smg space management group

UK HIGHER EDUCATION SPACE MANAGEMENT PROJECT

THE COST OF SPACE REPORT

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Feedback and support

A detailed Question & Answer section is regularly updated and posted on the Space Management Group (SMG) web-site. However, should you wish to provide feedback on any aspect of SMG work or have questions on how to use the findings or web-site model please send an e-mail to: info@smg.ac.uk.

Acknowledgments

We would like to express our thanks to the members of the UK Higher Education Space Management Group for their guidance and comments and to all the HEIs which shared their space management data, practices and issues with us.

Executive summary

1. This summary gives readers an overview of the work undertaken in developing a methodology to calculate and benchmark the total cost of any higher education institution's (HEI's) non-residential estate in the UK.

Why is the cost of space important?

2. Effective space management techniques and tools can help HEI managers make more informed choices and budgeting decisions regarding the size of their estates. Understanding cost, what drives cost and how it can be measured are important elements in this decision-making process. This report sets out a step-by-step approach to calculating the cost of an HEI estate.

3. To understand the empirical drivers of the size of an HEI's estate readers should consult the companion report: 'Drivers of the size of the higher education estate'.

4. There is also an interactive spreadsheet model on the SMG web-site (www.smg.ac.uk) that enables any HEI to construct its own estimates for the cost of its space and to benchmark the size of its estate.

Modelling the cost of space

5. We have constructed two different measures for the cost of an HEI's non-residential estate:

- the sustainable estate provision
- the total estate provision.

6. The **sustainable estate provision** includes the following cost components:

- operating costs such as energy, water and cleaning
- the maintenance spending necessary to keep space in good condition
- the cost of building depreciation – including the cost of replacing buildings at the end of their lives.

7. The sustainable estate provision is the expenditure per m^2 required to maintain the non-residential estate in a good and fit for purpose condition indefinitely.

8. The **total estate provision** also includes an estimate of the opportunity cost of the capital which is tied up in buildings and the land beneath them. This opportunity cost is equal to the investment income an HEI forgoes by owning a building or land rather than selling the property and investing the proceeds.

9. The total estate provision takes into account all the explicit and implicit costs of using space, and approximates to the rent that would be charged by a landlord. As such, it provides useful information for determining a fully cost-reflective space charge.

The level of non-residential estate costs

10. We evaluated each of these costs for HEIs across the UK. While we took an HEI's operating costs directly from its spending records for energy, water, cleaning, rates and similar costs, we had to make several assumptions to estimate other costs. This report explains the basis of these assumptions.

The average sustainable estate provision is £147.40 per m²

11. We estimate the sustainable estate provision for space to average £147.40 per m² annually across UK HEIs on the basis of the Estate Management Statistics (EMS) data for 2002-03. This cost comprises:

- operating cost: £43.80 per m²
- maintenance cost: £53.40 per m²
- depreciation cost: £50.20 per m²

The total estate provision is £192.50 per m²

12. This figure is obtained by adding an opportunity cost of capital of £45.10 per m² to the sustainable estate provision.

The sustainable and optimal estates

The sustainable estate provision can be used to determine the 'sustainable estate'

13. An HEI's 'sustainable estate' is the ratio of its estate budget to its sustainable estate provision per m². The sustainable estate is the amount of its existing space the HEI can afford to maintain in the long run. Our model of the sustainable estate provision, together with accurate data on total estate budgets, allows HEIs to calculate their sustainable estates. A sustainable estate smaller than an HEI's current estate would identify a funding shortfall.

The total estate provision can be used to determine the 'optimal estate size'

14. The sustainable estate will not necessarily be the optimal estate size because it does not involve any assessment of the trade-offs between an institution's spending on the estate and spending on other resources. Even if an HEI can sustain its current estate, it might choose to release some space so that it can spend more cash on other resources, such as staff salaries. When an HEI is at the point where it would not wish to release any space (or acquire new space) in order to spend more (or less) elsewhere, it has achieved optimal estate size.

The model

15. The interactive spreadsheet model on the SMG web-site allows an HEI to find its own estimates of the sustainable estate and total estate provision using either our default values or its own institution-specific information and assumptions.

16. The focus of the cost spreadsheet and benchmarking tool in the model on the web-site is the net internal area of an HEI's non-residential estate.

17. To facilitate the use of both tools, EMS data and a number of other parameters are provided as default settings, but users are free to override these with their own data.

18. The cost spreadsheet allows users to calculate both the cost of maintaining the estate in a steady state and the total estate provision taking into account the opportunity cost of the funds tied up in the estate.

19. An HEI can compare the size of its estate with the one that the benchmarking tool predicts and see the effect of various different assumptions on the estate size predicted. It is important to note that, because it is based on the average relationship across the sector, the benchmark does not reflect the best or most efficient use of space. Moreover, the benchmark result should be viewed as space management information for an HEI determining the appropriate size of its estate but not as a normative space guide. There may be specific reasons why a particular HEI's estate deviates from the size that the benchmark tool predicts.

Note

Annex 2 of this report clarifies the differences between the SMG Model of the Affordable Estate and the Transparent Approach to Costing (TRAC) methodology.

Introduction

20. As part of the three-year research project on space management in the higher education (HE) sector commissioned by the UK Funding Councils in August 2003, we (Kilner Planning and London Economics) undertook extensive research on:

- the factors that help explain the variation in the size of the non-residential estate across higher education institutions (HEIs)
- the cost of the non-residential estate.

21. Effective space management techniques and tools can help HEIs make more informed choices and budgeting decisions regarding the size of their estates. Understanding cost, what drives cost and how it can be measured is an important element in this decision-making process. This report sets out a step-by-step approach to calculating the cost of an HE estate.

22. The web-based model, that is to be used in conjunction with this report, is based on the results of our research. It will assist an HEI in determining the size of the estate it could sustainably or optimally hold. Additionally, the results can be used by the HEI to benchmark the size of its estate, forecast estate requirements and undertake scenario planning. The model is highly flexible and can be adapted to a user's specific needs.

23. In this report, we provide an in-depth discussion of two space cost measures, the sustainable estate provision and the total estate provision. These two measures differ conceptually, but both are useful space management tools. In this report, we discuss in greater detail the two space cost concepts, show how they can be constructed, and for illustrative purposes, report the average sustainable estate provision and the total estate provision across all HEIs for which we have data.

24. Sector-wide averages are based on Estate Management Statistics (EMS) data and a number of assumptions. An important variable is the insurance replacement value (IRV) of the non-residential estate. As insurance practices vary between HEIs, the insurance replacement value reported in EMS may not be strictly comparable across HEIs. This in turn could affect the calculated sector averages. We also report similar average cost estimates for various HE space categories such as teaching space and research space.

25. In one of our reports, 'Drivers of the size of the higher education estate', we present the results of our statistical analysis of the factors explaining the variability in the size of the non-residential estates across HEIs.

26. The structure of this report is as follows:

- we present in greater detail the two cost concepts
- we then describe how the two cost measures can be estimated and report HE sector-wide estimates of the two cost measures of the non-residential HE estate
- we present similar sector-wide cost estimates for various non-residential space categories

- finally, we describe the feedback and support systems implemented as part of the project.

In Annex 1, we show how the optimal size of the estate can be derived using economic theory and basic economic principles.

Conceptual framework

27. Below, we describe in greater detail the two space cost concepts, beginning with the sustainable estate provision.

Sustainable estate provision and the sustainable estate

28. We define the sustainable estate provision as the annual cost of keeping an HEI's estate in a good and fit for purpose condition.

29. The cost of maintaining the estate in a good and fit for purpose condition includes operating and maintenance costs. It also requires providing for the replacement of buildings at the end of their lives and for periodic refits to each building.

30. The sustainable estate is the estate that, given the sustainable estate provision, an HEI can provide on an on-going basis at a certain level of estate spending. This level of spending may be either the current estate budget or any other level chosen by the HEI.

The total estate provision and the optimal estate

31. The total estate provision is the sum of the sustainable estate provision and the opportunity cost of the funds tied up in the existing estate.

32. The optimal estate is the size of the estate at which, given the explicit or implicit prices of estate and other teaching/research factors, an HEI does not wish to change the mix between these areas. In other words, at this optimal estate level, an HEI is happy with the status quo, neither wishing to dispose of any estate and use the proceeds elsewhere, nor wishing to reduce spending on other areas in order to add more space.

The cost of space

33. This section reviews how the sustainable estate provision and the total estate provision can be estimated, and then constructs the costs from their components.

Components of the sustainable estate and total estate provisions

34. The following discussion reviews the components of the two space cost concepts. All costs are based on costs per m^2 of net internal non-residential area as defined in EMS.

Operating costs

35. Operating costs are the short-run costs of using a building. Using EMS data, we defined operating costs as the sum of an HEI's energy, rates, water, sewerage, cleaning, security and porterage costs, and its insurance premiums

and service charges. We have also added the HEI's internal and external property management costs.

36. The EMS net service charges (i.e. the costs of leased space minus rental income on space let out) are not included in operating costs in the cost spreadsheet, as all the costs related to rented property (buildings and land) are considered separately.

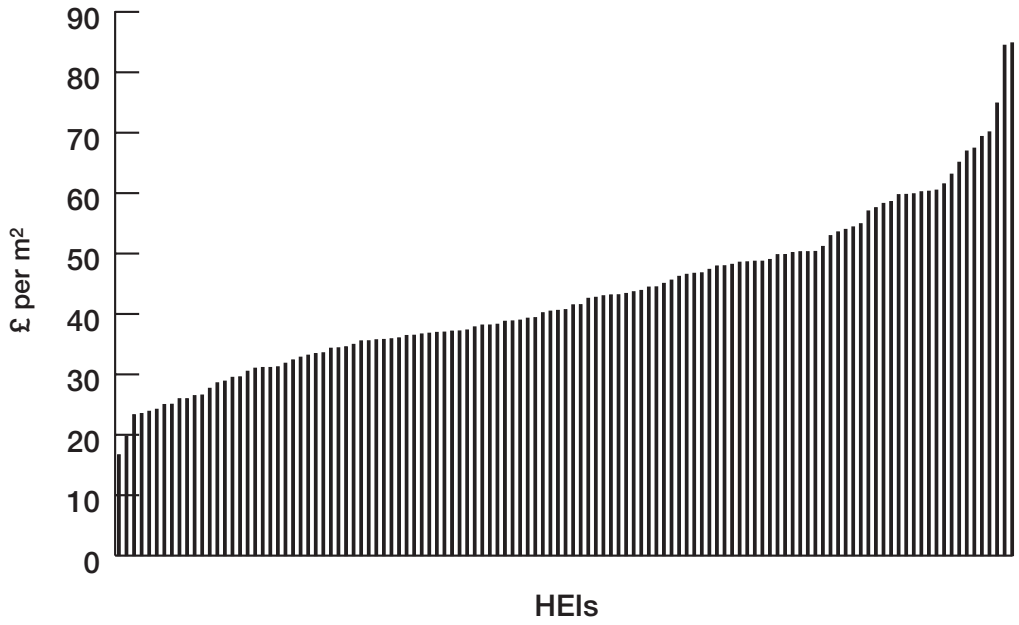
37. The 2004 EMS report provides data on all the elements of the total estate provision for 121 HEIs in 2002-03.[1] Of these 121, the mean operating cost per m^2 of the non-residential estate is £43.80. Operating costs per m^2 vary greatly across HEIs; the standard deviation is £14.40. Figure 1 shows the distribution of operating costs per m^2.

Maintenance costs

38. We define the total estate provision as the cost of keeping buildings in their current condition. Therefore, the cost of maintenance includes the cost of all maintenance required to keep the quality of a building's fittings in good condition.

39. The EMS includes data on actual HEI maintenance spending. **Of the 121 HEIs with maintenance spending data, the mean expenditure per m^2 for the non-residential estate in 2002-03 is £22.80.** However, the backlog of repairs in the HE sector suggests that average HEI maintenance spending is insufficient to maintain the HE estate in good condition. Therefore, in our

Figure 1 **Operating cost of net internal non-residential space**



Source: London Economics and EMS 2002-03

[1] Where data for cleaning, water or other cost elements are missing, we omit the HEI from our calculations. Where external property management costs or net service charges are missing, we assume these costs were zero and retain the HEI in our calculations.

illustration of the calculation of the total estate provision we do not use actual HEI maintenance spending in our estimate of cost, but a level that would keep buildings in good condition throughout their life.

40. In its 2004 (and 2003) 'Review of Maintenance Costs', Building Maintenance Information (BMI) uses a benchmark building maintenance rate of 2.5 per cent of a building's capital cost. This benchmark figure is an average across many sectors, and may not be appropriate for all HEIs. Moreover, the percentage reported by BMI may change from time to time. Nevertheless, in the absence of better information, we believe that this 2.5 per cent figure provides a good benchmark.

41. Therefore, we have used the BMI's finding, and applied this 2.5 per cent figure to the insurance replacement values (IRVs) given in the EMS. We believe IRV is the relevant measure to use for the non-residential estate's 'capital cost' in this context, because maintenance costs relate to the cost of buildings, but not to the value of the land on which the estate sits. Similarly, IRV reflects the cost of replacing the physical structures, but not the land.

42. So, for the 121 HEIs in the EMS with complete data for 2002-03, **this 'full maintenance cost' averages £53.40 per m^2 of non-residential estate.** The standard deviation is £20.20.

