# 4. DATA COLLECTION

## 4.1. Introduction

This chapter presents the process of quantitative data collection through the use of postal questionnaires. The Higher Education Statistics Authority (HESA) also provided additional data for all UK Higher Education institutions (the most recent data available was for the academic year 2000-2001). This data included the number of student enrolments, the number of academic staff and the percentage of total income coming from Funding Council grants by institution. In the final sections of this chapter, the tests for representativeness and assumptions for statistical analysis are carried out on the sample data.

## 4.2. Questionnaire sample

To define the population for the study, a list of all Higher Education institutions in the UK was taken from the government Higher Education and Research Opportunities (HERO) website (www.hero.ac.uk) accessed on 17 September 2002. All institutions listed were contacted except for the following:

- Institutes of the University of London were not contacted as separate HEIs as in general they do not have their own Personnel department; they use the HR services provided centrally by the University of London.
- Cranfield University has also been excluded from the list as notification was received that there was currently no Head of Personnel due to long-term sickness.

The sample size for the main study is highly dependent on the limited size of the population: 180 universities and Higher Education colleges in the UK. Aiming for a realistic response rate of around 40% means around 75 responses. The key empirical studies reported earlier as being relevant to this study have a vast array of sample sizes, ranging from around 20 to 500 cases, with many below 100 cases. Although it is often

useful to look at the sample sizes of previous relevant studies to gauge what may be an appropriate sample size (Sudman, 1976), in this instance the variation is so great that little can be drawn from this.

In order to boost response rates, the Universities Personnel Association (UPA) agreed to send out questionnaires to the Head of the Personnel department in all of their member institutions that appeared on the HERO list. The questionnaires were sent out with a covering letter explaining the UPA's support for the study. The initial postal mailing of the questionnaire was followed up one week later by a reminder email placed on the UPA mailbase. To boost responses, all those institutions that had not replied by the initial deadline were sent a second copy of the questionnaire; this increased the response numbers by 87%. Table 5 shows the number of responses received.

**Table 5: Questionnaire mailing to UPA institution Personnel departments**

| | |
|---|---|
| Date sent out: | 24/09/02 |
| Number sent out: | 109 |
| Date follow-up emailed: | 01/10/02 |
| Initial deadline: | 11/10/02 |
| Date re-mailed: | 22/10/02 |
| Number re-mailed: | 86 |
| Final deadline: | 08/11/02 |
| Total number of responses: | 43 |

Source: analysis of questionnaire responses.

All the other institutions on the HERO list that were not members of the UPA were contacted directly by the researcher. This time, there was no follow-up by email or telephone for the postal mailing, as the contact details of potential respondents were not known. A second mailing of questionnaires was sent out to all those institutions that had not responded by the initial deadline. This boosted the initial response numbers by 44% (see Table 6 for details of the mailing.)

There were four anonymous responses received in addition to those listed, which could not be identified as to whether they were UPA or non-UPA member institutions. In summary, a total of 73 responses were received from the 179 Personnel departments

contacted in UK HEIs which gave a response rate of 41%. In terms of geographical split, 50 responses were from England, eight from Scotland, seven from Wales, three from Northern Ireland and one from Ireland.

**Table 6: Questionnaire mailing to non-UPA institution Personnel departments**

| | |
|---|---|
| Date sent out: | 26/09/02 |
| Number sent out: | 70 |
| Initial deadline: | 11/10/02 |
| Date re-mailed: | 16/10/02 |
| Number re-mailed: | 52 |
| Deadline: | 08/11/02 |
| Total number of responses: | 26 |

Source: analysis of questionnaire responses.

The sample can also be analysed for its composition by looking at UPA membership and HEI status figures (see Table 7). 59% of the sample are UPA member institutions, and 36% non-UPA member institutions. 43% of the sample are pre-1992 universities, 27% are post-1992 universities, and 26% are specialist Higher Education institutions or colleges. (Looking also at the interview sample, 47% of interviews were with pre-1992 universities, 29% with post-1992 universities and 24% with HE colleges. This shows a close match between the quantitative and qualitative samples.)

**Table 7: Breakdown of sample responses by UPA membership and HEI status**

| | % | n | Sample size |
|---|---|---|---|
| UPA | 59 | 43 | 73 |
| Non-UPA | 36 | 26 | 73 |
| Anonymous | 5 | 4 | 73 |
| Pre-92 | 43 | 31 | 73 |
| Post-92 | 27 | 20 | 73 |
| Institute | 26 | 19 | 73 |
| HEI status unknown | 4 | 3 | 73 |

Source: analysis of questionnaire responses.

Using the HERO list as the population, the sample represents 39% of UPA and 37% of non-UPA member institutions in the UK (see Table 8). The sample also represents 44%

of the pre-1992 university population, 48% of post-1992 university population, and 28% of specialist institutes and colleges population. (It is expected that the specialist institutes should be underrepresented, as some are not large enough to have separate administrative departments and hence fall outside the scope of this study.) The sample can therefore be seen as representative of the population percentages. Carrying out chi-square goodness-of-fit tests on the two sets of categories were statistically insignificant at $\alpha = .05$ (sig. = .809: $\chi^2 = .058$ with 1df for the UPA variable; and sig. = .203: $\chi^2 = 3.190$ with 2df for the type of institution variable), indicating that the sample is a good fit to the population.

**Table 8: Sample representativeness of UPA and HEI status populations**

| | % | n* | Population size |
|---|---|---|---|
| UPA | 39 | 43 | 109 |
| Non-UPA | 37 | 26 | 70 |
| Pre-92 | 44 | 31 | 71 |
| Post-92 | 48 | 20 | 42 |
| Institute | 28 | 19 | 67 |

* Anonymous responses are not included.

Source: analysis of questionnaire responses.

Once responses had been received from Personnel departments, the Estates, Finance and Registry departments were contacted in the same institutions. Only the same institutions were contacted as those from which data on the Personnel department had already been received, in order to limit the impact of variation in institutional context. Some of the smaller specialist institutes, which did not have a specialist Personnel function and hence a general or other functional manager had responded to the Personnel mailing, were not contacted again at this stage. In total, 188 heads of departments in 63 HEIs were contacted (see Table 9).

Although relevant professional associations for departments other than Personnel in HE exist (for example, the Association of Heads of University Administration, the Association of University Directors of Estates and the British Universities Finance Directors Group), these were not contacted following the experience in the pilot study of a sufficiently high response rate being achieved by contacting the departments

directly. The study is less directly relevant to these groups, therefore gaining the support of these associations would be less beneficial for both parties. No follow-up telephone calls were made or emails sent once the questionnaires had been posted, as the contact details of the potential respondents were not known. There was no re-mailing of questionnaires to the non-respondents following the second round of mailing due to the timing coinciding with the Christmas holiday period.

**Table 9: Questionnaire mailing to Estates, Finance and Registry departments**

| | Other departments linked to 1st Personnel mailing | Other departments linked to 2nd Personnel mailing |
|---|---|---|
| Date sent out: | 21/10/02 | 18/11/02 |
| Number sent out: | 111 | 77 |
| Deadline: | 08/11/02 | 08/12/02 |
| Date re-mailed: | 04/12/02 | - |
| Number re-mailed: | 88 | - |
| Deadline: | 18/12/02 | - |
| Total number of responses: | 49 | 22 |

Source: analysis of questionnaire responses.

In summary, the 71 responses received from the 188 Estates, Finance and Registry departments contacted in UK HEIs resulted in a response rate of 38%. It is interesting to note that despite the extra efforts made to increase response rates amongst Personnel department respondents, a very similar overall response rate was achieved.

Before starting with the full analysis of the data, the next stage in the study was to explore the nature of the quantitative data collected, to check its representativeness and to check its suitability for statistical analysis. The results of this process are presented in the following sections.

## *4.3. Exploratory data analysis*

In this section, the sample of 73 HEIs is first tested to establish the extent to which it can be classed as representative of the population. It is analysed in terms of the size of the institution (number of students and academic staff), the independence of the institution (proportion of income received from funding council grants) and the details

of the respondents (number of years in current job, institution and specialism). The data regarding institution size and funding have been supplied by the Higher Education Statistics Agency (HESA). Further tests are also carried out regarding whether the institution is a member of the Universities' Personnel Association (the professional body for HEIs). Finally, in the last section of this chapter, data are tested for their suitability for use in univariate and multivariate analyses.

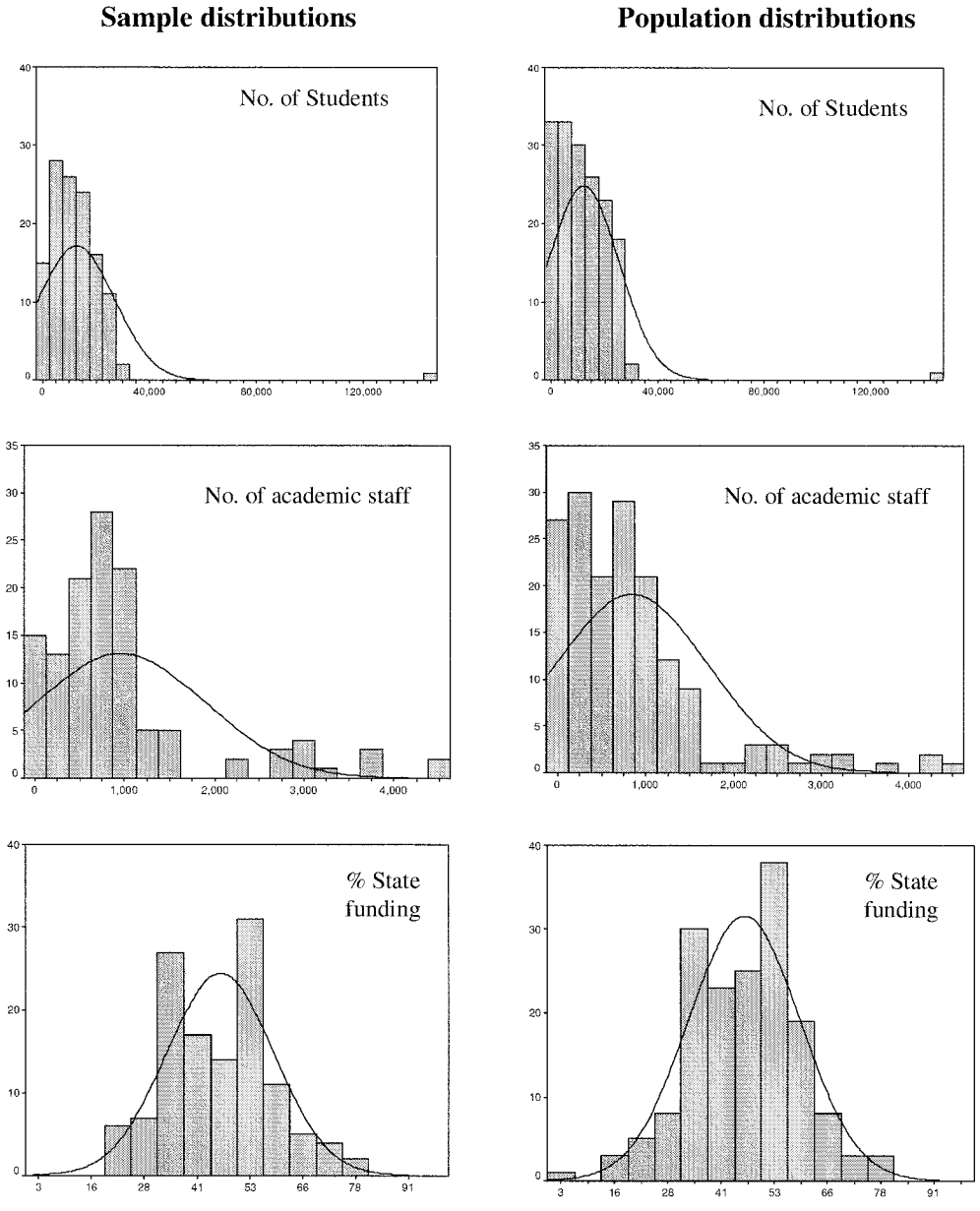
### 4.3.1. Tests for representativeness

Firstly, the size and funding variables are explored for the 73 respondent institutions to see the extent to which they match the distribution of the population. Figure 5 shows the histograms for each of these variables with those for the sample on the left-hand side and those for the population on the right-hand side.

In general the graphical representations of the sample and population distributions show how well the former replicates the latter. This indicates that the sample is a good representation of the HESA population of Higher Education institutions in the UK. Looking at the sample data in more detail, we can see in particular that one case has an extremely high number of students relative to all other institutions. We can see the same phenomenon occurring in the population. However, it was decided to remove this value from the database so that the number of students variable closer approximates the normal distribution for the purpose of statistical analysis. We can also see that there are a few cases with high numbers of academic staff in the sample, however this skew is also observed in the population.

Exploring the data available from HESA regarding the different types of institution, some of their key characteristics are presented in Table 10. The post-1992 universities are the largest institutions in general (68% of them have over 15,000 students), and the HE colleges the smallest (75% of them have less than 5,000 students). Pre-1992 universities vary in size much more than the other types of institutions. Regarding dependence on government funding, HE colleges are most dependent (53% of them receive more than 55% of their income from the funding councils), followed by post-

1992 universities (20% receive more than 55% income from the state). Pre-1992 universities are the most financially independent with only 6% receiving over 55% state funding, and 41% receiving less than 35% state funding. The sample data show a slight bias in mid-range institutions on both variables, as the percentage of cases falling at the upper and lower ends of the scales are lower than across the HESA population.




Source: Higher Education Statistics Authority for academic year 2001/2.

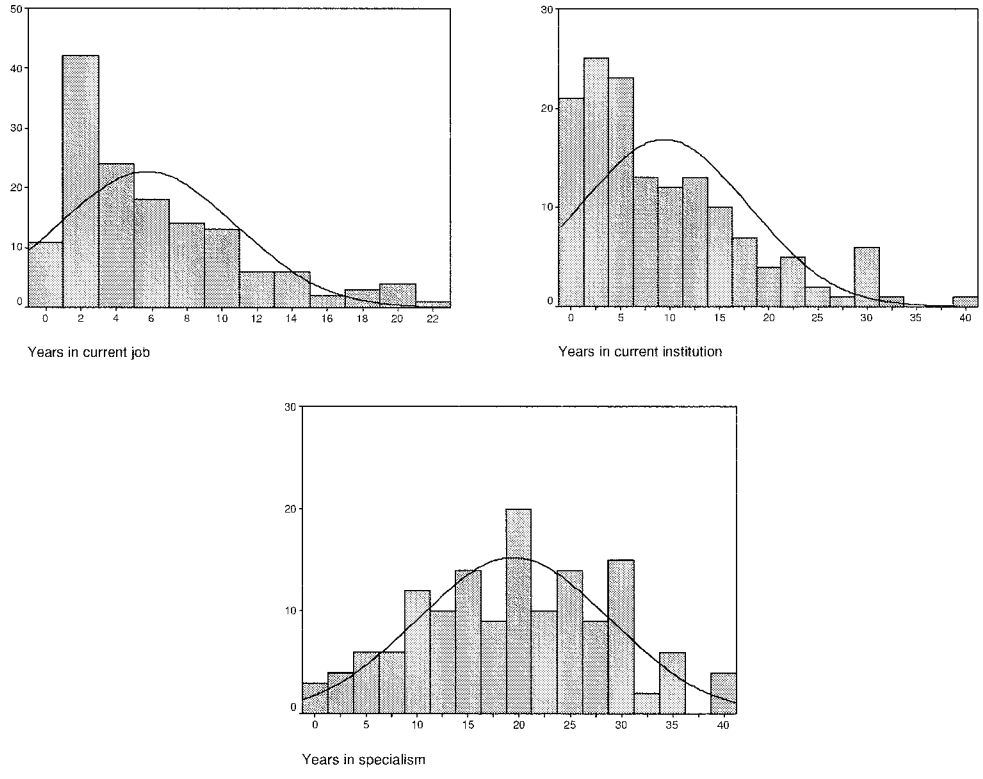
**Figure 5: Histograms of sample and population distributions (y-axis = no. of cases)**

**Table 10: Characteristics of different types of institution**

| | | % of institutions | | | |
|---|---|---|---|---|---|
| | *n* | **<5,000 students** | **>15,000 students** | **<35% state funded** | **>55% state funded** |
| Pre-1992 university | 66 | 12 | 41 | 41 | 6 |
| Post-1992 university | 41 | 2 | 68 | 2 | 20 |
| HE college | 59 | 75 | 0 | 7 | 53 |
| All institutions | 166 | 32 | 33 | 19 | 26 |
| *Sample* | *62* | *26* | *31* | *16* | *21* |

Source: Higher Education Statistics Authority for academic year 2001/2.

Looking at the characteristics of the individual respondents to the questionnaire, Figure 6 shows few remarkable features deviating from an approximate normal distribution. In general, the number of years people have been in their current job or institution show a slightly positive skew, however, this phenomenon would equally be expected across the population as people change jobs between institutions through their career.




Source: analysis of questionnaire responses.

**Figure 6: Histograms of characteristics of respondents (y-axis = no. of cases)**

To check for response representativeness, one-way ANOVA tests for response bias were carried out using the HESA and respondent data from all cases. (The tests were based on a 95% confidence interval and analysis-by-analysis case exclusion). The variables were divided into four groups based on equal intervals of the variable data. The level of significance of factors below .05 is reported below in brackets following the variable description. Where incidences of heteroscedasticity were found, i.e. the Levene statistic was significant, the non-parametric Kruskal-Wallis test was run in place of the ANOVA test. Although some of the variables have a positive distribution, as ANOVA tests are robust to departures from normality, no transformation was made for the purpose of the following tests.

Comparing responses from different size institutions based on the number of students with institutions grouped by:

- less than 4,999 students (33 responses)
- 5,000 to 9,999 students (21 responses)
- 10,000 to 14,999 students (40 responses)
- and 15,000 students or more (37 responses),

significant differences were found in the following variables: centrality of Estates (sig. = .000), centrality of Finance (sig. = .001), centrality of Personnel (sig. = .022), coping of Estates (sig. = .033), and IS sophistication (sig. = .012).

Comparing responses from institutions with varying levels of dependence on funding council grants grouped by:

- 0 to 34.99% (25 responses)
- 35% to 44.99% (37 responses)
- 45% to 54.99% (47 responses)
- and those with 55% or higher financing (23 responses),

two significant differences were found between the groups: Personnel resource proportion (sig. = .003) and centrality of Registry (sig. = .017).

There are thus a number of significant differences particularly based on the size of institutions. It is therefore important that a range of sizes is included in the research to ensure the analyses carried out represent the characteristics of the population as closely as possible.

Comparing responses from respondents with different lengths of time in their current job, one significant difference was found: non-substitutability of Estates (sig. = .047). Respondents were split by:

- less than 1.49 years (28 responses)
- 1.5 to 3.99 years (35 responses)
- 4 to 6.49 years (32 responses)
- and 6.5 or more years (49 responses).

No significant differences were found for any variables when comparing responses from respondents with different lengths of time in their current institution. Respondents were split by:

- less than 1.99 years (25 responses)
- 2 to 5.99 years (37 responses)
- 6 to 9.99 years (24 responses)
- and 10 or more years (58 responses).

Nor were there any significant differences found for any variables when comparing responses from respondents with different lengths of time in their current specialist occupation (e.g. Personnel), where respondents were split by:

- less than 12.99 years (38 responses)
- 13 to 19.99 years (27 responses)
- 20 to 26.99 years (43 responses)
- and 27 or more years (36 responses).

In summary, the respondent variables did not indicate any substantial signs of response bias in the data.

An independent sample t-test for response bias was also carried out on the professional body (Universities Personnel Association – UPA) membership data of institutions from the 73 Personnel department cases (cases excluded analysis-by-analysis). The level of significance of variables if less than .05 is reported below in brackets following the variable description.

Comparing between respondent institutions that are UPA members (43 responses – 59%) and non-UPA members (26 responses – 36%), significant differences were found in the following variables: Personnel resource proportion (sig. = .029), proportion of professional staff (sig. = .035), involvement (sig. = .035), centrality of Estates (sig. = .009), centrality of Finance (sig. = .000), centrality of Personnel (sig. = .006), and IS sophistication (sig. = .048). The sample size is sufficiently large to assume the sample percentage is a good point estimator of the population percentage {$n \bullet p \geq 500$ and $n \bullet (100-p) \geq 500$ where n = sample size, and p = percentage of sample meeting criteria: $68 \bullet 59 = 4012$ and $68 \bullet (100-59) = 2788$}. However, multiple significant differences are found between UPA and non-UPA member institutions. This is to be expected, as the UPA is only representative of universities and not of Higher Education colleges or specialist institutes. Its membership is therefore skewed to the larger organisations (the mean number of students per institution being 16,203 compared to 11,992 across all HESA institutions). This finding justifies having carried out a separate mailing of the questionnaire to non-UPA members to ensure that the sample is representative of the HEI population in the UK as a whole.

The date on which the questionnaire was returned can also be recorded to check for early or late response bias. However, due to the use of reply-paid envelopes for the return of the questionnaires, the envelopes were rarely date-stamped. It was therefore not generally possible to ascertain how long a respondent had taken to reply. As there were no issues of early or late response bias identified in the pilot study, and very few questionnaires were returned immediately or exceptionally late, no further checks on this aspect have been carried out on this data.

A question was also included which asked for the job title of the respondent. This was used to check who had actually completed the questionnaire. In 91% of the cases the appropriate person, the head of the department, had completed the form, otherwise it was completed by a deputy head (5%) or general manager (4%). The sample can therefore be classed as representative of the head of department population.

### 4.3.2. Assumption testing for statistical analysis

Moving on to the second aim of the exploratory data analysis, all variables to be used in parametric analyses are checked to see that they meet the assumptions for both univariate and multivariate tests. It is important when using a mixture of dichotomous, ordinal and metric data to be sure of the characteristics of the data being used. This ensures that appropriate statistical tests are applied. This rigour is also required when working with perceptual data that requires strong theoretical argumentation.

As the effects of independent variables on dependent variables are expected to be small due to the subjective nature of the study of power, and the sample size is limited to 144 responses from 73 institutions, the study has been designed with less restrictive levels of confidence ($\alpha = .05$ and $\alpha = .10$). This will ensure that tests of the null hypotheses are not too restrictive as to hide possible relationships and hence will increase the power of the statistical tests and their generalisability. At the same time, the risk of finding a relationship when there is not actually one there is also increased, but this has to be balanced against the aims and nature of the study.

The statistical power of quantitative data analysis is based on sample size. With 10 independent variables and a sample size of around 100, $R^2$ will be found statistically significant ($\alpha = .05$) if it is equal to or greater than 0.15 (Hair, *et al.*, 1998: 165). However, if the sample size is closer to 50, $R^2$ needs to almost double to 0.29 to be statistically significant. In other words, it is expected that the sample for this study (73 institutions) will identify significant relationships explaining between 15 and 29 percent of variance.

#### *4.3.2.1. Checking for extreme and missing data*

Detailed tests for normality were carried out on the metric variables in the study. Firstly the incidence of outliers throughout the data set was checked. In addition to the influential number of students raw score already discussed, there were two extreme values for the Personnel resource proportion variable. In these two cases, they were small institutions but nevertheless had a dedicated Personnel function. It was decided to remove these two values from the database to ensure the variable would be more reliable for use in statistical analysis. No further observations were removed as any outliers were deemed not too extreme and the known characteristics of the institution to which the outlying data refered were sufficient to explain the raw score observed.

Secondly, the database was checked for the impact of missing data that could affect the reliability of the results. HESA data is missing for eleven out of the 73 cases: all incidents can be explained either because the institution does not report figures directly to HESA or the cases were anonymous and therefore no HESA data could be ascertained. