of the Insight Initiative would be achieved through a single “big-bang” approach. Therefore the Project Team elected to focus initially on the development of a cost/benefit model which would facilitate the evaluation of existing or proposed C&IT initiatives. The initial scope for the cost/benefit model was developed through an analysis of requirements, drawing together existing work in the field and identifying ‘gaps’ that had to be addressed. This analysis encompassed a number of overlapping activities:

- Existing literature was reviewed to ensure that the Insight Initiative took account of previous work in the area of the evaluation of costs of ICT within higher education.

In particular, this project draws on the work of the Joint Funding Council's Costing Guidelines for Higher Education Institutions, which provides a framework for costing within higher education, and two HEFCE Reports:

- ❖ 98/42- Information Systems and Technology Management – Value for Money Study
- ❖ 99/21 – Appraising Investment Decisions.
- The work of the Flashlight team at the University of Indiana¹ and the work carried out by Dr. Paul Bacsich and his team at Sheffield Hallam University² has also proved very useful in informing our thinking.
- Literature was reviewed in the area of evaluation of benefits of ICT in higher education and on different evaluation frameworks³.
- Traditional cost-benefit and activity-based costing models were assessed for their applicability to higher education. The most useful guide that the team identified was the Cost Benefit Analysis Guide by the Centre for Information Technology, part of the National Institute of Health, Maryland, USA.⁴ This provided useful insights into the issues of cost / benefit evaluation of IT in a public service environment.
- A visit was made by the Insight Project Team to Sheffield Hallam University to discuss in detail the work done by Costs of Networked Learning team.
- Contact was established with potential international partners. For example, initial contact has been made with Queens University of Technology(QUT), Australia. This has led to a response from the Director, Academic Policy and Programs at QUT offering collaborators for work both on costing and benefits.
- Interviews were carried out with staff from the University of Strathclyde involved in ICT projects and with members of senior management interested in assessing the cost/performance of IT (Director of Finance, Head of Internal Audit).
- Case studies of ICT teaching and learning projects were identified within the University of Strathclyde. (e.g. the use of laptop technology in teaching and learning, a 'New Approaches to Teaching and Learning in Engineering (NATALIE)' project concerning the use of Personal Response Systems). Those responsible for managing these projects were interviewed in order to capture stakeholders perceptions of costs and benefits. The issues raised in these initial investigations helped inform the development of the Insight Model.

Several points became clear from the initial analysis. Significant work has already been undertaken within the sector to identify and allocate costs to activities. The Joint Funding Councils have produced a number of best-practice guidelines to assist institutions in the development of costing systems. The Cost of Networked Learning project at Sheffield

¹ 'Modelling Resource Use in Teaching and Learning with Technology' – Ehrmann and Milam, University of Indiana, 1997

² 'The Costs of Networked Learning' – Bacsich, Ash, Boniwell and Kaplan, Sheffield Hallam University, 1999

³ e.g. 'A Framework for Pedagogical Evaluation of Virtual Learning Environments – Britain S, JISC Technology Applications Programme, Report 41, Oct 1999.

'Integrative Evaluation: an emerging role for classroom studies of CAL' in Computers and Education, 26, pp17-32. S. Draper et al., 1996.

⁴ 'Cost-Benefit Analysis Guide For NIH IT Projects' – Prepared by the Office of The Deputy Chief Information Officer, National Institute of Health, Maryland, USA. , 1998

Hallam has built upon those principles, and in its second phase, had piloted the introduction of activity based costing in higher education. These reports, together with the findings of the University of Indiana's Flashlight project, have informed the development of the Insight model for costing on-line teaching activities.

On the benefits side the Insight investigations revealed that there is a body of work, particularly at the level of classes or courses, on the evaluation of the teaching and learning benefits of ICT. However, there is little work (that we know of) that evaluates the benefits in the wider context of the institution (e.g. the repercussions of ICT innovations on internal communications within the institution or on staff development or organisational development). Perhaps the most important finding in the light of the literature searches, discussions and visits was the need to strengthen the focus on the cost-benefit relationship and on ways of linking costs and benefits together in a model. It is in this area that there is least literature to draw on and where least work appears to have been undertaken.

In summary, by comparing the work already done in this area with the initial objectives four main areas were identified that warranted more detailed investigation.

- On the “cost” side there is a need for more “joined-up thinking” - taking the best of the costing techniques and guidelines already established and encapsulating them in a framework.
- On the “benefits” side there is a need for a framework for evaluating ICT teaching and learning projects that goes beyond just a narrow analysis of benefits for learners. In particular, there is a need to be able to evaluate the benefits of ICT in terms of the wider strategic mission and objectives of the institution.
- Most importantly, the costs framework and the benefits framework should be linked together in a model that depicts cost-benefit relationships and that could be used to evaluate different scenarios or ICT options. Having collected cost and benefit information in a model this information should be usable in a variety of outputs to enable decision-making in an institution. The aim would be to go beyond current cost-benefit models which merely produce cost-benefit statements as their output.
- The work done on ICT benefits and their relationship to costs in higher education, to date, has been based on fairly constrained scenarios, such as the provision of an on-line course. In this type of example the benefits tend to be fairly easy to identify although they are still fairly difficult to measure. Additionally, they tend to appear to have a broadly direct correlation to the costs of the activity. There is a need to investigate more complex scenarios, in all areas of IT usage, and to test the robustness and flexibility of the Insight model in relation to such scenarios.

1.2.2 Findings to Date

The initial findings of the Insight Team to date are described in the four sections below:

- Section 2 provides a framework for the identification of the parameters of a “cost centre” or a service under evaluation and discusses the methodology for costing apportionment.
- Section 3 provides a framework for the identification of the scope of benefits across the institution and their apportionment.

- Section 4 links the costs and benefits frameworks together in a model and discusses the different cost-benefit analyses that could derive from the model.
- Section 5 discusses how the model might be used in planning and decision-making.
- Section 6 identifies unresolved issues and areas in need of further investigation.

1.2.3 Conducting an Insight Evaluation

The findings contained in this report are based on observation of the use of ICT in the higher education sector, often a complex scenario. However the aim of the Insight Model is to provide a practical method of evaluation based upon the type of information that is likely to be readily available to managers. This is achieved by providing a structure to resolve some of the complexity and by taking a broad view of what information might be deemed relevant to decision-making. Consequently we believe the model should be equally applicable to the further education sector.

Another document has been produced which will be of interest to those intending to conduct an Insight Evaluation :- ‘Practical Guidance For Implementing the Insight Model’ . This document provides a step by step guide and worked example for those wishing to implement the Insight Model, together with advice on the likely resource implications.

The contents of this paper, and other information about the Insight Initiative, can be found at <http://www.mis.strath.ac.uk/predict/projects/insight/index.htm>

2 Cost Centres and Cost Apportionment

2.1 Introduction

This section contains a description of the Insight Model's approach to the identification of costs and their allocation (directly or indirectly) to cost centres.

One of the main issues relating to the evaluation of ICT in a large organisation is the complexity and inter-dependence of underlying ICT support structures. For example if we wish to evaluate the use of ICT in the teaching of an individual class the resources utilised (both ICT and otherwise) may extend beyond those used directly in the production and delivery of the teaching material. The class may rely on the institution's ICT network, which in turn utilises network hardware, network software and ICT support staff resources. Therefore in order to derive a full cost for the class it is necessary to identify all the resources involved in the teaching of that class and identify the proportion of the indirect costs (such as the cost of the network) that should be attributed to the class.

Activity Based Costing (ABC) techniques can be used to perform this type of cost-apportionment. However setting up and running ABC within a higher education institution can be a costly exercise. While Prof. Paul Bacsich and his Telematics in Education Research Group at Sheffield Hallam University present a robust argument in favour of activity based costing in their 'Cost of Networked Learning – Phase 2' report⁵ they also detail the amount of effort required to establish ABC in a single school or faculty.

With this in mind, and given that few institutions have ABC systems in place currently, the Insight Model takes a much more pragmatic and high-level approach to the attribution of costs to value-adding activities, hopefully delivering many of the benefits of ABC but at a much lower cost.

2.2 Identification of Cost Centres

In developing the Insight costing framework the first elements that must be defined are the 'cost centres' - the activities against which costs are collected. Three distinct types of cost centre are utilised in the model :

- Infrastructure
- Support Services
- Value-Added

Infrastructure Cost Centres are used to collect the total cost of ownership (TCO) for ICT assets. For example the total cost of ownership of a networked server would encompass

⁵ The Costs of Networked Learning – Phase 2 , Bacsich, Ash, Heginbotham, Kandare, Sheffield Hallam University, 2001

not only the acquisition costs but also licensing costs, support contracts and ICT support staff time.

Value-added and support services cost centres are distinguished by the type of activity they represent. Value-added activities are defined as any activity in an institution which results in the generation of an external benefit (financial or otherwise) for the institution and which is undertaken in pursuit of the institution's primary objectives. Therefore value-added activities would include the teaching of students, conducting research and the commercial exploitation of the institution's knowledge. It should also include residences and catering activities - per HEFCE 'Guidelines on Institutional Costing' (1997). All other (non value-added) activities within an institution can be defined as 'support services activities'. This would encompass administrative and academic support functions, including an institution's central C&IT functions.

Not all costs in an institution can be directly attributed to value-added activities. Therefore the Insight Model recognises that costs may be collected against infrastructure or support service cost centres before being subsequently re-allocated to value-added cost centres.

2.3 Costing Approach

In order to make any assessment of ICT activities a consistent costing methodology must be identified. The Joint Funding Council's Costing guidelines of 1997 identify 2 types of costing approach that might be suitable to a higher education environment:

- Full Costing
- Marginal Costing

The full-cost approach starts by identifying costs at an institutional-wide basis and allocating those costs, either directly or through apportionment metrics, to individual cost centres. The advantage of this method is that it ensures that all costs are allocated.

Alternatively, with a marginal costing approach, one identifies only those costs that vary with a change in activity and attributes them (either directly or through apportionment) to that cost centre. This is the approach adopted by many investigations into ICT costs. However, this approach is problematic because of the difficulty of identifying marginal cost information in isolation. Another limitation is that this approach is only really relevant to option appraisals and therefore restricts any other type of evaluation.

While the Insight Initiative is concerned with the costs and benefits of ICT these cannot be viewed in isolation. Therefore a full cost approach has been adopted, with the caveat that this model is not designed to be a complete Activity Based Costing system for institutions. Given the absence of corporate costing structures in many higher education institutions it is necessary to take a pragmatic approach to full costing.

This pragmatic approach involves:

1. identifying (in detail) all academic department costs and benefits that are relevant to the value-added activities being evaluated by the model.

2. identifying (in detail) all ICT costs and benefits and allocating them to appropriate infrastructure and support service cost centres
3. identifying (in detail) all support department costs and benefits that are relevant to support service costs centres being evaluated by the model.
4. consolidating all other expenditure and income (which has not been previously detailed) into an overhead figure to be apportioned to support and value-added activities.

The total cost of the value added activity under consideration in the Insight Model will be the sum of the direct costs of that activity (item 1 above), an appropriate apportionment of the ICT and other support department costs that directly support the activity (items 2 and 3) and an overhead amount to reflect all other institutional costs we have not considered in detail (item 4).

This approach should deliver the benefits of full-cost accounting to the areas under evaluation while avoiding the necessity of analysing all costs in the institution. This approach to value-added activity costing is described in more detail in the document 'Practical Guidance For Implementing the Insight Model'.

2.4 Types of Cost

Having identified our Cost Centres and decided on the costing methodology we wish to adopt we must now consider how we will collect the cost information and aggregate it under our 'cost centre' headings.

The Insight Model categories all costs under four headings and treats each differently within the model :

- Staff Salaries
- Capital Expenditure
- Revenue Expenditure
- Overheads

2.4.1 Staff salaries (plus employment costs)

Staff salaries account for 58% of all expenditure in Higher Education (see 1998/99 HESA statistics), with academic salaries accounting for 33% of the total expenditure. This indicates how crucial it is to ensure that any higher education costing model incorporates realistic estimates for staff time. However we have to accept that, regardless of the recommendations of a number of reports, it is unlikely that academic staff in the near future will (universally) provide detailed information on their day to day deployment. Therefore the Insight model assumes that an estimate can be given for the time academic staff spend on specified activities, but the value of the information produced by the model will (almost) always vary with the accuracy by which academic staff time is estimated.

The model assumes that an institution will define "categories" of staff (e.g. lecturer, technician, ICT support staff, etc) and that each of these categories of staff is associated with an annual cost. This annual cost might be the average of the salary plus employers'

cost for the individuals in the staff category. There are three reasons for using a “staff category” cost rather than the actual cost of individual members of staff:

- Confidentiality. While this model could interface with a Human Resources system to pick up the actual cost of staff we cannot assume that the users of the model will have the right to access this information.
- Planning. The model has been developed to look at both historic and forecast situations. When planning for the future individual staff costs may not be known and a staff category total may have to be used.
- Granularity. As the model allows the staff categories to be user-defined the user can make the categorisation as granular as they feel is appropriate to the situation in their institution.

The model itself does not prevent certain categories of staff being costed at a premium or discount if management wished and this would not skew the outcome of the model as long as the staff time is being costed consistently across cost centres.

The model assumes that any member of staff (academic or otherwise) will be able to define their input to an activity or service either in terms of a percentage of time expended between two dates or in terms of a number of hours expended. Obviously if the estimate is based on the output of a detailed time-management system then that accuracy will be reflected in the output of the model.

2.4.2 Capital Expenditure

Each institution will have a threshold beyond which expenditure is capitalised (e.g. over £ 10,000). In the financial accounts of the institution these investments will be written off over a number of years in line with the University’s depreciation policy, with the depreciation policy reflecting the residual value of the asset.

The Insight model recommends a similar approach for including capital expenditure in the ‘total cost of an activity’ calculations. The user of the Insight Model should define the number of years over which the costs of a capital investment will be charged to a cost centre, reflecting the estimated useful life of the asset as opposed to the ‘residual value’. For example a server may be written off over 5 years in the financial accounts, while the expected useful life may be 7 years – in which case 1/7th of the costs should be charged to the annual cost of the activities which use that server.

The Insight Model suggests that users of the model may wish to amortise project costs in the same way by charging the implementation costs of a new project or activity over the expected useful life of the output of the project (e.g. the expected life of a piece of software acquired or developed as part of a project.)

2.4.3 Revenue Expenditure

In contrast to true Activity Based Costing, where the institution’s financial ledger would be reanalysed to provide the required costing information, the Insight Model advocates

that revenue expenditure figures can be sourced from much higher level documentation (annual budgets and forecasts, planning documents, expenditure summaries, etc).

The validity of this approach hinges on two assumptions :

- There is not a significant variation between the expenditure figures derived from these 'high-level' sources and the actual expenditure contained in the financial ledger.
- The user of the Insight Model will correctly identify all the relevant expenditure that needs to be incorporated into the model. True ABC ensures this by reanalysing the entirety of the financial records.

In both instances the Insight Model relies on the user of the Model to add significant value by correctly identifying and recording the relevant information. These value-judgements facilitate a much quicker, cheaper analysis of expenditure but there is a greater risk of missing or wrongly classifying expenditure than in the more mechanistic ABC approach. Consequently it is important to have a clear definition of what we will consider as a relevant cost. The Joint Funding Council Guidelines on Costing (1997) define relevant costs as follows :

A cost is relevant to a particular cost objective (i.e., a specific project, department or function) if the goods or services are chargeable or attributable to that cost objective in accordance with relative benefits received.

*For example, a cost is relevant to a course if:
it is incurred solely to advance the work of the course; or
it benefits both the course and other work of the institution, where proportions can be approximated through the use of reasonable methods; or
it is necessary to the overall operation of the institution and is deemed to be partly attributable to the course.*

Some costs may be relevant to an objective but so small that it is reasonable to ignore them on the grounds that they are immaterial.

A body of opinion exists which holds that costs incurred by students or staff, in addition to the costs borne by the institution, are relevant to a cost/benefit assessment of ICT. This argument is based on a standard public-sector Cost/ Benefit technique which assumes that a public-sector body expends money for the public benefit and therefore all the attendant 'public' costs should be included in the Cost / Benefit Analysis, not just those costs incurred by the public-sector body.

The Insight team has taken the view that this technique is not particularly applicable to Universities. An individual institution is not in a monopolistic, public-sector situation but instead operates in a quasi-competitive situation with its fellow institutions. Therefore the analysis of the impact of costs on a student should be viewed in the way that any commercial enterprise would view its pricing policy for customers. A commercial company would not view the selling price of a product to its customers as part of the cost-benefit equation.

Let us consider the example of an institution which asks its students to buy their own laptop computer as an integral part of their tuition (this scenario exists in several American institutions). The Insight Model would evaluate this initiative by assessing the benefits in the context the costs to the institution. The actual cash outlay by the student would be no more relevant to the institution (in an evaluation of this initiative) than the fact that the student has to provide themselves with transport, housing, food, books, etc. in the course of their studies at University. The change in marginal cost to the student is a “pricing” issue for the institution. If the University gets this “pricing” decision wrong e.g. if the requirement for a laptop actually dissuades students from choosing that institution then the Insight cost/benefit analysis would reflect the drop in tuition fee income as a cost to the institution.

Likewise the potential impacts of networked learning on staff (e.g. additional hours worked, additional expenses incurred) are really management issues rather than cost issues. If an individual works extra hours because of a change in teaching methodology brought about through an ICT initiative then (presumably) it is incumbent on management to resolve the change in hours through reducing hours spent on other activities (e.g. other ‘cost centres’). Likewise additional expense incurred by staff but not refunded by the institution is a question of institutional policy on staff expenses and refund, rather than ICT cost / benefit.

Assuming we consider only institutional expenditure to be relevant if it falls upon the user of the model (or the institution) to then define what level of expenditure they consider relevant to decision-making. Depending on the context within which the Insight Model is being used and the scale of the activities being assessed the user of the model may wish to determine a threshold below which individual items of expenditure are not considered significant (e.g. £1,000). The worked example in the paper ‘Practical Guidance For Implementing the Insight Model’ operates at the threshold of £100.

2.4.4 Overheads

As described in Section 2.3 (above) we are taking a pragmatic approach to full costing. This involves identifying a number of cost types (academic salaries, ICT support costs) that we wish to analyse in detail and then allocating these to cost centres directly. All other cost types are then apportioned to costs centres as overhead. Again the underlying assumption is that the use of this broad-brush approach will not significantly affect the main outputs of the model and therefore the loss of detail (in comparison with ABC) is justified by the lower ‘cost of costing’.

2.5 Allocation of Costs to Cost Centres

Figure 1 below illustrates the relationship between *Costs* (sub-divided by cost type), the direct allocation (shown by the shaded arrows) of certain costs to costs centres and the subsequent re-allocation (shown by the clear arrows) of *Infrastructure* and *Support* cost centres to *Value-Added* cost centres.

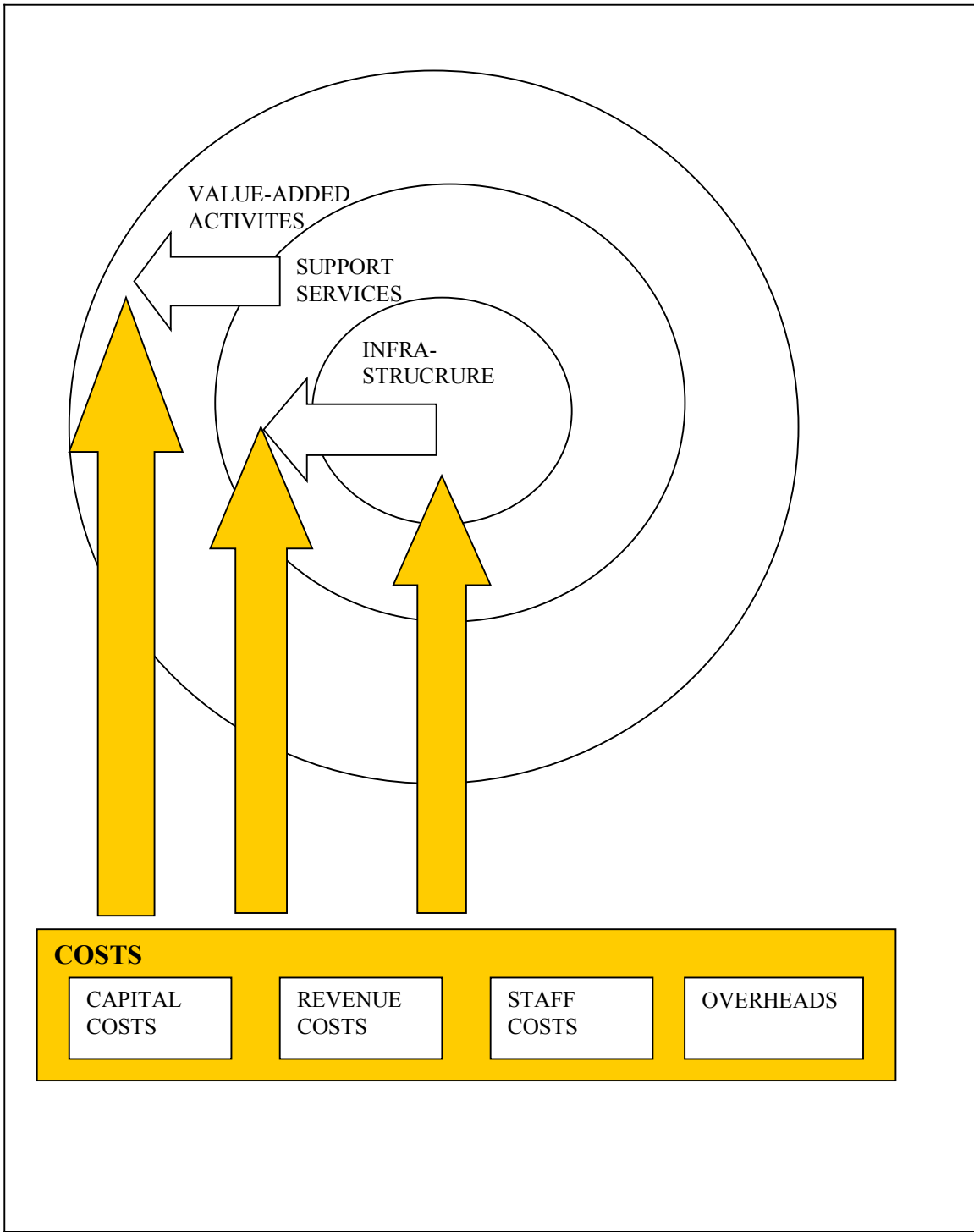


Figure 1 : Allocation of Costs to Cost Centres

3 Identification of benefits

3.1 Introduction

The section above highlighted the difficulties involved in identifying and apportioning the full range of costs associated with an ICT innovation (or an investment decision) in teaching and learning and of allocating these costs to cost centres. There are parallel issues on the benefits side. The task on the benefits side is to identify (or more accurately, evaluate) the full range of benefits resulting from an ICT innovation in teaching and learning and to give these benefits a value which can be related to a cost centre. Only in this way will it be possible to link costs and benefits together. However, there are a number of problems in evaluating the benefits of an ICT innovation.

3.2 Problems in evaluating benefits

3.2.1 Evaluation of benefits tend to be too narrowly defined

Most research studies of teaching and learning innovations tend to evaluate benefits from a limited, usually pedagogical, perspective (see Gunn, 1997, Draper, 1997). The main concern of these studies is the learning benefits accruing to students from the ICT innovation. Few studies evaluate the benefits within a wider institutional framework: for example, the benefits that a local ICT initiative in teaching and learning might have on the development of staff skills (e.g. IT skills) or on organisational processes within the institution (e.g. improved communication) or on the external standing of the institution in relation to recruitment in that subject area.

3.2.2 Benefits rarely considered in relation to mission and strategic objectives

A second, and related, point is that the benefits of an ICT initiative are rarely evaluated in relation to the overall goals of the higher education institution as defined in its mission statement and its strategic objectives. An ICT initiative in teaching and learning that helped progress an institution's strategic objectives might be valued more highly (the benefits would be considered greater) than for a comparable initiative that did not progress those objectives. For example, if the innovation involved giving students laptops to improve their learning and this required that an appropriate local area network had to be constructed then the benefits would be more highly rated if the University had as one of its strategic objectives to become a fully networked campus,

3.2.3 Establishing a causal relationship between benefits and ICT innovations

It has been argued above (section 4.2.1) that the benefits of a local ICT initiative might extend across the institution. But this raises the further issue: how easy it is to identify causal relationships between local ICT initiatives and the extended repercussions in other areas within the organisation? When ICT is introduced into existing teaching and learning contexts there are usually associated changes in other areas: for example, if delivery methods for teaching and learning change then this may necessitate corresponding changes in organisational processes. Hence it is difficult to separate out the effects of the ICT investment from the effects of changes in other areas. Put another

way, a change in one area may correlate with changes in other areas rather than be causally linked.

3.2.4 Comparing benefits across ICT projects.

Another issue is the need for evaluation methodologies and criteria that would allow one to compare benefits (using a similar metric) across different ICT projects. Comparisons across ICT projects are crucial as an aid to making investment decisions. However, in most evaluations of ICT initiatives the methodologies used are fairly unique and tailored to the situation. They may also use a ‘triangulation’ of methods in order to be able to draw more robust conclusions. Some commonality of methods and of possibly criteria would seem to be a prerequisite for project comparisons.

3.2.5 Inherent difficulty in quantifying benefits

The benefits of IT are notoriously difficult to measure in any precise way even in the area of teaching and learning not to mention in the wider context. For both practical and ethical reasons it is not usually possible to use a control group against which a relative assessment of the benefits of an ICT teaching and learning initiative may be made. The measuring of benefits is subjective - it involves making qualitative judgements. These judgements depend on values and the importance of those benefits to the institution concerned. The best that can be achieved is the giving of relative weightings to benefits to reflect their importance to the institution and its strategy. This will require explicit, and ranked criteria, and a method of assessing each ICT option in relation to those criteria

The HEFCE Paper – Appraising Investment Decisions (99/21) makes the following observations about non-quantifiable benefits in the higher education sector:

A scoring system, even a subjective one, can help to clarify the decision process and give it more rigour. The institution must first decide what criteria are significant and how to score them; scores can be weighted to reflect their relative importance. The results are only an aid to decision making, and can never relate to any absolute measure. However, even if the scores and weightings are fundamentally subjective, the institution will be in a better position to explain the rationale for its decision.

In order to facilitate the evaluation of non-quantifiable benefits a framework should be developed which in a systematic and consistent way allows institutions to weight and score the benefits of IT investments in the context of their institutional strategies

3.2.6 Evaluating benefits in relation to costs

When ways have been found to resolve some of the above problems then there will still be the challenge of linking benefits and costs within a single model so as to be able to compare cost-benefit relationships across existing ICT projects or to make investment decisions.

3.3 A Framework for the Analysis of Benefits

Having identified the problematic issues in evaluating benefits (section 4.2) the next step was to start to construct a benefits framework that might help overcome some of these issues and that could be linked to costs. The first goal in this process was to establish the range of benefit categories that might be relevant to the functioning of a higher education institution. The diagram below (Figure 2) depicts three broad categories of benefits that would need to be considered within any institutional framework: educational, institutional and external. This categorisation recognises that institutions seek to deliver the best education that they can (educational objectives), to be effectively and efficiently organised (institutional objectives) and to have a high standing within its external communities and within society (external objectives).

These categories are tentative and provisional but they provide a starting point for benefit analysis. The value of this categorisation is that it is a reasonably comprehensive framework. As the diagram shows these benefit categories overlap and inter-relate but this distinction facilitates analysis. The benefits of any ICT initiative are containable within these three benefit categories. For example, an ICT initiative in teaching and learning might not just incur educational benefits for students but might also improve the external standing of the institution with a particular external community.

3.4 Benefit Types

- The tables below provide examples of the benefit types under each of the main categories. The advantage of this framework is that it facilitates the identification, weighting and scoring of benefits in accordance with institutional objectives. It is assumed that the benefit types identified below would be different depending on the institution and its strategic objectives. Indeed the benefit types are ‘user-defined’ – they would be specified by the institution itself using the framework.

Each benefit type would be allocated a weighting (to represent institutional priorities) and a score (to represent relative merit). By summing the weighted score for each benefit an overall score for the ICT innovation (or proposal) could be calculated.

While still essentially subjective, this type of evaluation can be made more objective by the use of consistent assessment criteria to produce the score. The final column of the first tables below shows examples of the type of assessment methods that could be used to evaluate each of the benefit types. Again these methods are not fully worked and are merely indicative. While the assessment of educational benefits has been the subject of a number of studies, organisational development and external standing are rarely evaluated when examining the benefits of an ICT teaching and learning initiative. For example, little work has been done on methods of evaluating institutional efficiency. But the formal criteria used for ‘Investors in People’ accreditation, with its focus on the communication and ownership of institutional objectives and on staff training, might provide some insight into the development of tools to evaluate benefits in the areas of organisational and staff development.

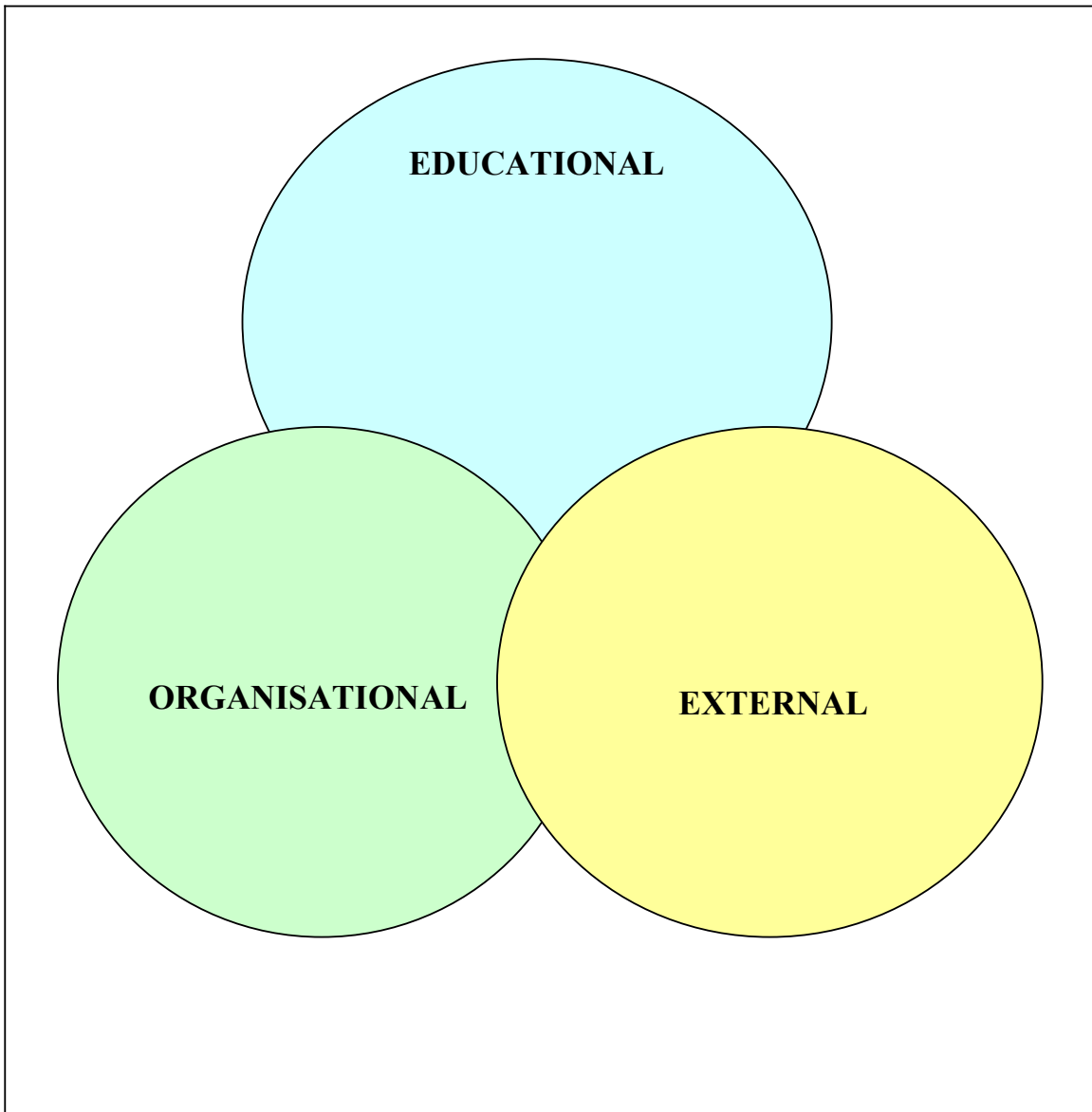


Figure 2 : Categorisation of Benefits

3.4.1 Educational Benefits :

BENEFIT TYPE	EXAMPLE EVALUATION METHODS
Increased student satisfaction / motivation	<ul style="list-style-type: none"> • Questionnaires • Alumni Surveys • Focus groups
Improved Understanding / Subject Knowledge	<ul style="list-style-type: none"> • Retention Rates • Course assessment • Classroom assessments • Diagnostic tests
Wider Range of Transferable Skills (including communication and group working)	<ul style="list-style-type: none"> • Classroom assessments • Employability / First Destination indicators
Access available to a wider range of resources	<ul style="list-style-type: none"> • Survey • Log-in information
	<ul style="list-style-type: none"> •
Flexible delivery of courses	<ul style="list-style-type: none"> • Access data
Courses kept up-to-date	<ul style="list-style-type: none"> •

3.4.2 Organisational Benefits

BENEFIT TYPE	EXAMPLE EVALUATION METHODS
Increased staff satisfaction /motivation	<ul style="list-style-type: none"> • Surveys • Staff turnover rates • Appraisal data
Development staff skills	<ul style="list-style-type: none"> • Investors in People indicators • Appraisal data
Improvements in organisational efficiency	<ul style="list-style-type: none"> • Investors in people indicators • Information flow indicators • ‘Knowledge Capital’ Indicators • Reduced Cost(e.g. saving in staff time)
Improvements in service provision / effectiveness	<ul style="list-style-type: none"> • Service Level Agreements • Service Level Monitoring • Increased Functionality • ‘Knowledge Capital’ Indicators • Increased Revenue (e.g. increased income from tuition fees)
Innovation	<ul style="list-style-type: none"> • Research Income • Patents

3.4.3 External Standing Benefits

BENEFIT TYPE	EXAMPLE EVALUATION METHODS
Public profile of the institution	<ul style="list-style-type: none"> • Public Perception of the Institution – survey data • Recruitment Rates • Quality of Recruitment • Increased Revenue (Tuition Fees, commercial, etc.)
External Partnerships	<ul style="list-style-type: none"> • Formal and informal agreements • Surveys
Political Acceptability	<ul style="list-style-type: none"> • Compliance with Funding Council / Political Guidelines and Strategy
Impact on the community / environment	<ul style="list-style-type: none"> • Compliance with Planning and Local Government Constraints • Formal and informal Market Research (Public opinion, press coverage, etc)
Increased wealth creation	<ul style="list-style-type: none"> • Economic indicators
Course offerings highly regarded by professional bodies	<ul style="list-style-type: none"> • Visits by professional bodies • Employment statistics

3.5 Benefits derived from Activities

In a holistic system it may be difficult to attribute a perceived benefit or benefits to a specific activity or cost centre. For example an institution may have detected a measurable improvement in its public’s image, based on the results of market research it has undertaken. However this effect may be due to a number of factors acting concurrently (e.g. the introduction of new technology, more advertising, an ‘outreach’ campaign, etc). It may prove impossible to disaggregate the effect of these factors.

How should we reflect this situation in the Insight Model ? In contrast to the treatment of costs in the Insight Model a large degree of subjective assessment is required in order to quantify benefits. Consequently where we cannot attribute a benefit wholly to a particular activity or cost centre then the ‘rating’ applied to that benefit in the Insight Evaluation should take this into consideration.

Figure 3 (below) illustrates the overall picture of costs and being allocated either directly or through apportionment to the three types of costs centre we have identified and benefits being derived from the costs centres, as value is added to the inputs (the costs).

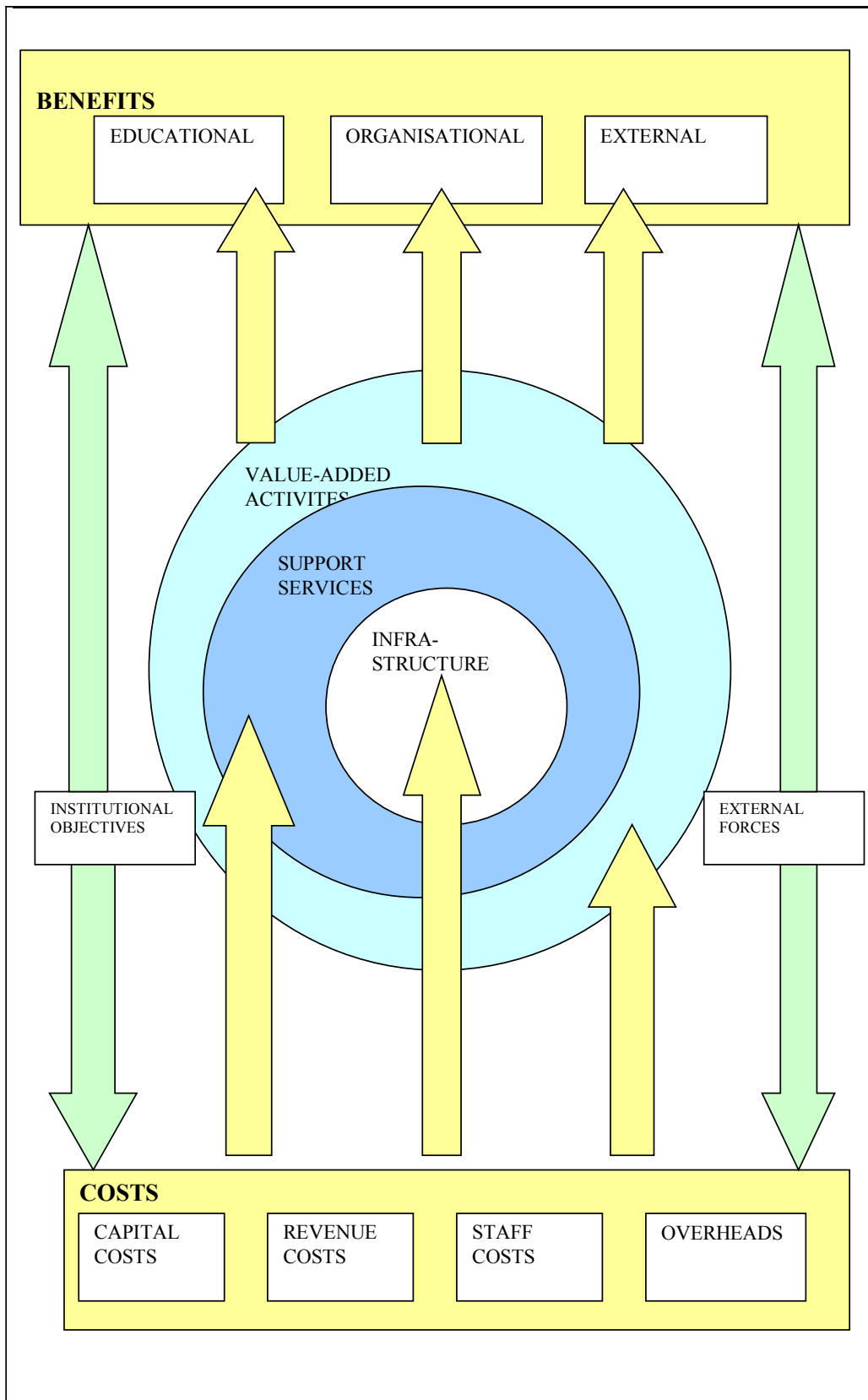


Figure 3 : Allocation of Costs and Benefits to Cost Centres

4 Evaluation Models

4.1 Types of Evaluation

Sections 2 and 3 (above) have discussed how we identify cost centres, allocate costs to cost centres and identify the benefits that are derived from them. However simply collecting costs and benefits against a cost centre does not allow us to make any real evaluation of the ICT investment therefore an evaluation methodology is required.

The evaluation of any kind of investment, including ICT investments in higher education institutions presents a particular set of problems. Commercial organisations will employ discounted cash flow techniques or internal rates of return to assess the desirability or success of investments. These techniques are not suitable for the education sector, given that the sector does not have an easily identifiable cost of capital. The type of public sector cost / benefit analysis techniques, which assume that an organisation, has a supply monopoly and that all expenditure is undertaken for the achievement of societal benefits, are also unsuitable as the higher education sector operates in a quasi-competitive environment.

Therefore we have to identify other methodologies that might be relevant for the evaluation of ICT in Universities. It should be stressed that none of these evaluation methodologies remove the need for a degree of subjective assessment. Where a cost centre is associated with non-quantifiable benefits there is a need to either apply management judgement to compare them or to use methodologies which facilitate the assessment of these benefits in relative terms so that a rating can be applied. Likewise, where weightings are applied to prioritise benefits, these weightings can only be based on management judgement, albeit judgement informed by institutional strategy.

Despite this element of subjectivity the Insight model should facilitate a structured approach to evaluation. It should help ensure that information presented to management is complete and comparable and it should help provide a structure for decision-making.

4.1.1 Cost Control

At its simplest the model will allow institutions to identify the costs of assets, support services and value-added activities on a full-absorption cost basis. The aim of this evaluation would be to identify the costs of the service and thereby identify opportunities to reduce the cost.

4.1.2 Benchmarking

Benchmarking is an advance on simple cost control. The cost of assets, support services and value-added activities could be evaluated through comparison with benchmarks. Obviously a high degree of caution would have to be exercised to ensure that the benchmark comparison was valid. The main difficulty in adopting benchmarking as an evaluation methodology is the absence of readily available benchmarks. While the

statistics provided annually by HESA (the Higher Education Statistical Agency) facilitate some high level comparisons, they are unlikely to provide any actual benchmarks against which we might evaluate individual activities.

In the eventuality of no benchmark comparison being available the only evaluation that could be drawn would be to apply the Insight guidelines to the same type of activity in a number of different departments or institutions and draw a comparison in that way.

4.1.3 Meeting Objectives

The simplest form of evaluation of the costs and benefits of an activity would be to compare actual outcomes against objectives, whether they are expressed in a project plan or a recurrent control cycle (e.g. service levels, budgets, etc). However the outcome of this form of evaluation is as likely to reflect the accuracy of the planning process as it is to reflect the value of the service being evaluated.

4.1.4 Costs and Benefits Statement

A Cost Benefit Statement would simply state the unquantifiable benefits which would be obtained for a net financial cost (costs less financial benefits). No attempt would be made to quantify the non-financial benefits and, consequently, management judgement would have to be used to assess the best option. The value of this technique is in its simplicity. Management retains control of decision – making process while benefiting from a structured presentation of the information.

4.1.5 Cost / Benefit Analysis

Terminology and definitions relating to Cost/Benefit Analysis techniques vary in different texts therefore for we have provided our own definitions for Cost/Benefit, Cost/Efficiency and Cost Effectiveness.

Cost-Benefit Analysis is a method of assessing which of a group of alternative options provides the best cost / benefit ratio. It is based on the assumption that a financial value can be applied to all benefits which might arise from a course of action. This technique is very controversial and past experience would indicate that the (somewhat) arbitrary financial values placed on benefits would fail to gain wide acceptance in a University environment.

4.1.6 Cost / Efficiency Analysis

A Cost-Efficiency Analysis is a simplified Cost-Benefit Analysis, which can be done when either the benefits or the costs are the same for all alternatives. The analysis is greatly simplified because the best alternative is either the one with the most benefits (when the costs are the same for all alternatives) or the one with the lowest cost (when the benefits are the same for all alternatives).

4.1.7 Cost / Effectiveness Analysis

This technique would be most effective in option appraisal where several competing options are assessed for their effectiveness in comparison to their cost. Their

effectiveness is gauged by allocating a weighted grading to each of their potential benefits.

With some adaptations the technique can also be used when assessing the relative merits of a variety of services in an institution. In order to use Cost / Effectiveness Analysis in this way an institution would have to identify and weigh the expected objectives/benefits in line with institutional objectives and then assess each service in relation to those weighted objectives.

4.1.8 Example of Cost / Effectiveness Evaluation

An institution, the ‘West of Scotland University’ wishes to evaluate the costs and benefits of four classes, which utilise ICT in different ways and to different degrees.

The University has defined a set of objectives that it wishes to fulfil through its teaching and has weighted these on a 1-10 scale as follows :

Benefit Type	Weighting (in scale of 1-10)
Student Satisfaction	8
Better Understanding	7
Flexible Delivery of Courses	7
Increased Staff Satisfaction	5
Improve organisational efficiency	5
Innovation	9
Public Perception of the Institution	9
	50

The effectiveness of each class in meeting the institution’s objectives is evaluated by allocating a rating (on a 1-10 scale) against each of the objectives. Consequently the maximum score that any class could achieve would be 500 - by achieving a maximum ‘10’ rating against each of the weighted objectives.

The institution undertakes an Insight evaluation of the cost structure to calculate the annual cost of delivering each of these classes. The institution can now compare the costs and the effectiveness of each class; the effectiveness being assessed as the sum of the weighted benefits for each option. This comparison gives the following results:

Class	Annual Cost £ K	Effectiveness (000)	Effectiveness /Cost Ratio
Class 101	148.8	389	2.61
Class 202	132.0	245	1.86
Class 303	100.4	334	3.33
Class 404	74.8	189	2.53

From this analysis we can see that Class 303 gives the most favourable ratio, followed by Class 101, Class 404 and finally Class 202. Although Class 101 is the most effective, its high cost weighs against it in the Cost / Effectiveness Study. Class 404 has a relatively low effectiveness (weighed against the defined objectives) but its low cost gives it a reasonable cost/effectiveness rating.

These results can be plotted on a graph (see Figure 4 below), with the “Expected Benefits” line showing an average level of benefit that one would expect to accrue per £ of expenditure. Options above and to the left of this line give a better than average effective return per £ of cost, whereas options to the right and below the line give a poorer than average return. Potentially, if enough data were accumulated about existing and proposed services, this “Expected Benefits” ratio could be used to judge the value of any project / service in isolation.

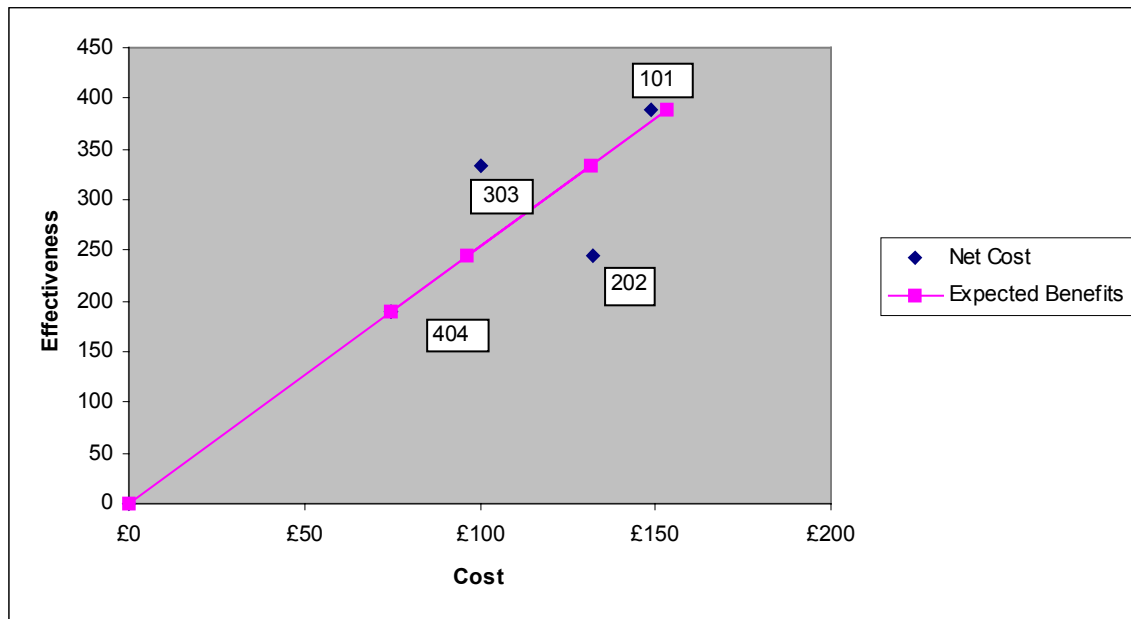


Figure 4

While Class 404 is exactly on the line and Class 101 is only slightly to the ‘favourable’ side, clearly Class 303 gives the best cost /effectiveness rating, while Class 202 has the poorest.

We can conclude that the West of Scotland University should choose to invest in the technology behind class 303 which gives the best return on investment. If no cash constraints existed then Class101 has the highest overall effectiveness rating. Class 404 is the least effective (measured against the institution’s objectives) but is cheap.

For fuller explanation of this example can be found in the document ‘Practical Guidance For Implementing the Insight Model’

5 Advantages of the Insight Model

Clearly the model described above is relatively complex however weighed against the large investments that institutions are making in ICT the benefits of adopting a formal evaluation methodology should outweigh the effort involved.

5.1 Planning

The availability of better information about ICT costs and benefits should allow for better planning at various levels in the institution e.g. :

- Better informed strategic planning and project management in relation to new ICT initiatives in teaching, research and administration.
- More effective planning of routine activity through the development of Service Level Agreements
- Better informed plans for on-going equipment replacement cycles and strategic acquisitions.

5.2 Decision Making

The availability of more accurate information about the costs and benefits of ICT assists in the University's decision-making processes, particularly in relation to option analysis and investment appraisal e.g. :

- A more objective method for determining the efficacy and effectiveness of investing in certain new ICT infrastructure or services, or of configuring and conducting IT services and using the ICT infrastructure in a different way;
- A more consistent method of determining the relative merits of adopting ICT into a teaching and learning programme in a particular way.
- A more structured approach to the development of business cases for extending investment.

5.3 Audit and Control

The development of a consistent methodology for the costing of ICT facilitates a more objective, quantifiable assessment of value for money in relation to internal and external benchmarks.

6 Outstanding Issues and Further Development

Having defined a broad framework and an evaluation model for Insight several issues are still unresolved and warrant further investigation.

- The benefit evaluation aspect of the Model needs further refinement to be able to deal with the issue of the scale of benefits (i.e. how many people actually benefit from a particular innovation or initiative). There appears to be little in the way of existing literature on this subject – and yet it raises a fundamental question: Is it better to implement a project that has a small impact on a lot of people or a project that has a big impact on a smaller group of people?

- Institutional strategic objectives may be stated in a format that does not readily translate to criteria against which benefits can be assessed. Consequently further work is required on the development of evaluation methods and criteria that are applicable across projects, so that comparisons can be made.
- Further consideration needs to be given to the development of a methodology that will make the allocations of weightings and ratings to benefits more rigorous and less subjective.
- The model does not currently take into consideration the degree of certainty of future outcomes e.g. all forecast costs and benefits are assumed to be known with 100% certainty. Consequently the Insight Model requires further refinement in terms of risk analysis when anticipating the possible outcomes of proposals.

The PReDICT (Policy, Research and Development in ICT) Unit within the Information Strategy Directorate are 'championing' the use of the Insight Model within the University of Strathclyde. Applications to date have included :

- Investigation of the cost and benefits of the services provided by the Information Resources Directorate to the University.
- Modelling the cost structure and potential benefits of a proposed investment in laptop technology within the University.

Through continued deployment of the Insight Model in real situations we hope to refine it and resolve the outstanding issues noted above.