43. Adding this maintenance cost to the £43.80 average operating cost gives an average running cost of £97.20 per m^2 of non-residential estate.

44. This average of £97.20 is somewhat higher than the £84.30 median running cost per m^2 of non-residential estate quoted by the EMS Annual Report 2004 (HEFCE 2004/45) However, this £84.30 figure also includes an HEI's rateable value in its running costs, which we omit. The two cost measures are therefore not comparable. The EMS cost figure includes rateable value as a proxy of the market rent, while we make a separate explicit estimate for market rental value, which is discussed later in the report.

45. Our running-cost figure of £97.20 is substantially lower than the total estate provision, since it omits both a depreciation charge and the opportunity cost of capital.

Depreciation costs

46. We define a building's depreciation cost as the sum that must be saved each year to be able to replace a building at the end of its natural life and pay for periodic refits to the building.

47. We assume the sums saved each year earn interest until they are spent. Thus, if a building had a 10-year life, we would calculate an annual depreciation cost below 10 per cent of the replacement value, due to the interest earned on the HEI's depreciation fund.

48. We assume the cost of replacing a building is its IRV, as given by the EMS data. However, IRVs may not always equate to replacement costs, for the following reasons:

- IRVs that are not regularly updated may not reflect changes in construction prices

- IRVs may understate the cost of replacing HEI estates, as some HEIs may not fully insure
- conversely, an IRV may reflect the cost of replacing like for like. In the case of historical estates this might exceed the cost of replacing old space with new space of equal functionality.

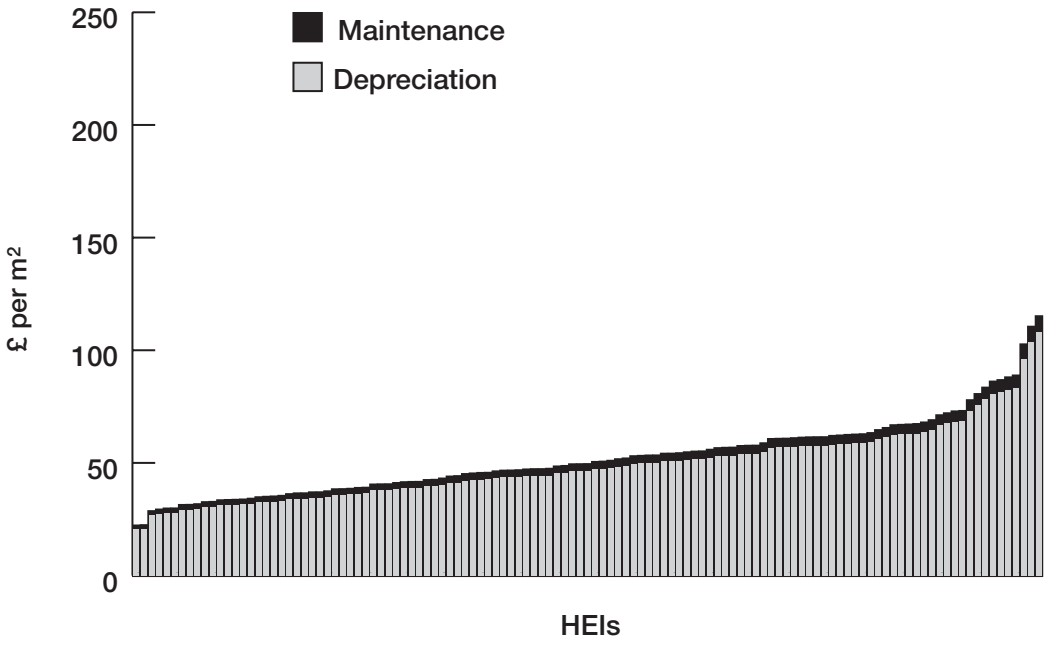
49. In our illustrative example, we assume that an HEI's buildings last 60 years and undergo major refits when they are 15, 30 and 45 years old, with each refit costing 30 per cent of each building's IRV. We also assume that HEIs do not wish to hold any risk in their depreciation funds. Thus, we assume these funds include only inflation-indexed UK long-term government bonds, which on average earn a 2 per cent real interest rate.[2]

50. **These assumptions imply an annual depreciation cost of 2.35 per cent of insurance replacement value.**

51. Thus, of the 121 HEIs in the 2002-03 EMS with full data, **the mean depreciation cost is £50.20 per m^2 of non-residential estate.** The standard deviation is £19.00.

52. Since we have constructed both maintenance and depreciation costs as fractions of IRV, both costs vary across HEIs. Figure 2 shows the distribution of these costs across the HEIs.

Figure 2 **Maintenance and depreciation costs for net internal non-residential space**



Source: London Economics and EMS

[2] The Bank of England (www.bankofengland.co.uk) provides data on yields on UK inflation-indexed bonds. From 2000 to April 2004, average yields on bonds of different maturities range from 2.38 per cent (2.5 year maturity) to 2.02 per cent (25-year maturity). To remove all risk to their ability to replace their buildings, HEIs may wish to hold bonds with maturities equal to their buildings' lives. This would imply HEIs held only long-term government bonds. Thus, the yield on 25-year inflation-indexed bonds most closely approximates the real interest rate available to HEIs wishing to hold no risk to their ability to replace buildings.

Sustainable estate provision for the HE non-residential estate

53. The sum of operating, maintenance and depreciation costs is the sustainable estate provision.

54. Full funding of the sustainable estate provision would be sufficient for an HEI to maintain its estate fit for purpose and in good condition indefinitely, since this would enable the HEI to pay its operating and maintenance costs, pay for periodic refits, and replace buildings at the end of their lives. On the basis of our assumptions, we estimate the sustainable estate provision for the HE non-residential estate to average £147.40 per m^2, that is:

> £43.80 (operating cost) + £53.40 (maintenance cost) + £50.20 (depreciation cost) = £147.40

It is important to note, however, that even if an HEI's estate is of a sustainable size, it may not be of an optimal size. This is because the sustainable estate provision excludes the opportunity cost of funds tied up in the estate.

55. To determine the total estate provision for the non-residential estate, and hence its optimal size, HEIs must consider the cost of the capital that is tied up in the estate. This rationale underlies the use of capital charging in the private sector. For example, the Royal Institution of Chartered Surveyors, RICS, recommends companies charge their business units the full market cost of the space they use.[3] Successive UK governments have also used this rationale to introduce capital charges in the NHS (1991) and in central government (since 1999-2000), as part of the Treasury's move to Resource Accounting and Budgeting (RAB).

56. For example, HM Treasury (1998) states:

> 'Capital charging will embody for public services the disciplines faced by the private sector to manage assets well' and,

the Ministry of Defence, MOD (2002) states:

> 'Under RAB, the MOD's budgets and accounts display the full cost of holding and using capital. This means a charge for depreciation – using up an asset – counts as part of the budget, as does a cost of capital charge, reflecting the fact that we have tied up in fixed assets, capital that could have been used elsewhere.'

57. In the next section, we discuss in greater detail how the opportunity cost of capital is estimated.

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[3] For example, RICS (2002) states (p.51) 'What owner-occupiers should do is firstly value the property they own at current market rates; secondly, calculate the appropriate market rent that they would be paying if they did not own the property (often referred to as the "imputed rent"); calculate all the other property costs they pay, such as taxes and facilities management; and finally pass on the full costs of property usage to the business units via internal charging.'

The opportunity cost of capital

58. The opportunity cost of capital is the flow of earnings an HEI forgoes by owning a building rather than selling it and investing the proceeds.[4] Therefore, to find the opportunity cost of the capital tied up in the estate, it is necessary to estimate the price that the various parts of the estate would fetch in the market place.

59. Selling a building and investing the proceeds produces the flow of funds Pi, where P is a building's market price and i is the interest rate. However, owning a building produces the capital gain Pa, where a is the expected rate of appreciation in the building's price. Thus, the flow of earnings forgone by owning rather than selling a building is $P(i-a)$.

60. To estimate the opportunity cost of capital, we require estimates of P, i and a.

Constructing the space value P

61. P is the open market value (OMV) of each HEI's estate. This is the largest amount of funds that could be gained from selling the estate.

62. Data on the market prices of HEI estates are not available across the sector, however. The EMS data do not provide market prices of estates, and HEI accounts typically list their buildings at historical cost rather than market price.[5]

63. In the absence of open market values for HEI estates, alternative values can be used to proxy for P. Without data on P, we cannot be sure how these proxies relate to P. We can, however, make some educated guesses, based on the construction of these proxies.

Proxies for *P* – market prices of office buildings

64. Sale prices of office buildings provide a reference value for the market price of parts of HEI estates. Data on sale prices per m^2 of office buildings in 2003 show that these prices differ substantially across towns and for different buildings in the same town.[6] Their overall range is wide, from £936 per m^2 to £5,632 per m^2.

65. HEI estates may have lower market prices than purpose-built office buildings as some HEI buildings are of a specialist design that would be costly to adapt for private sector use.

Insurance replacement value

66. Our discussion of depreciation costs noted reasons why IRV may differ from a building's replacement costs. There are other reasons why it may differ from the market price P:

- first, in principle IRV reflects the cost of building replacement buildings, and thus excludes the value of land beneath a building

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[4] We understand that some HEIs are strongly of the view that, for various reasons, their estate could not be sold. While we present the general approach in this section, we will address such special situations later on.

[5] Several HEI annual accounts can be accessed via http://bufdg.niss.ac.uk/pub/accountsurls.html.

[6] These prices are given in Knight Frank's UK Research Reports at http://www.knightfrank.co.uk.

- second, IRV may reflect the value to an HEI of its historical buildings. This may exceed their value to alternative users, and thus their market price
- third, and importantly, the IRV could be higher than *P* because it does not reflect the age and obsolescence of much of the HE estate.

67. **The mean IRV of non-residential estate is £2,188 per m^2** across the institutions providing IRV information in the 2002-03 EMS.

68. In some cases the IRV may be roughly comparable to what an estate's market value would be, but in others it could be above or below depending on alternative use assumptions and the local property market.

Rateable value and underlying capital value

69. As noted earlier, in principle the rateable value of a property used by its owner reflects the rent a property could fetch in the market. This rent is based on observed market rents for similar properties if available or, in cases where there is little or no comparable evidence, on an estimate of the capital value of the building and the land, which is often based on the contractor's method of valuation. The 1995 and 2000 rating reviews set the rateable value (RV) on HEI buildings as 3.67 per cent of capital value (Office of the Deputy Prime Minister, ODPM 2003). Thus, we can use RVs reported in the EMS to derive the capital value as calculated for rating purposes.

70. The contractor's method is a depreciated replacement cost of buildings, with an addition for land value (ODPM 2003). However, the land is not included at its market price. Rather, the land is priced at a level with 'a site which would enable the HEI to function equally well' (Valuation Office Agency, VOA, 2003). But, such a site may be some distance from the HEI's actual location and could be cheaper.

71. For the 121 HEIs in the 2002-03 EMS with complete data, **the average capital value underlying the rateable value is £902 per m^2 of non-residential estate.** This is lower than the average IRV.

Depreciated replacement cost valuations

72. Depreciated replacement cost (DRC) valuations would provide another measure of the value of HEI buildings. However, it would exclude the value of the land beneath these buildings. We asked several HEIs for DRC valuations of their estates, but only some have them.

73. One HEI supplied us with data on alternative valuations of its estate, as follows:

- IRV £48.19 million
- DRC £25.72 million
- OMV £10.55 million
- capital value for rating of £25.1 million.

Conclusion

74. In our sample calculation of the total estate provision, we use the capital values underlying rateable values as the basis for calculating the opportunity

cost of capital. These are readily available, estimated by third parties and easy to use. It is, in theory, an estimate of the market value of an HEI estate, though the method of valuing land in the estate suggests it may differ from the true market value.

75. Ideally, in their own calculations, HEIs should use accurate and up-to-date open market valuations of their estates to establish the cost of capital tied up in them. While this may not be current practice, we note that NHS capital charges for users of the NHS estate are based on regular revaluations of land and buildings, at market value where possible and otherwise at DRC (NHS Estates 2003).

76. Next, we address the issue of the yield (interest rate) to be used in estimating the cost of capital.

Constructing forgone interest (*i-a*)

77. We calculate the cost of forgone interest *i-a* assuming that, if an HEI sold some of its estate, it would wish to hold the same amount of risk in its financial portfolio after the sale as it had before.

a. We start by assuming the HEI holds a portfolio of real estate, equity and bonds. Our baseline assumption for our illustrative example is that its portfolio is split 60:20:20 between the three assets.

b. Next we calculate the expected return and variance of the HEI's portfolio given these portfolio shares and data on returns for real estate, equity and bonds from 1971 to 2003 from Investment Property Databank, IPD (2004).[7]

c. We then assume the HEI sells real estate worth 1 per cent of its portfolio, and reallocates the proceeds to a mix of equity and bonds so that the spread of its portfolio is the same as before the real-estate sale.

d. Forgone interest *i-a* then equals the increase in the expected return on the HEI's portfolio (multiplied by 100 since we assume 1 per cent of the portfolio was reallocated).

e. If the typical HEI initially holds a 60:20:20 portfolio in real estate, equity and bonds respectively, then (*i-a*) = 5.1 per cent in real terms.

