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Measuring the Effectiveness of Information Technology Management: a comparative study of six UK local authorities

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Abstract

Evaluating and managing the effective delivery of IT services is an issue which has been brought into sharper relief recently. This has been particularly prevalent in the UK public sector where the growing emphasis on formalised client-contractor relationships, outsourcing and benchmarking (both between local authorities and between local authorities and private sector organisations) has meant that the definition of service standards and agreeing performance criteria has attracted considerable practitioner attention.

This research is based on 300 interviews conducted in six UK local authorities. The investigation used both gap analysis and perceptual mapping techniques to develop an understanding of the aspects of IT service delivery that users' value most in conjunction with an assessment of how well they perceive their IT department is performing on these criteria. The paper exposes considerable differences in the relative performance of the six local authorities from both the gap analysis and the perceptual mapping elements of the investigation. The methodology is shown to provide an effective way of identifying key performance issues from the user perspective and benchmarking service performance across organisations.

Key words:

Service delivery; local government; effectiveness; benchmarking; perceptual mapping; gap analysis.

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Measuring the Effectiveness of Information Technology Management : a comparative study of six UK local authorities

Introduction

This paper proposes a way of thinking about the management of information systems and especially within the local government community. It presents a framework for the evaluation of information systems effectiveness incorporating all the main stakeholders. This subject is important because it is increasingly clear that the current approach to information systems management has not always produced satisfactory results. Specifically, computer systems take too long to develop, cost too much to produce (Allingham and O'Connor 1992; Lester *et al*. 1993;), and are frequently not perceived to deliver the business benefits which were intended (Heygate, 1993; Attewell, 1993; Brynjolfsson, 1993; Wilson, 1993; Strassman, 1985; Peters, 1988; Parker *et al*., 1989; Hitt and Brynjolfsson, 1994; Remenyi *et al.,* 1995; Willcocks, 1991). These circumstances are not new, having been a central challenge for information systems management for the past thirty years, and they continue to be a major problem in many organisations today.

The IT function of an organisation is involved in the development, implementation and maintenance of numerous information technologies/systems. These systems aim to meet needs at all levels within the organisation. In evaluating the success or effectiveness of the IT department it is necessary to evaluate the performance of the individual systems, and then use the aggregate of the performances on the individual systems as an overall measure of the success or effectiveness of the IT department. In organisations where there is a high degree of decentralisation of the IT function, the evaluation is not focused so much on the IT department but rather on the users of the information systems (Silk, 1990).

There have been continuous attempts to improve both the efficiency and effectiveness with which computer systems are conceptualised, developed and commissioned and although considerable progress has been made the situation is still fraught with many problems (Remenyi and Money, 1993; Remenyi et al, 1995 (a); Remenyi et al, 1997(b)). However, in the second half of the 1990s, these problems require an urgent resolution as it becomes more and more apparent that traditional information system methods no longer fit the way organisations need to conduct their business in an ever-increasingly competitive environment.

From a functional perspective, which has implications for managing the IT function, local authorities are highly complex organisations (Worrall, 1994; 1995). It has been estimated that each year, collectively, local government in the UK spends over £1 billion on information technology (SOCITM, 1996). This is a substantial sum, yet, apart from regular analysis by the Audit Commission, we are unaware of any systematic cross-local authority comparisons of how the users of IT view the relative importance of aspects of their organisation's IS/T strategies or how satisfied they are with how their organisation performs on those criteria. The research presented here

moves some way to filling this gap in our knowledge and is based on questionnaire interviews with IS/T users in six local authorities, the names of which have been fictionalised. The interviews were completed in September 1997 and used a variant of a questionnaire which had been designed and tested elsewhere (see Remenyi and Money, 1991; 1993).

This paper comprises seven main sections. The first section contains a description of the approach used to collect the data and a description of the respondents to the sample in terms of their level in the organisation and their intensity of use of IT. The second section contains an analysis of responses on the importance of factors affecting IS/T effectiveness and a user assessment of organisational performance on these factors. The third section uses factor analysis to reduce the dimensionality of the data, distilling eight factors which can be used to compare the performance of local authorities. In the fourth section, the relationship between an organisation's performance on the importance composite variables produced by the factor analysis on users' overall satisfaction with the IT department is compared in order to assess the relative importance of the derived variables.

In the fifth main section, the local authorities are compared based on their scores on the eight derived variables. In the sixth, a cross-local authority analysis of a number of attitudinal variables is conducted in order to try to explain some of the differences in performance across local authorities that the analysis has exposed. Finally, there is an analysis of the open responses which the questionnaire sought to obtain. This final section is based on a content analysis of the open responses to which correspondence analysis has been applied in order to seek similarities between local authorities and the issues that users have identified within them. The conclusion summarises the main findings.

The Approach and the Characteristics of Respondents

The approach

This research uses a previously validated self-completion questionnaire which is used to undertake two different types of analysis. These are the Parasruramana (1985) and Kim (1990) type gaps to establish levels of user satisfaction, and multivariate analysis techniques such as regression analysis (Lehmann, 1989), factor analysis (Kerlinger, 1969) and correspondence analysis (Greenacre, 1984), to more fully understand the antecedents of user satisfaction.

Given the perennial problem of gaining access to organisations in business and management research, initial contact was through the Society of Information Technology Managers with six local authorities who agreed to participate in the study. The local authorities were the London Borough of Banton, Dunton County Council, Esston County Council, Posham County Council (changing to a Unitary Council), Wrenton Council (changing to a Unitary) and Brinton Council. The interview process took place between July and September 1997. The number of

respondents varied across the responding organisations and this is summarised in Table 2.1.

Table 2.1: Responding local authorities and the number of responses

Local authority	Type of local authority	Responses
Banton	London Borough	52
Brinton	District Council	52
Dunton	County Council	49
Esston	County Council	82
Posham	Unitary Authority	31
Wrenton	Shire District became a Unitary in 1998	29
Total		295

Response varied from 82 valid cases from Esston County Council to 29 valid cases from Wrenton Council. In the analysis that follows, the data were weighted[1] to reflect this differential level of response across local authorities so that each local authority had equal weight.

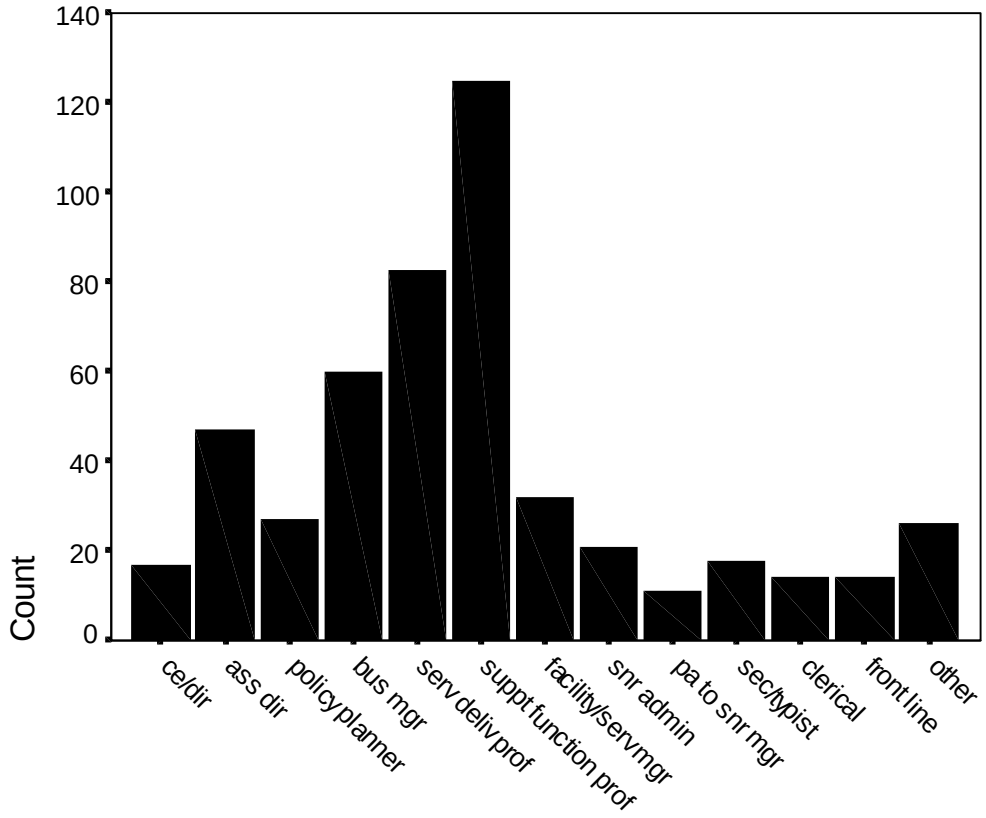
The questionnaire was extensive and comprised seven major components. The first part of the questionnaire elicited information about the respondents such as their level in the organisation, their years of experience working with IT, their intensity of use of IT and 'how comfortable' they felt using IT. The second section of the questionnaire asked respondents to rate how important each of thirty eight attributes[2] were in ensuring the effectiveness of their organisation's IS/T strategy. The third section then went on to ask respondents to rate their organisation's performance on the same thirty eight factors. In sections four and five respectively , respondents were asked to identify how intensively they use various systems in their organisation and how effective they thought those systems were.

The sixth section contained a range of questions to identify, among other things, how well users had been involved in the process of IS/T development, how well existing IT meets the users' managerial and operational needs, users' satisfaction with the training they have received and users' views on how well service level agreements work and their overall opinion of the IT department. The final section of the report gave the users the opportunity to identify how they thought the effectiveness of the IS/T service in their organisation could be improved using an open ended question.

The characteristics of respondents

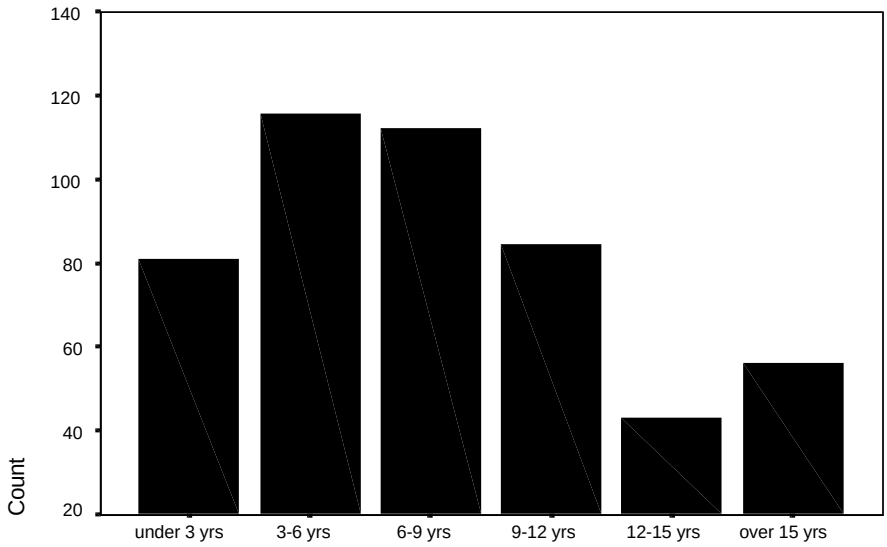
One of the main objectives of the study was to obtain a managerial perspective on the IS/T function in local government. The profile of respondents by their level in the organisation reflects this objective. Almost 13% of respondents were assistant directors and above with a further 54% of respondents being either business unit managers (here defined as service heads), service delivery professionals or support service professionals. Consequently, a clear majority of respondents fulfil managerial roles in their respective organisations. The profile of respondents by their level in the organisation is shown in Figure 2.1.

Figure: 2.1: The characteristics of respondents - organisational level



A second series of questions sought to assess the respondent's background and, in particular, their level of experience and 'comfort' of working with computers. Almost 49% of respondents had been working with PCs for less than or up to 6 years with a further 40% having been working with PCs for between 6 and 12 years (see Figure 2.2). The average respondent had been employed by the respective local authority for 11.1 years and had 7.4 years experience of working with PCs, 4.2 years of experience of working with PCs networks and used PCs or PC networks for an average of 16.2 hours per week.

Figure 2.2: Years working with PCs



The intensity of PC and PC network use was found to vary substantially by organisational level with there being a clear inverse relationship between seniority and the number of hours usage per week. At the top of the organisational hierarchy, Directors and above claimed that they used PCs for an average of 5.4 hours per week though this increased to an average of 27.7 hours per week for 'front line' staff.

The most intensive users of IT in local authorities were thus identified as front line staff, staff who classified themselves as 'other', secretaries/typists, personal assistants and support function professionals. The average number of hours of PC use for each level in the managerial hierarchy is shown in Table 2.2.

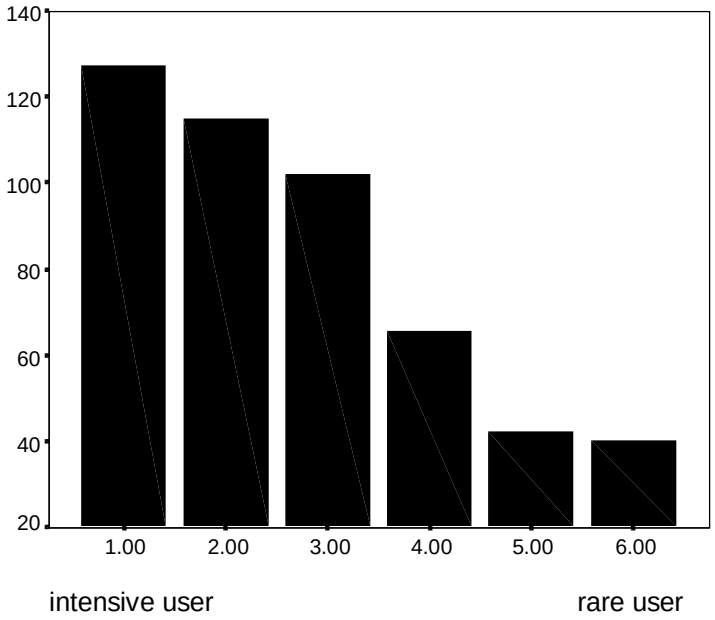
Table 2.2: Intensity of IT use by organisational level

Level in organisation	Intensity of PC use (hours)	Self-assessed intensity of use score
Chief Executive or Director	5.4	2.4
Deputy/Assistant Director	8.5	2.8
Policy/strategic/corporate planner	15.3	4.3
Business Manager/Group Head	12.2	3.7
Service delivery professional	16.5	4.3
Support function professional	18.6	4.6
Service/function/facility manager	12.1	3.9
Senior administrator	16.5	3.9
Personal Assistant	19.2	4.3
Secretary/typist	22.5	5.1
Clerical	18.3	5.4
Customer service/front line staff	27.7	5.7
Other	26.6	5.2
All levels	16.2	4.2

At a rather more subjective level, respondents were asked whether they regarded themselves as intensive users of IT or rare users using a six point scale. In Table 2.3, a high score indicates that a group perceives itself to have a high intensity of use of IT (i.e. the scale in Figure 2.3 has been inverted). It can be seen that Figure 2.3 shows that the majority of users see themselves as intensive IT users with over 49% rating themselves 1 or 2 on the six point scale.

Whether respondents perceived themselves to be intensive or rare users of IT varied by organisational level. This is shown in Table 2.3 where the figures in the final column represent the average score for each group (with a high numerical value indicating that respondents in that group perceived themselves to be high intensity users).

Figure 2.3: Self-assessed intensity of use of IT



The analysis, at the global level, reveals that 30% of respondents rated themselves at the rare user side of the mid-point of the scale and with only 8% classifying themselves as rare IT users. The data in Table 2.3 show that there is a strong relationship between the average hours of PC use per week for each organisational level and the self-assessment of whether groups perceive themselves as intensive or rare users.

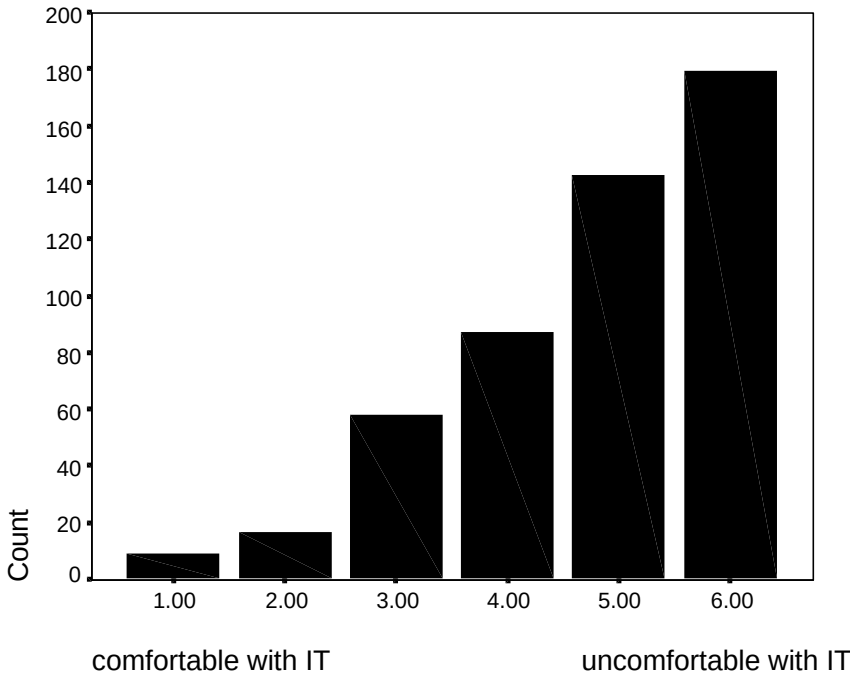
The average hours of PC use for each of the six levels of intensive-rare IT users is shown in Table 2.4. On the basis of this analysis, it would appear that an intense user of IT spends almost 20 times the amount of time using IT than a rare user.

Table 2.3: Average hours of PC use per week by intense and rare users

Self-assessed Intensity of use	Number of respondents (weighted)	Average hours of use per week
1 (intense)	127	27.5
2	115	18.7
3	102	13.6
4	66	10.1
5	42	5.3
6 (rare)	40	1.4
Total	492	16.2

Again, on a more subjective level, respondents were asked to locate themselves on a six point scale in terms of how comfortable or uncomfortable they felt in using IT. The distribution for the entire panel of respondents is shown in the figure below.

Figure 2.4: User's self-assessed degree of comfort with IT use



The figure above reveals that 65% of respondents rated themselves as at level 5 or above on the 'comfort in using IT' scale. Table 2.4 shows how the average comfort score varies by organisational level compared to the overall average of 4.8. While there were substantial differences in hours of IT use and self-assessed intensity of use by organisational level, the average comfort score does not vary substantially across organisational levels. All levels rate themselves, on average, at above 4 on the comfort scale.

Table 2.4: Self-assessed comfort level with IT use by organisational level

Level in organisation	Average 'Comfort score'
Chief Executive or Director	4.3
Deputy/Assistant Director	4.2
Policy/strategic/corporate planner	4.9
Business Manager/Group Head	4.2
Service delivery professional	4.6
Support function professional	5.2
Service/function/facility manager	4.7
Senior administrator	4.7
Personal Assistant to senior manager	4.4
Secretary/typist	4.7
Clerical	5.2
Customer service/front line staff	5.7
Other	5.2
All levels	4.8

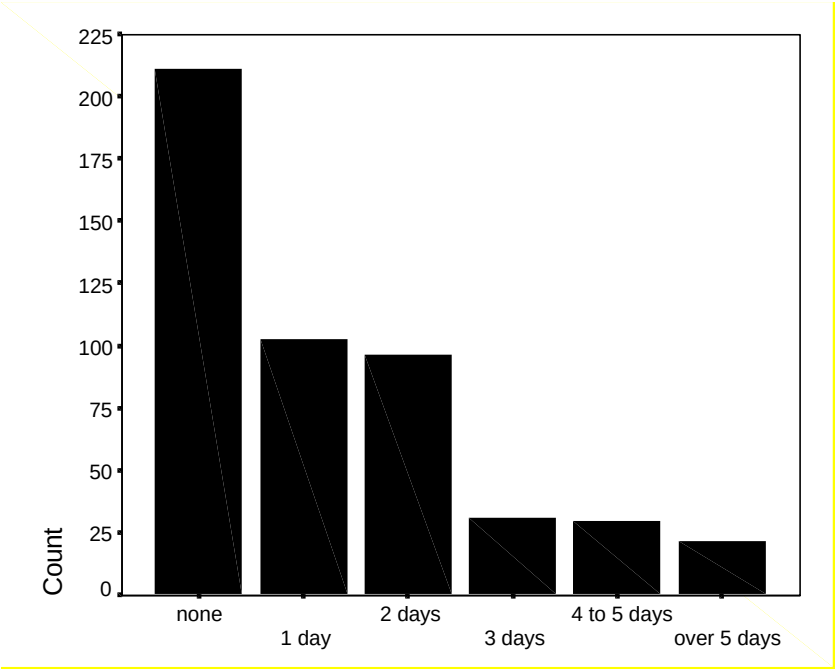
There was, however, a clear relationship between the user's self-assessed level of comfort with IT use and the number of hours of IT use. This shown in Table 2.5 below. Those who felt uncomfortable with IT use are clearly low level users and make significantly less use of IT than those at the other end of the comfort spectrum.

Table 2.5: Average hours of PC use by self-assessed level of comfort with IT use

Self-assessed comfort level with IT use	Number of respondents (weighted)	Average hours of use per week
1 (uncomfortable)	9	0.9
2	16	7.2
3	58	9.0
4	87	12.8
5	142	16.6
6 (comfortable)	179	21.5
Total	492	16.2

An important element in the extent to which IT is integrated within business practice in an organisation is the extent and effectiveness of user training. Respondents to the survey were asked how many days of formal IT-related training they had received in the last year. The analysis revealed that almost 43% of respondents had not received any IT-related training in the last year with a further 40% of respondents only having had less than 3 days formal IT training. In the authors' experience these are very low rates of training.

Figure 2.5: Days of formal IT training in the last year



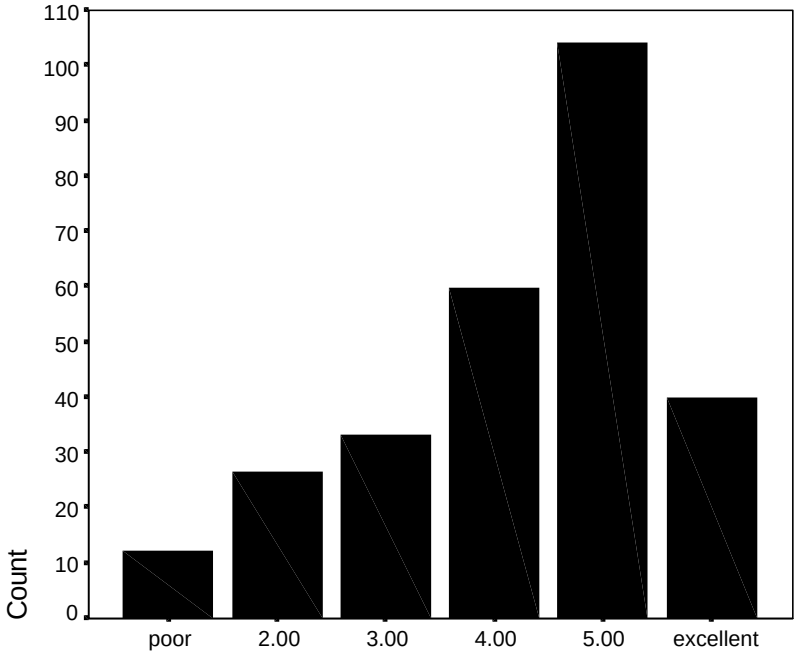
The volume of IT training varied considerably by organisational level with Directors and above only having 0.6 days of formal training on average. The only group to receive less than the Director's level of training was front line staff who, it can be seen in earlier tables, are the most intensive users of IT. This is hardly an expected result and perhaps helps to explains some of the dissatisfaction reported by this category of users later in this study. Clerical, typing and secretarial staff would appear to have the highest volume of formal training of any group of workers.

Table 2.6: Hours of IT-related training received by organisational level

Level in organisation	Days of training received
Chief Executive or Director	0.6
Deputy/Assistant Director	1.2
Policy/strategic/corporate planner	0.6
Business Manager/Group Head	1.0
Service delivery professional	1.4
Support function professional	1.9
Service/function/facility manager	1.3
Senior administrator	1.4
Personal Assistant to senior manager	0.1
Secretary/typist	2.5
Clerical	2.4
Customer service/front line staff	0.5
Other	3.7
All levels	1.5

Above, it was identified that 43% of respondents had not received any IT training over the last year. Those who had received training were asked to comment on the quality of the training they had received using a six point scale ranging from poor to excellent. While the volume of training delivered per capita is low, respondents overwhelmingly proved to be content with the quality of the training they had received. Only 4% of respondents rated the IT training they had received as poor with over 52% assessing the training a 5 or 6 (excellent).

Figure 2.6: Perceived quality of IT training received in the last year



The perceived quality of IT-related training varied considerably by organisational level with front line staff having the lowest level of satisfaction (2.5) of any group and significantly below the level of the next highest category (3.5% for service delivery professionals and clerical staff).

Table 2.7: Perceived quality of IT training received by organisational level

Level in organisation	Average perceived training quality score
Chief Executive or Director	5.6
Deputy/Assistant Director	4.4
Policy/strategic/corporate planner	4.4
Business Manager/Group Head	3.9
Service delivery professional	3.5
Support function professional	4.3
Service/function/facility manager	3.9
Senior administrator	4.8
Personal Assistant	6.0
Secretary/typist	4.4
Clerical	3.5
Customer service/front line staff	2.5
Other	5.0
All levels	4.2

Summary

This section of the report shows clearly that there are distinct patterns of IT usage by organisational level with front line staff being among the most intensive IT users in the panel of respondents. The 'average respondents' uses IT for just over 16 hours per week though there is considerable variation around this by organisational level. The majority of users feel comfortable with IT and this would appear to be explained more by the level of usage of IT than my organisational level where there is little variation in the self-assessed level of comfort with IT.

Perhaps the most important point to emerge at this point is the low level of IT-related training received by the panel. While almost 43% received no training at all, a further 40% received less than 3 days of IT training in the last year. As has been stated earlier these numbers appear to be very low.

The purpose of this section has been to paint a picture of the profile of respondents on the variables discussed above. In the second part of this report, we will analyse what actual and relative importance respondents attributed to thirty eight elements which could be contained in an IT strategy and we then assess how well respondents rated the current performance of their organisation on these thirty eight attributes.

An Assessment of the Importance of Factors Affecting IS and IT Effectiveness and a User Assessment of Organisational Performance on These Factors

One of the main objectives of the research project was to identify the degree of importance that users ascribed to each of 38 attributes integral to the design and development of an IS/T strategy in a local authority. The mean score on each of the 38 attributes was calculated and the attributes were then ranked to give an impression of the relative importance that users ascribed to each of the attributes. The results of this analysis, ranked by the perceived importance of attributes, are shown in Table 3.1.

It is very noticeable that the most highly rated attributes relate, not to the technological components of the IS/T strategy but to many of the 'softer' aspects of the IS/T strategy such as a high degree of technical competence from support staff, ease of access to facilities, fast response from support staff to remedy problems, user confidence in systems and a positive attitude by support staff to users. The majority of the top ten rated attributes are clearly related to the quality of the support service that the IT department can provide.

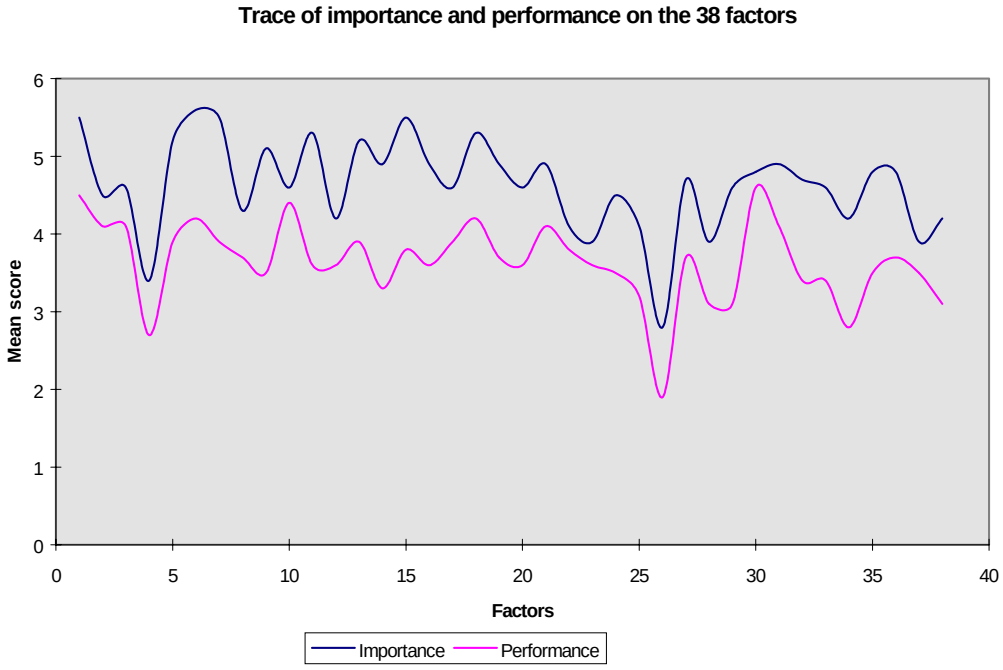
A second element in this section is to measure how well users perceive the performance of their organisation's IS/T strategy on the 38 attributes. The average performance score and the average importance score on each of the 38 factors is also shown in Table 3.1 below. A trace of these scores, both performance and importance, for each of the 38 factors is also shown in Figure 3.1.

Table 3.1: Respondent's assessment of the importance of each factor to the effectiveness of the IS/T strategy and an assessment of current performance

Attribute	Importance Mean score	Performance Mean score
A high degree of technical competence in systems support staff.	5.6	4.2
Ease of access for users to computing facilities.	5.5	4.5
User confidence in systems.	5.5	3.9
Fast response time from systems support staff to remedy problems.	5.5	3.8
Provision for disaster recovery.	5.3	3.6
Positive attitude of information systems/IT staff to users.	5.3	4.2
A low percentage of hardware and software downtime.	5.2	3.9
System's response time.	5.2	3.9
Systems responsiveness to changing user needs.	5.1	3.5
Extent of user training.	4.9	3.3
Participation in the planning of the system's requirements.	4.9	3.6
Users' understanding of the system.	4.9	3.7
Ability of the system to improve personal productivity.	4.9	4.1
The quality of the reports delivered to the user.	4.9	4.1
Use of Windows software (graphical presentation, use of mouse).	4.8	4.6
Systems analysts who know the user's business.	4.8	3.5
Flexibility of the system with regards to both data and reports.	4.8	3.7
Users' willingness to find time to learn the system.	4.7	3.7
Prompt processing of requests for changes to the existing systems.	4.7	3.4
Up-to-dateness of software.	4.6	4.1
Confidentiality of user's own data.	4.6	4.4
Flexibility to produce professional reports.	4.6	3.9
Overall cost-effectiveness of information systems.	4.6	3.6
The monitoring of the IT Department's performance in delivering services to users.	4.6	3.1
The alignment of the information systems plan with the overall corporate plan.	4.6	3.4
Up-to-dateness of hardware.	4.5	4.1
Documentation to support training.	4.5	3.5
The degree of personal control users have over their systems.	4.3	3.7
Procedures for avoiding software piracy.	4.2	3.6
Short lead times for the development of new systems.	4.2	2.8
The measurement of benefits derived by the user from the system.	4.2	3.1
Ability of the system to enrich the working experience of the user.	4.1	3.8
Help with database or data model development.	4.1	3.2
Standardisation of hardware.	3.9	3.6
The use of a service level agreement with the IT Department.	3.9	3.1
Increasing the portfolio of applications.	3.9	3.5
Access to external databases through the system.	3.4	2.7

Ability to conduct computer conferencing with colleagues.	2.8	1.9

Figure 3.1: A trace of the average performance and importance scores on each of the 38 factors



The table and figure above show clearly that in all cases the average importance score is higher than the average performance score and that the two curves mirror each other closely. What is most important, however, is the distance between these two measures in the context of the relative importance of factors. To this end, a new measure was constructed which was the individual's performance score minus their importance score on each variable. The measure of the gap between importance and performance on each indicator is shown in Figure 3.2 and Table 3.2 below and is indicative of the extent of the performance deficit on each measure.

Figure 3.2: Importance of factors and the importance-performance gap

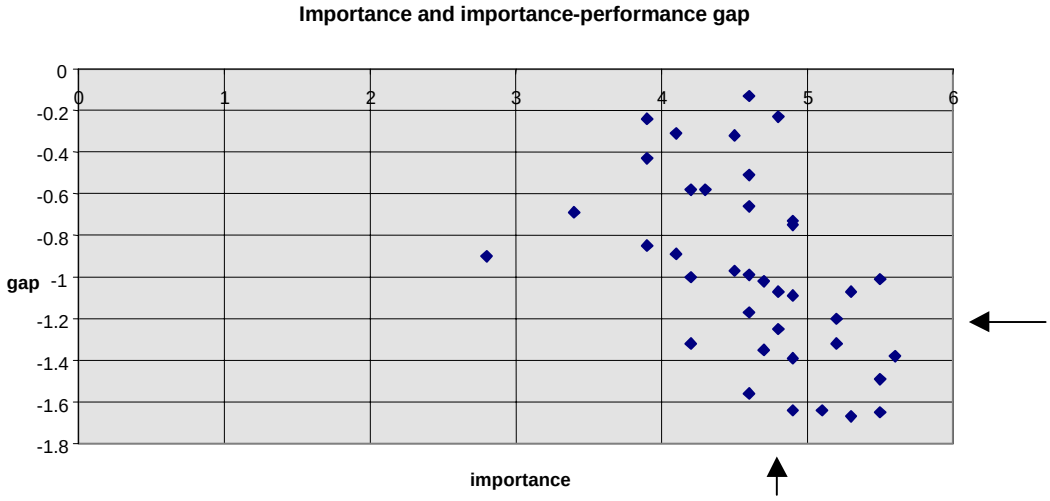

Importance and importance-performance gap
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
gap
0
1
2
3
4
5
6
importance

Table 3.2: The ranked importance of factors and the importance-performance gap

No	Attribute	Importance	Gap
6	A high degree of technical competence in systems support staff.	5.6	-1.38
1	Ease of access for users to computing facilities.	5.5	-1.01
7	User confidence in systems.	5.5	-1.49
15	Fast response time from systems support staff to remedy problems.	5.5	-1.65
11	Provision for disaster recovery.	5.3	-1.67
18	Positive attitude of information systems/IT staff to users.	5.3	-1.07
5	A low percentage of hardware and software downtime.	5.2	-1.32
13	System's response time.	5.2	-1.2
9	Systems responsiveness to changing user needs.	5.1	-1.64
14	Extent of user training.	4.9	-1.64
16	Participation in the planning of the system's requirements.	4.9	-1.39
19	Users' understanding of the system.	4.9	-1.09
21	Ability of the system to improve personal productivity.	4.9	-0.75
31	The quality of the reports delivered to the user.	4.9	-0.73
30	The use of Windows type software.	4.8	-0.23
35	Systems analysts who know the user's business.	4.8	-1.25
36	Flexibility of the system with regards to both data and reports.	4.8	-1.07
27	Users' willingness to find time to learn the system.	4.7	-1.02
32	Prompt processing of requests for changes to the existing systems.	4.7	-1.35
3	Up-to-dateness of software.	4.6	-0.51
10	Confidentiality of user's own data.	4.6	-0.13
17	Flexibility to produce professional reports.	4.6	-0.66
20	Overall cost-effectiveness of information systems.	4.6	-0.99
29	The monitoring of the IT Department's performance in delivering services to users.	4.6	-1.56
33	The alignment of the information systems plan with the overall corporate plan.	4.6	-1.17
2	Up-to-dateness of hardware.	4.5	-0.32
24	Documentation to support training.	4.5	-0.97
8	The degree of personal control users have over their systems.	4.3	-0.58
12	Procedures for avoiding software piracy.	4.2	-0.58
34	Short lead times for the development of new systems.	4.2	-1.32
38	The measurement of benefits derived by the user from the system.	4.2	-1
22	Ability of the system to enrich the working experience of the user.	4.1	-0.31
25	Help with database or data model development.	4.1	-0.89
23	Standardisation of hardware.	3.9	-0.24
28	The use of a service level agreement with the IT Department.	3.9	-0.85
37	Increasing the portfolio of applications.	3.9	-0.43
4	Access to external databases through the system.	3.4	-0.69
26	Ability to conduct computer conferencing with colleagues.	2.8	-0.9

The figure above can be used to identify those measures which are rated as important but which are also characterised by a high importance-performance gap. If an importance score of 4.7 or above and an importance-performance gap score of 1.2 or

above are taken as cut-off points, it can be seen that 11 measures can be isolated (both these levels are arbitrary). These measures are listed below (ranked by importance):

- A high degree of technical competence in systems support staff
- User confidence in systems
- Fast response time from systems support staff to remedy problems
- Provision for disaster recovery
- A low percentage of hardware and software downtime
- System's response time
- Systems responsiveness to changing user needs
- Extent of user training
- Participation in the planning of the system's requirements
- Systems analysts who know the user's business
- Prompt processing of requests for changes to the existing systems

The analysis reveals that these measures are those deemed most important by users where the organisation's IS/T department has the highest performance gap.

An Analysis of the Importance-Performance Scores

The questionnaire sought to elicit views on 38 attributes of importance and performance. The interpretation of the results of these 38 variables is somewhat difficult and so it was decided to apply a data reduction technique (factor analysis) to the importance and performance data in an attempt to:

- identify the latent structure of the satisfaction and importance scores;
- create a set of composite variables to make the analysis more understandable;
- provide a base for the comparative analysis of the six local authorities.

Consequently, factor analysis was applied to the satisfaction and importance data in order to collapse the 38 attributes onto a smaller number of factors. The results of the application of these techniques to the importance and performance data is contained below.

Table 4.1: "Importance" factors and their related attributes

	Factor 1: Systems support	Importance
37	Increasing the portfolio of applications.	3.9
36	Flexibility of the system with regards to both data and reports.	4.8
35	Systems analysts who know the user's business.	4.8
34	Short lead times for the development of new systems.	4.2
32	Prompt processing of requests for changes to the existing systems.	4.7
	Factor 2: Training and service monitoring	
29	The monitoring of the IT Department's performance in delivering services to users.	4.6
24	Documentation to support training.	4.5
14	Extent of user training.	4.9
	Factor 3: Support staff	
18	Positive attitude of information systems/IT staff to users.	5.3
7	User confidence in systems.	5.5
6	A high degree of technical competence in systems support staff.	5.6
	Factor 4: Up-to-datedness	
3	Up-to-dateness of software.	4.6
2	Up-to-dateness of hardware.	4.5
	Factor 5: Enhancing personal effectiveness and alignment	
21	Ability of the system to improve personal productivity.	4.9
20	Overall cost-effectiveness of information systems.	4.6
33	The alignment of the information systems plan with the overall corporate plan.	4.6
	Factor 6: Job enrichment and control	
22	Ability of the system to enrich the working experience of the user.	4.1
8	The degree of personal control users have over their systems.	4.3
	Factor 7: Confidentiality and security	
10	Confidentiality of user's own data.	4.6
11	Provision for disaster recovery.	5.3
12	Procedures for avoiding software piracy.	4.2
	Factor 8: System responsiveness	
5	A low percentage of hardware and software downtime.	5.2
13	System's response time.	5.2

Obviously, in any data reduction process, information is lost. However, in the above case, the first eight factors listed in the table above accounted for over 53% of the variance in the data set. Each factor has been given a label to reflect the common characteristics of the variables which load most highly onto that factor. The first factor groups together a set of variables related to increasing the portfolio of applications, increasing system flexibility, having systems analysts who understand the user's business, having short lead times and the prompt processing of requests for changing existing systems. This single factor accounts for over 23% of the variance in the total data set. The factor to account for the next highest percentage of the total variance can be seen to relate primarily to training and to the monitoring of the IS/T department's performance, while the third factor relates almost exclusively to the attitude and technical confidence of support staff.

A similar type of analysis was undertaken on the performance data set. However, in this case the factors which emerged from the analysis were somewhat different from those that emerged from the importance data set, though there were some similarities.

Table 4.2: "Performance" factors and their related variables

No	***Factor 1: Desktop and reports***	Importance
31	The quality of the reports delivered to the user.	4.9
30	The use of Windows type software (i.e. graphical presentation, use of mouse).	4.8
17	Flexibility to produce professional reports (e.g. graphics and desktop publishing).	4.6
	Factor 2: Support staff	
18	Positive attitude of information systems/IT staff to users.	5.3
15	Fast response time from systems support staff to remedy problems.	5.5
6	A high degree of technical competence in systems support staff.	5.6
	Factor 3: Training and support	
25	Help with database or data model development.	4.1
24	Documentation to support training.	4.5
16	Participation in the planning of the system's requirements.	4.9
14	Extent of user training.	4.9
	Factor 4: Alignment	
33	The alignment of the information systems plan with the overall corporate plan.	4.6
	Factor 5: Facilities	
3	Up-to-dateness of software.	4.6
2	Up-to-dateness of hardware.	4.5
1	Ease of access for users to computing facilities.	5.5
23	Standardisation of hardware.	3.9

The factors listed in the table above account for over 49% of the variance in the data set with factor 1 accounting for 30.8% of the total variance. The factor to emerge which accounted for the highest share of the variance can be seen to relate almost exclusively to reporting at the desktop as the 3 variables which contributed most to this factor being the quality of reports, the use of Windows type software and the flexibility to produce professional reports. The second factor on the performance data mirrors quite closely Factor 3 on the importance data with the positive attitude of IT staff and high degree of technical competence being shared by both factors. Factor 3 on the performance data isolates variables related to both training (the extent of user training and documentation to support training) and thus has some similarities with Factor 2 on the importance data set. The alignment of the information systems plan, however, emerged more succinctly on the performance data set than on the importance data set.

From the analysis, it would appear that the analysis of the importance of certain measures to the IS/T strategy are reducible to 8 factors which are (in order of greatest contribution):

- systems support: the prompt and effective meeting of user needs
- training and service monitoring
- support staff: attitudes and technical competence
- up-to-datedness: hardware and software
- effectiveness and alignment
- job enrichment and control
- confidentiality and security
- system responsiveness

The Relationship Between Performance on the Importance Factors and Overall Satisfaction with the IT Department

If an IT facility is to be managed to improve the overall level of user satisfaction with that Department, it is important to be able to assess the relative contribution of each of the 8 factors to overall satisfaction. To enable this analysis to take place, 8 new variables were constructed (labelled PFAC 1 to PFAC 8) reflecting the 8 importance factors by creating an average score for each respondent based on their performance scores for each of the importance variables that were shown to load onto each importance factor. The variables and their descriptions are shown below:

- PFAC1 - systems support: the prompt and effective meeting of user needs
- PFAC2 - training and service monitoring
- PFAC3 - support staff: attitudes and technical competence
- PFAC4 - up-to-dateness: hardware and software
- PFAC5 - effectiveness and alignment
- PFAC6 - job enrichment and control
- PFAC7 - confidentiality and security
- PFAC8 - system responsiveness

The next stage in the analysis was to use the regression analysis technique to explain overall satisfaction with the organisations' IT Departments by reference to individual's scores on the newly constructed PFAC scores. The output of the regression analysis is shown below (backwards elimination[3] was used to identify the most parsimonious model).

Table 5.1: Overall satisfaction and its relationship with the PFAC variables

Factors	Correlation with overall satisfaction
PFAC1	0.486 **
PFAC2	0.400 **
PFAC3	0.585 **
PFAC4	0.300 **
PFAC5	0.310 **
PFAC6	0.257 **
PFAC7	0.309 **
PFAC8	0.190 **

** significant at the 5% level

Equation 5.1: Regression equation or model of overall satisfaction and the PFAC variables

OS = 0.817 +0.24PFAC1 +0.14PFAC2 +0.60PFAC3 -0.13PFAC6 +0.11PFAC7 -0.17PFAC8
(t=4.03) (t=3.84) (t=3.00) (t=10.49) (t=-2.57) (t=2.27) (t=3.71)

R^2 = 0.411 (Std error 0.8478)

An analysis of the correlation coefficients and the beta parameters of the regression equation reveals that two of the variables (derived from the factor analysis of the importance measures) have particular power in explaining overall satisfaction with the organisation's IT Department. These are:

- PFAC1 - systems support: the prompt and effective meeting of user needs
- PFAC3 - support staff: attitudes and technical competence

In regression model using these two variables, while it has less explanatory power than the six variable model listed above still explains 37% of the variance in overall satisfaction. The statistics derived from this model are shown below:

Equation 5:2: Regression model of overall satisfaction with PFAC1 and PFAC3

OS = 0.78 +0.25PFAC1 + 0.54PFAC3
(t=4.14) (t=4.38) (t=10.10)

R^2 = 0.365 (Std error 0.8749)

The regression coefficient shows that the variable (PFAC3) explains most of the variation in overall satisfaction with the IT Department. This is comprises of :

- Positive attitude of information systems/IT staff to users.
- User confidence in systems.

- A high degree of technical competence in systems support staff.

Synthesis of the factor analysis

The analysis has revealed that the 38 importance attributes can be collapsed into eight factors which collectively account for 53.4% of the total variance in the data set. The eight factors were then used as composite variables with the objective of examining the explanatory power of these variables on a respondent's overall level of satisfaction with the organisation's IT Department.

It was discovered that two composite variables – systems support and support staff - accounted for almost 40% of the variation in overall satisfaction with the organisation's IT department. These factors comprised the following raw variables:

- Positive attitude of information systems/IT staff to users.
- User confidence in systems.
- A high degree of technical competence in systems support staff.
- Increasing the portfolio of applications.
- Flexibility of the system with regards to both data and reports.
- Systems analysts who know the user's business.
- Short lead times for the development of new systems.
- Prompt processing of requests for changes to the existing systems.

Of most importance is the finding that a positive attitude of IS/T staff, user confidence in systems and a high degree of technical competence in support staff emerge as the three most powerful variables.

A Comparison of the Six Local Authorities and Their Performance on the Importance Factors

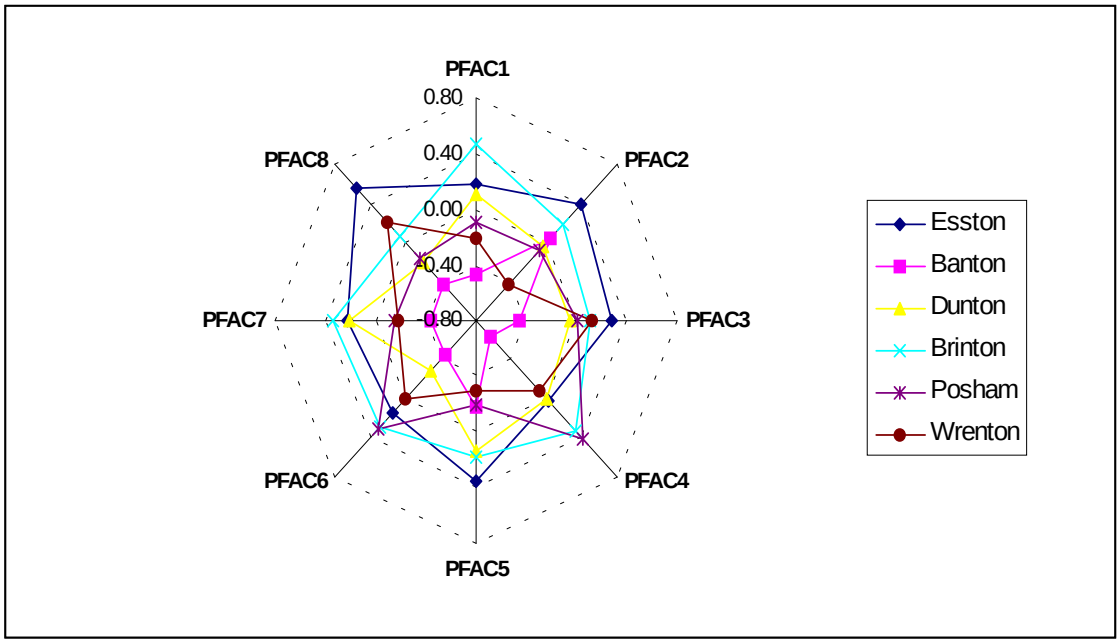
In order to assess the relative strengths and weaknesses of the 6 local authorities within the study, an analysis of how each local authority scored on each of the eight factors (composite variables) was undertaken. The mean score of each local authority on each of the eight factors was computed and the results are shown in the table below.

Table 6.1: Local authority scores on the eight factors

LA	PFAC1	PFAC2	PFAC3	PFAC4	PFAC5	PFAC6	PFAC7	PFAC8
Esston	3.60	3.70	4.41	4.16	4.05	3.91	4.12	4.51
Banton	2.94	3.34	3.68	3.49	3.53	3.33	3.45	3.51
Dunton	3.52	3.25	4.07	4.13	3.84	3.50	4.11	3.73
Brinton	3.89	3.48	4.24	4.46	3.89	4.06	4.23	4.00
Posham	3.32	3.21	4.14	4.53	3.51	4.09	3.74	3.78
Wrenton	3.21	2.86	4.25	4.05	3.41	3.77	3.72	4.16
Total	3.41	3.31	4.13	4.14	3.70	3.78	3.89	3.95

The data in Table 6.1 are shown graphically in Figure 6.1 below as variations around the mean of the total panel of respondents.

Figure 6.1: Radar diagram of local authority performance (difference from the global mean)



The table and figures above indicate some significant differences between the six local authorities (this was analysed using the Bonferroni procedure). From this analysis, Banton emerges as the local authority which fares worst on the majority of the eight factors (PFAC1, 3, 4, 6, 7, 8). On PFAC4 (up-to-datedness of hardware and software), the Bonferroni procedure shows that Banton is significantly different than the other 5 local authorities, on PFAC6 (job enrichment and control) and PFAC3 (support staff: attitudes and technical competence) it is significantly different from all local authorities other than Dunton, on PFAC1 (systems support: the prompt and effective meeting of user needs) it is significantly different from all local authorities other than Wrenton and on PFAC7 (confidentiality and security) and PFAC8 (system responsiveness) it is significantly different from three of the other five local authorities.

The radar diagram in the figure above (where scores are plotted in terms of distance from the average scores for all local authorities) shows clearly that there are radical differences in the traces of the 6 local authorities. Esston and Brinton score highly on the majority of derived variables (factors) while Wrenton, Posham and Dunton occupy the middle ground.

User Involvement, Meeting Managerial and Operational Needs and Overall Satisfaction

The preceding analysis has exposed some significant differences between local authorities on the derived variables constructed out of the 38 basic measures. The purpose of this section is to try to augment the analysis by looking for differences on a number of attitudinal variables about the extent to which users feel that they have been involved in influencing IT developments; about whether users feel that IT meets their managerial and operation needs and users overall opinion of the IT department. An analysis of responses to these questions is presented below.

Table 7.1: Degree of user involvement in influencing IT developments

	Esston	Banton	Dunton	Brinton	Posham	Wrenton	Total
High	31.7	19.5	14.5	11.1	9.9	15.9	17.1
2	29.3	25.6	18.1	17.3	21.0	22.0	22.2
3	19.5	17.1	24.1	27.2	17.3	28.0	22.2
4	11.0	15.9	14.5	11.1	13.6	12.2	13.0
5	6.1	11.0	20.5	21.0	28.4	12.2	16.5
Low	1.2	7.3	8.4	9.9	9.9	9.8	7.7

Responses on user involvement vary considerably from a high of 61% scoring their organisation at 1 or 2 in Esston to a low of 28% in Brinton. A regression analysis of this variable with the 8 PFAC variables has low explanatory power (r^2 0.124). An analysis of the inter-relationship between degree of user involvement and overall satisfaction does reveal that the independence hypothesis must be rejected and that user involvement is a strong component in building overall satisfaction (chi square score of 185.8 with 36 degrees of freedom).

Table 7.2: How well does IT meet managerial needs?

	Esston	Banton	Dunton	Brinton	Posham	Wrenton	Total
High	7.3	6.0	12.3	2.4	0.0	0.0	4.7
2	42.7	16.9	16.0	30.5	27.7	25.3	26.5
3	23.2	19.3	40.7	32.9	37.3	39.8	32.2
4	18.3	36.1	24.7	20.7	16.9	15.7	22.1
Low	4.9	16.9	6.2	9.8	7.2	15.7	10.1

Response on this measure again varies considerably from a high of 50% in Esston (scoring 1 or 2) to a low of 22.9% in Banton. The relationship between this variable and overall satisfaction is also relatively strong (with a chi square score of 222.7 at 36 degrees of freedom).

Table 7.3: How well does IT meet operational needs?

	Esston	Banton	Dunton	Brinton	Posham	Wrenton	Total
High	8.5	3.7	9.8	3.7	3.7	3.6	5.5
2	47.6	17.1	32.9	26.8	41.5	31.3	32.9
3	22.0	23.2	32.9	30.5	30.5	31.3	28.4
4	14.6	32.9	15.9	25.6	7.3	18.1	19.1
5	4.9	13.4	6.1	11.0	9.8	6.0	8.5
Low	0.0	6.1	2.4	0.0	3.7	3.6	2.6

There are also very strong differences between local authorities in terms of the extent to which IT is perceived to meet the organisations operational needs. This ranged from 56.1% (scoring 1 or 2) in Esston to 20.8% in Banton. In this latter case, Banton was substantially below the other five local authorities. The relationship between meeting operation needs and overall satisfaction with the IT department was particularly pronounced (with a chi square score of 233.6 at 36 degrees of freedom).

Table 7.4: Overall opinion of the IT department in your organisation

	Esston	Banton	Dunton	Brinton	Posham	Wrenton	Total
Poor	1.2	6.0	0.0	0.0	0.0	0.0	1.2
2	8.5	13.3	2.4	3.7	16.9	12.0	9.5
3	13.4	22.9	18.3	17.1	7.2	21.7	16.8
4	39.0	42.2	46.3	32.9	48.2	31.3	40.0
5	32.9	13.3	30.5	43.9	24.1	31.3	29.3
Excellent	2.4	0.0	2.4	2.4	3.6	0.0	1.8

Given the analysis of the three preceding variables, it is not surprising that there are some substantial differences in users' overall opinion of their organisation's IT department. Reported satisfaction (i.e. the percentage recording a score of 5 or 6) is highest for Brinton (46.3%) followed by Esston (35.3%). Banton recorded the lowest level of overall satisfaction.

An Analysis of Attitudes

The final section of the questionnaire provided respondents with an opportunity to give their views on how they thought the effectiveness of their organisation's IS/T service could be improved. What follows is a distillation of their responses. The first phase of the exercise comprised a content analysis of the issues that respondents raised. In all 17 themes were identified which are shown in the table below.

Table 8.1: Issues identified from the content analysis of the open ended question

Number	Name	Description
1	BSERV	problems with the quality/level of service from IT dept
2	DATA	Data management problems
3	DECENT	Need for more decentralisation
4	DSKILL	IT dept does not have the skills needed
5	ECOM	e-mail and internal communications
6	HWORK	Need for better access to systems
7	LIAISE	Need for better user/IT Dept liaison
8	MGT	Problems with management of IT
9	OLDS	Problems with old systems
10	PLAN	Concerns about IT planning and strategy
11	PROD	Productivity concerns
12	RESC	Problems with resourcing
13	STA	Need to standardise on soft/hardware
14	SUPPT	Problems with support from IT dept
15	TRN	Need for better training
16	UNEEDS	IT dept does not understand user needs
17	USER	Low user knowledge/skill

The second stage of the exercise was to construct a 2-way contingency table (see Table 8.2) which counted the number of times responses were cited in each local authority. The third stage of the process used correspondence analysis to explore two themes:

- first, to identify which local authorities were alike in terms of the issues raised; and,
- second, to analyse the joint relationship between local authority and the issues raised to identify if certain issues tend to cluster around certain local authorities.

Table 8.2: Contingency table of responses by the six local authorities

Name	Brinton	Dunton	Posham	Banton	Wrenton	Esston	Total
BSERV	3	0	0	7	5	6	21
DATA	0	0	4	2	1	6	13
DECENT	0	0	0	0	2	5	7
DSKILL	1	2	0	8	3	11	25
ECOM	1	2	0	8	4	1	16
HWORK	0	0	3	2	2	1	8
LIAISE	2	0	0	5	5	4	16
MGT	2	1	2	13	10	14	42
OLDS	0	3	0	6	5	3	17
PLAN	3	1	2	6	6	9	27
PROD	2	0	0	3	5	4	14
RESC	0	0	0	7	2	15	24
STA	1	0	1	7	3	4	16
SUPPT	2	3	2	8	2	8	25
TRN	5	1	0	3	4	8	14
UNEEDS	3	1	1	3	3	3	14
USER	3	2	1	4	0	5	15
Total	28	16	16	92	62	107	321

While a technical discussion of correspondence analysis is beyond the scope of this paper, the graphical output below was generated using this procedure and it allows us to explore the topics listed above. The points numbered 1-17 in Figure 8.1 relate to the issues listed in Table 8.1 and the triangles represent the locations of the six local authorities whose codes are shown in the Table 8.2 below.

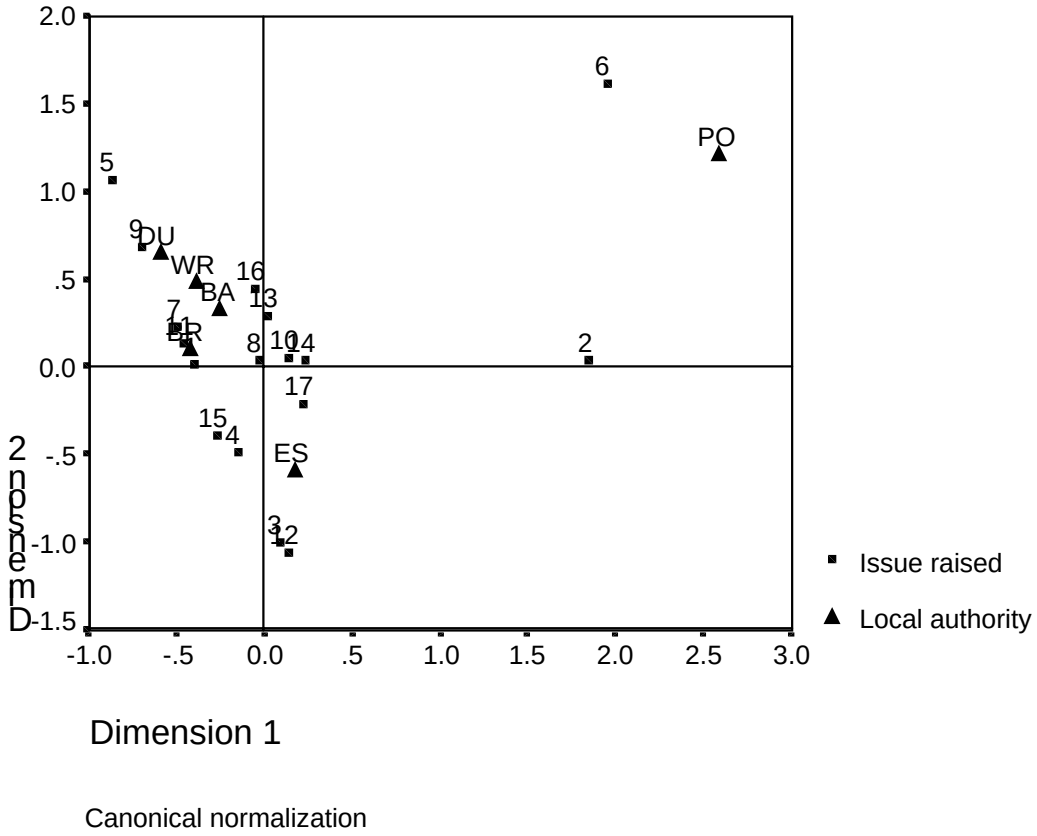
Table 8.2: Local authority codes used in Figure 8.1

Local Authority	Code
Banton	BA
Brinton	BR
Dunton	DU
Esston	ES
Posham	PO
Wrenton	WR

The graphical output of the correspondence analysis reveals that Brinton, Dunton, Banton and Wrenton tend to cluster together thus displaying a degree of similarity with Esston being a slight outlier to this group. Posham, however, is significantly detached from this main group. The advantage of correspondence analysis is that it allows us to explore the relationship between the rows and columns of a contingency table simultaneously. This reveals, for example, that:

- in Posham, the need for better home-working facilities and data management are viewed as being more problematic than in other local authorities;
- in Esston, the need for more decentralisation, problems with resourcing, the lack of IT skills, the need for better training and low user skills are seen as relatively problematic.

Figure 8.1: Perceptual map: local authorities and key issues



Conclusions

The research has revealed considerable variability in how users perceived their organisation's IS/T department and the IS/T strategies which exist within their organisations. At a very basic level, the research has shown that there is a substantial lack of IT training in organisations with 43% of respondents not having had any training in the last year and front line staff being substantially less satisfied with the quality of training than staff at higher levels in the organisation.

The original questionnaire obtained users' views about the importance of a set of thirty eight measures to the effective delivery of an IS/T strategy and then, using the same measures, assess users' views on how their organisation was performing on these measures. The basic analysis revealed that there were substantial gaps between importance and performance on measures that users considered to be highly important determinants of IS/T strategy successfulness.

There areas which recorded both high importance and a wide performance-importance gap were:

- A high degree of technical competence in systems support staff.
- User confidence in systems.
- Fast response time from systems support staff to remedy problems.
- Provision for disaster recovery.
- Positive attitude of information systems/IT staff to users.
- A low percentage of hardware and software downtime.
- Systems responsiveness to changing user needs.
- Extent of user training.

Subsequent analysis, using factor analysis to reduce the 38 variables down to a more limited set of factors, showed that 8 factors accounted for over 56% of the variance in the data set. These factors were:

Factor 1: Systems support
Factor 2: Training and service monitoring
Factor 3: Support staff
Factor 4: Up-to-dateness
Factor 5: Enhancing personal effectiveness and alignment
Factor 6: Job enrichment and control
Factor 7: Confidentiality and security
Factor 8: System responsiveness

Composite variables were derived from the factors listed above and the ability of between these composite variable to explain variation in overall satisfaction with the IT Department was tested. It was found that Factor 3: support staff, comprising the variables listed below explained the most variation in satisfaction with the IT department overall:

- Positive attitude of information systems/IT staff to users.
- User confidence in systems.
- A high degree of technical competence in systems support staff.

Subsequent analysis revealed substantial differences in perceived performance with aspects of the organisations' IS/T strategies categorised on the 8 factors derived from the analysis. Esston was found to score highly on the majority of measures while Banton was found to have substantial problems in several areas. The framework provides a diagnostic model which could be used to help managers focus more clearly on those aspects of their IS/T strategies which are undermining users' perceptions of the performance of those strategies.

Additional analysis revealed significant relationships between users' overall satisfaction with the IT department in their organisations and (in priority order):

- How well IT meets operational needs
- How well IT meets managerial needs
- The degree of user involvement in influencing IT developments

The analysis contained in this report has been to some degree exploratory. In the final analysis section of the report, correspondence analysis was used to identify the similarities/differences between local authorities in terms of the IT problems that respondents identified in an open-ended question designed to let users articulate what they perceived to be major problems in their organisations. The analysis revealed that four of the organisations tended to cluster together but that Esston and Posham seemed to exhibit different types of problems from the remainder.

The exploration of effectiveness, particularly IS/T effectiveness, is a difficult research problem but this approach has shown that these problems do have a definable structure. Perhaps most important, they point to the knowledge base and user orientation of IT staff as the most important feature in explaining users' overall opinion of their IT department.

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Footnotes

1. The method used to weight the different local government authorities was very simple and gave each local authority equal weight in the production of aggregate figures.

2. We are using the word “attribute” to describe a characterise of an information system or an issue related to the effectiveness of an information system’s operation.

3. The analysis was conducted using backwards elimination. Here the regression analysis begins with an equation comprising all the variables included in the initial regression set. Variables which are found to have little explanatory power are then successively excluded until the most parsimonious model is derived.

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