78. This approach is theoretically coherent. However, deficiencies in data on real estate returns create some problems. For example:

a. The variable *a* represents expected price appreciation on an HEI's estate. Without specific data on these price expectations, we use the average historical capital gain on UK commercial real estate as a proxy for a. This average may differ from the expected price appreciation on a given HEI's estate.[8]

b. Since buildings are sold infrequently, historical data on real estate prices depend heavily on agents' valuations. It is reported that these valuations

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[7] In these data, the geometric mean real returns on equities and government bonds are 5.8 per cent and 3.6 per cent respectively. The geometric mean capital gain on real estate is -2.1 per cent.

[8] If the value of the estate is based on the contractor's value the price appreciation will reflect both the increase in construction costs (which affects the value of the structures) and the increase in land prices.

tend to be less volatile than actual sale prices (Booth and Matysiak 2001). Thus, our data may understate the risk to holding real estate.

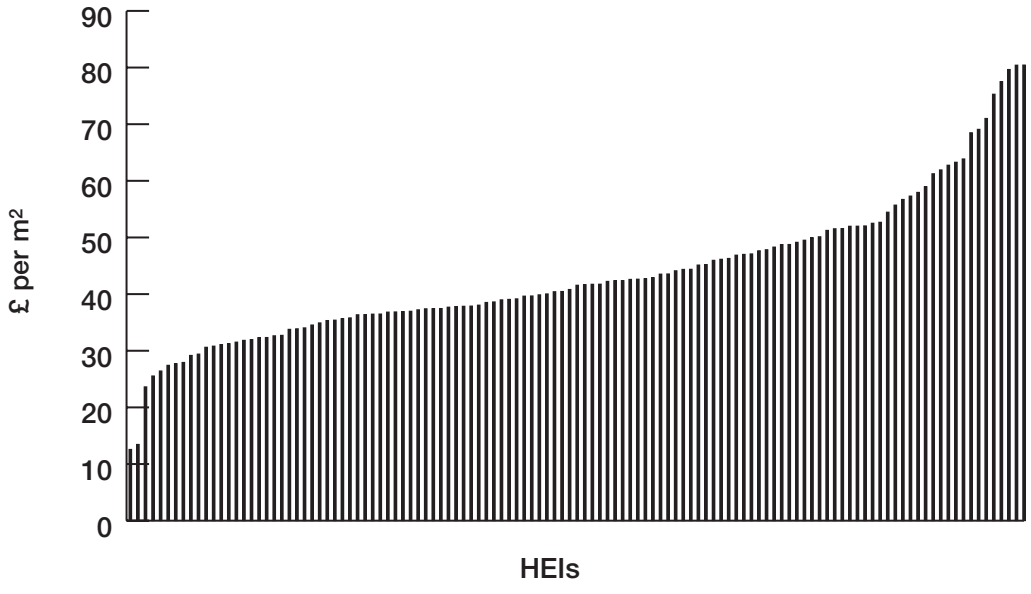
c. The forgone interest term (*i-a*) can vary greatly according to the HEI's assumed initial portfolio. For example, if the initial portfolio is split 90:5:5 between real estate, equity and bonds, *i-a* = 14.7 per cent. This shows that such an HEI has a strong motive to sell some real estate so as to reduce the overall risk of its portfolio.

d. Average future returns on financial assets may differ from their historical averages.

Estimates of the opportunity cost of capital in HEI estates

79. As we have just noted, our baseline assumptions imply that (*i-a*) = 5.1 per cent. For simplicity we have rounded this to 5 per cent. This implies that, using the underlying capital values calculated for rating purposes as a proxy for *P*, for the 121 HEIs with complete data in the 2002-03 EMS **the average cost of capital on non-residential estate is £45.10 per m².** The standard deviation is £17.70. Figure 3 shows the distribution of the opportunity cost of capital per m² across HEIs, using the capital value underlying rateable value as a proxy for market price.

Figure 3 **Opportunity cost of capital using contractor's value as a proxy for market price**



Source: London Economics and EMS 2002-03

What if the estate cannot be sold?

80. Some representatives of the HE sector expressed concern that HEIs could not always dispose of space. For example, some buildings were donated to HEIs under covenants that prohibit their use for non-educational purposes. Further, it was noted that 'Exchequer Interest' in buildings could in principle mean all revenues from disposing of space reverted to the Treasury, rather

than to the HEIs that sold them. If this were true the buildings would have no value or only a negligible one in terms of determining the opportunity costs of the funds tied up in the estate.

81. A full investigation of HEI options for disposing of space goes beyond the scope of this report. However, we believe that, in many cases, HEIs could dispose of space and retain the proceeds. It is rare that buildings have no value. HEIs may be able to change the terms of covenants on building use, although this may involve long and difficult procedures, or sell space that is not restricted by covenants. Further, the rules of Exchequer Interest permit HEIs to retain revenues from selling or letting space, so long as these revenues are reinvested in the HEI's estate (HEFCE 2003d).

82. Where HEIs are unable to dispose of space, the opportunity cost of space may fall below the total estate provision figures this report quotes, but this is not necessarily the case. The following hypothetical example illustrates this point.

83. Suppose an HEI owned some space and rented the remainder at market rents. Ignoring the many other factors that may be in play, space users would be willing to pay as much as the market rent to use the HEI's owned space. For each unit of owned space used, space users would reduce their bill for external rent by the market rent for a similar unit. Thus, if an HEI rents some space at the market rent, the opportunity cost of its owned space equals the market rent, which in principle equals the total estate provision estimated by this report.

84. Alternatively, an HEI may own all its space. If such an HEI had an internal market for space, space user bidding would set a price in this market that reflected the willingness to pay for space. This price could either be equal to or lower than the market rent for external space. However, without an internal market, it would be difficult for outside observers to determine user willingness to pay for space. If the HEI set a space charge of say £100 per m^2, and space users left some space empty, we would know only that space users were willing to pay less than £100 to use marginal units of space.

85. To summarise, we believe that in many cases, HEIs can dispose of space, so that the total estate provision estimated by this report typically reflects the cost of space at these HEIs. Even if HEIs could not dispose of space, the cost of their space would equal the total estate provision in some circumstances. In other cases, the cost of space would fall below the total estate provision estimated here, but would be difficult or impossible to estimate without further information on the space users' willingness to pay for the use of the space.

Total estate provision for the HE non-residential estate

86. To recap, the total estate provision is equal to the sustainable estate provision plus the opportunity cost of capital. Therefore, on the basis of our assumptions, we estimate the total estate provision for HEI space per m^2 of non-residential estate to average £192.50 using 2002-03 data:

> £43.80 (operating cost) + £53.40 (maintenance cost) + £50.20 (depreciation cost) + £45.10 (cost of capital) = £192.50.

87. This average total estate provision of £192.50 greatly exceeds the £84.30 'total property costs' quoted in the EMS institutional report 2004, and UK HEIs' current internal space charges. For example, the Newcastle University Space Management Project Report (2002) found the highest space charge to be £130 per m^2 in the six HEIs it surveyed. The median space charge found in the recent survey of space management practices carried out as part of this Space Management Project was £126 per m^2.

88. Space users may feel that raising space charges from around £130 to the total estate provision of around £200 would damage HEIs. For example, the Newcastle report (2002) refers to the 'unpalatable effects' of charging departments a cost of capital.[9]

89. However, as this report later explains, setting a space charge at the level of the total estate provision could benefit HEIs and their space users. It could also allow HEIs to determine the optimal size of their estates.

Sustainable estate and total estate provisions by type of space

90. The following sections apply the methodology for determining the sustainable estate and total estate provisions to the following space categories:

- general purpose teaching space
- specialist teaching space
- teaching office space
- research space
- learning resource centre space
- other support space.

91. We use estimates from various sources to calculate the cost of space in these sub-categories of the estate. These estimates are discussed more extensively in each of the following sub-sections.

Operating costs by type of space

92. In the absence of hard data on operating cost by type of space, we used statistical methods to arrive at total operating cost. We allocated total operating costs across the various space categories on the basis of the results of econometric regression analysis, relating an HEI's total operating cost to the shares of different type of space in the total non-residential estate. Table 1 reports these estimates.

[9] The Newcastle report (2002) notes that higher space charges are 'more effective' in provoking departments to release space, as is to be expected. However, it would not be to an HEI's advantage to make space charges arbitrarily high for this reason.

Table 1 **Average operating costs by type of space**

Type of space	Average operating costs £ per m²
Total non-residential estate (from Section on operating costs, paragraph 37)	43.80
General purpose teaching space	35.50
Specialist teaching space	41.20
Teaching office space	17.50
Research space	48.80
Library/Learning resource centre space	50.50
Other support space	24.40

Source: London Economics

Maintenance costs by type of space

93. As in the case of the total non-residential estate, we have used the BMI benchmark maintenance figure of 2.5 per cent of capital value. To calculate recommended maintenance costs, we require information on IRV by type of space.

94. To estimate IRVs by type of space, we use Building Cost Information Service (BCIS) data on the cost of building different types of space (BCIS 2003). Data from 2003 were used for consistency with the 2002-03 EMS data. We calculated that if the entire estate across the HE sector were valued at these new-build prices, the HE estate would be worth only 0.53 of its IRV. Therefore, we have divided the BCIS new-build prices by 0.53 to scale them up to the total IRV of the sector's estate. We estimate the required maintenance cost for each type of space to be 2.5 per cent of this scaled-up new-build cost. The BCIS new-build price for each type of space and the type-specific maintenance costs we estimate are shown in Table 2.

Table 2 **Average maintenance costs by type of space**

Type of space	New building cost, £ per m² (1)	Average maintenance cost, £ per m²
Total non-residential estate (from Section on maintenance costs, paragraph 42)		53.40
General purpose teaching space	920	44.20
Specialised teaching space	1,238	59.40
Teaching office space	920	44.20
Research space	1,312	63.00
Library/Learning resource centre space	1,040	49.90
Other support space	900	43.20

(1) New-build tender price from BCIS (2003).

Source: London Economics

Depreciation costs by type of space

95. As in the case of the total non-residential estate, we calculated depreciation costs by applying a depreciation rate to our space-specific IRVs.

96. The depreciation rate itself is a function of the life of a building, the type of space housed, the number of refits undertaken in each building's life, and the interest rate the accumulating funds earn.

97. In the section on depreciation costs (paragraph 49), we assumed that all buildings have lives of 60 years and undergo three major refits. In our example here, we apply the same assumptions to each type of space except research space. In the example, we also assume research space has a life span of only 30 years, and undergoes only one refit, after 15 years.

98. The depreciation costs of the various types of space obtained on the basis of these assumptions are shown in Table 3.

Table 3 **Average depreciation costs by type of space**

Type of space	Average depreciation costs, £ per m²
Total non-residential estate (from Section on depreciation costs, paragraph 51)	50.20
General purpose teaching space	40.70
Specialised teaching space	55.00
Teaching office space	40.70
Research space	85.60
Library/Learning resource centre space	46.00
Other support space	39.80

Source: London Economics

Sustainable estate provision by type of space

99. The sustainable estate provision by type of space is simply the sum of operating, maintenance and depreciation costs by type of space.

100. The estimates reported in Table 4 show that, on the basis of our assumptions, the sector-wide average sustainable estate provision by type of space ranges from £102.40 per m² in the case of teaching office space to £197.20 per m² in the case of research space.

Table 4 **Average sustainable estate provision by type of space**

Type of space	Average sustainable estate provision, £ per m²
Total non-residential estate (from Section on sustainable estate provision paragraph 54)	147.40
General purpose teaching space	120.40
Specialised teaching space	155.60
Teaching office space	102.40
Research space	197.40
Library/Learning resource centre space	146.40
Other support space	107.40

Source: London Economics

Opportunity cost of capital by type of space

101. As in the case of total estate, we define the opportunity cost of the various types of space as the costs of the funds tied up in the estate.

102. To determine the value of each space type we have allocated the capital value (for rating purposes) of the total non-residential estate to each type using the same method as in the allocation of the IRV. We have used an interest rate of 5 per cent to find the opportunity cost of capital in our example. Table 5 shows the resulting costs of capital for each type of space.

Table 5 **Opportunity cost of capital by type of space**

Type of space	Opportunity cost of capital, £ per m²
Total non-residential estate (from Section on the opportunity cost of capital, paragraph 79)	45.10
General purpose teaching space	36.70
Specialised teaching space	49.30
Teaching office space	36.70
Research space	52.30
Library/Learning resource centre space	41.40
Other support space	35.90

Source: London Economics

Total estate provision by type of space

103. Finally, Table 6 presents estimates for the total estate provision based on our assumptions. These range from about £143.3 per m^2 for teaching office space to £249.7 per m^2 for research space.

Table 6 **Total estate provision by type of space**

Type of space	Total estate provision, £ per m^2
Total non-residential estate (from section on total estate provision, paragraph 86)	192.50
General purpose teaching space	157.10
Specialised teaching space	204.90
Teaching office space	139.10
Research space	249.70
Library/Learning resource centre space	187.86
Other support space	143.30

Source: London Economics

Benefits of charging the total estate provision

104. Raising space charges to the total estate provision could benefit all space users provided a suitable compensation scheme accompanies the policy. Such a scheme would involve HEIs returning the cost of capital component to space users such as departments through an increased internal grant. This would exactly compensate departments for the higher space charges they faced. Departments would be no poorer than before, and would still be able to afford their previous space allocation. However, departments would face a higher reward for releasing marginal units of space, which would be to their benefit. Thus, a compensated price increase would make all departments better off or at least no worse off than before.

105. Annex 1 illustrates how such a compensated increase in space charges would work, first graphically and then in a numerical example.

Optimal choices at departmental level

106. Setting space charges would also allow an HEI to determine its optimal estate size. The logic of this result is that, if departments faced the total cost of space, they would face the same trade-off between buildings and other factors as the HEI faced as a whole. Facing this cost, a department's optimal choices would also be optimal for the HEI overall. By contrast, if a department were to face a space charge below the cost of space to the HEI, it would tend to choose more space than was optimal for the HEI overall.

Pros and cons of the devolved budget

107. These arguments assume that departments have devolved budgets. If so, they could retain funds saved by releasing space, and would thus have some incentive to do so. Sector representatives have pointed out to us, however, that creating many devolved budgets within HEIs may cause problems. It may be difficult to ensure that funds are being used appropriately and there may be missed opportunities to economise by purchasing in bulk. Such problems would have to be taken into account in any move to greater devolution of budgets.

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Annex 1

Economic theory of optimal space use

Graphical example

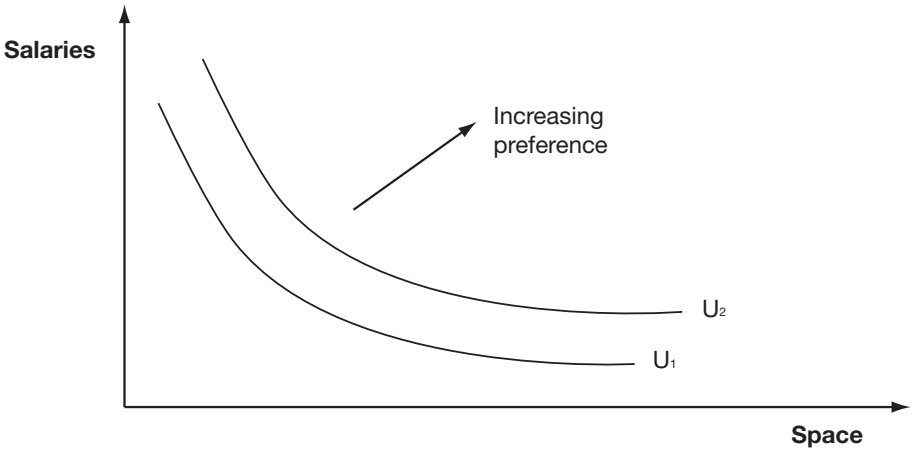
1. Figure 4 depicts possible resources for an HEI department. Salaries are on the y-axis and space on the x-axis. Thus, each point on Figure 4 represents a different combination of salaries and space.

2. The department prefers more of each resource to less. The arrow in Figure 4 shows that this implies the department prefers points lying to the north-east (more space and higher salary).

3. The curved lines labelled U_1 and U_2 are 'indifference' curves. The department is 'indifferent' between the combinations of salaries and space along any one indifference curve. These curves are bowed in towards the origin because departments prefer to have a roughly equal combination of salaries and space to having mostly salaries and little space or vice versa.

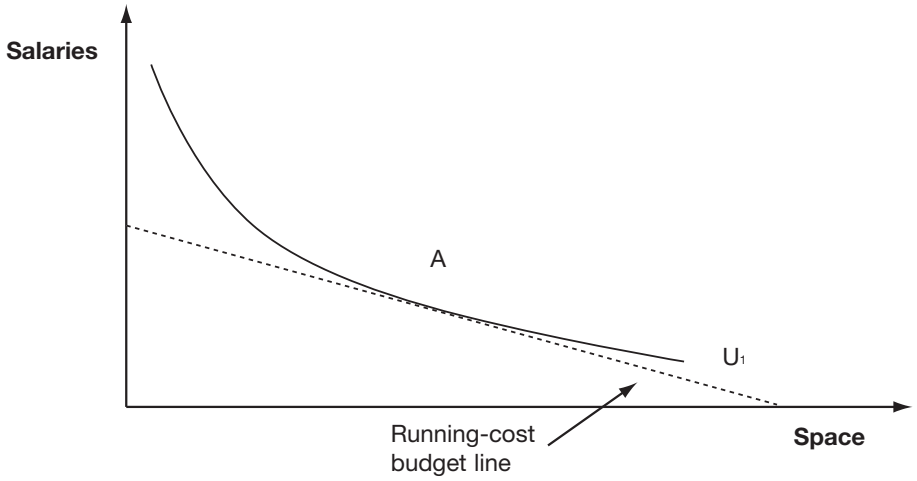
4. Since curves further to the north-east reflect greater happiness for the department, it would prefer any point on curve U_2 to any point on curve U_1.

Figure 4 **A department's preferences for salaries and space**



5. Figure 5 shows the budget of a department that faces a space charge equal to the running cost. The department can afford any point on or to the south-west of its budget line (the dotted line). At point *A*, the department reaches the highest indifference curve possible under its budget. Thus, at *A* the department is as satisfied as it can be given its budget and space charge.

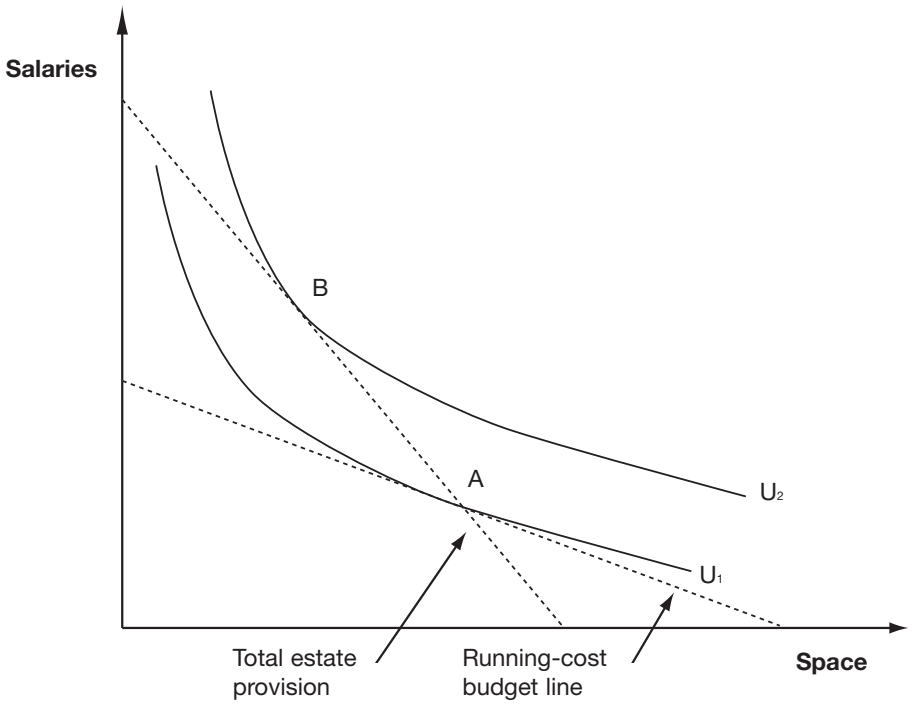
Figure 5 **Space charged at running cost**



6. Figure 6 shows both the budget line under a space charge equal to the running cost of space and another budget line equal to the total estate provision. This budget line is steeper, since the department must now give up more in salaries to gain each additional unit of space.

7. Both the running cost and total estate provision budget lines run through point *A*. This is because the HEI compensates the department for the increase in its space cost by increasing the department's budget. Thus the department can still afford the salary-space combination at point *A* under the total estate provision budget line.

Figure 6 **Space charge using the total estate provision**



8. Under the total estate provision budget line, the department can reach the higher indifference curve U_2. It reaches this level of satisfaction at point B. Thus, if the department is charged a space charge equivalent to the total estate provision and compensated for this higher space charge:

- the department reaches a new allocation of salaries and space that it prefers to its previous allocation. It cannot be worse off than before since it may still choose its old allocation
- the department will typically choose less space and more money for salaries than it did when it had a lower space charge.

Numerical example

9. This is an entirely hypothetical example.

Assumptions

10. An HEI has an annual income of £105 million and owns 100,000 m^2 of net internal space. Depreciation costs £50 per m^2 or £5 million for the HEI's estate. The HEI places this sum into an account to pay for building refits and replacement. Operating and maintenance costs total £100 per m^2. The total estate provision is £400 per m^2.

Space charged at running cost

11. Under running-cost space charging, the HEI charges £100 per m^2 for space and gives each of its 10 departments £10 million.

12. With this income and space price, each department chooses to use 10,000 m^2 of space, paying £1 million in space charges (10,000 m^2 @ £100 per m^2).

13. Each department has £9 million left for salaries.

14. The HEI's books balance, since it recovers its running costs from its departments. Its estate is sustainable, since it pays its depreciation costs. Yet it could use space more efficiently, as the next section shows.

Space charged at the total estate provision

15. The HEI could, alternatively, charge £400 per m^2 for space and give each of its 10 departments £13 million.

16. With this income and space price, each department could still use 10,000 m^2 and spend £9 million on salaries. Thus, they cannot be worse off than they were before.

17. Now that space is more expensive, however, they are likely to choose less space, for example 8,000 m^2 each, paying the HEI £3.2 million each in space charges.

18. The departments would then each have £9.8 million left for salaries.

19. If departments choose this allocation over their initial allocation of space and salaries, they must be better off.

20. The HEI's books would balance so long as it let the 20,000 m^2 released by departments to the private sector at a running-cost-inclusive rent of £400 per m^2.

21. The HEI could not compensate departments for further price increases, since it cannot let released space for more than £400 per m^2.

22. Thus, the HEI would now be using its space as efficiently as possible.

23. Therefore, the departments would have indicated that the HEI's optimal estate size was 80,000 m^2.

Conclusion

24. If HEIs raise their space charges for departments to the total estate provision, while compensating departments by increasing their budgets, departments will be better off than they were before.

25. We can think of the HEI as raising the reward for releasing space; this is what achieves the efficiency improvement.

26. This choice leads to the most efficient use of space possible; the HEI could not afford a higher reward for releasing space.

27. The graphical and numerical examples assume an HEI could retain rent earned on space it let out. If there is Exchequer Interest in this space, however, HEIs may have to give such rental income to the Treasury.

28. If so, the HEI would not gain from charging a space cost higher than the running cost plus the depreciation cost.

29. It is not clear that the Treasury would claim HEI rental income on buildings with Exchequer Interest, however. The HEFCE Financial Memorandum (HEFCE 2003d) allows HEIs to retain funds derived from renting or selling space with Exchequer Interest if these funds are used for capital expenditure on estates.

Annex 2

TRAC and the SMG Model of the Affordable Estate

This note clarifies the differences between the Space Management Group's (SMG's) Model of the Affordable Estate and the Transparent Approach to Costing (TRAC) methodology. The two methodologies have different applications and therefore we have not attempted to combine them.

In brief, the SMG model is an estates planning and forecasting tool to support institutional strategic development. By contrast, TRAC is a retrospective device, at institutional level, to measure full economic cost of teaching and research. TRAC addresses all costs of HEI activity, while the SMG model deals solely with estates costs.

The SMG model uses existing Estate Management Statistics (EMS) and Higher Education Statistics Agency data sets. It does not cause additional burden to institutions, because there is no requirement by institutions to provide a formal submission to HEFCE.

In addition:

a. Data source – While the SMG Model of the Affordable Estate uses EMS as the core data, TRAC takes data from the audited financial statements as its starting point. TRAC also uses Insurance Replacement (IRV) as the start point to calculate the buildings infrastructure adjustment.

b. Routine maintenance – The SMG model uses an appropriate percentage of IRV to indicate the level of expenditure which should be allowed for under good practice, rather than actual spend. TRAC uses actual expenditure.

c. Depreciation – The SMG model uses an appropriate level of IRV as a theoretical aspect. In TRAC, depreciation is based on IRV too, but also includes an infrastructure adjustment.

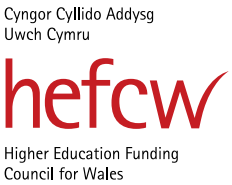
d. Cost of capital element – The SMG model recognises the cost of capital as the flow of earnings an HEI foregoes by owning a building rather than selling it and investing the proceeds elsewhere. SMG recognises it as a necessary future allowance and calculates it as an adjusted view of rateable value for non-rented property. The Cost of capital element in TRAC is still under review.

Consequence of differences

The SMG model uses a different terminology to TRAC to avoid confusion with the TRAC definition of full economic costing (fEC). The SMG model uses the terminology of Sustainable Estate Provision and Total Estate Provision, thus differentiating between an actual cost (the fEC in TRAC) and the 'provision' which is calculated under the SMG model.

List of abbreviations

BCIS	Building Cost Information Service
BMI	Building Maintenance Information
DRC	Depreciated replacement cost
EMS	Estate Management Statistics
HE	Higher education
HEFCE	Higher Education Funding Council for England
HEI	Higher education institution
IPD	Investment Property Databank
IRV	Insurance replacement value
MOD	Ministry of Defence
OMV	Open market value
RICS	Royal Institution of Chartered Surveyors
RV	Rateable value
SMG	Space Management Group
SMP	Space Management Project
VOA	Valuation Office Agency



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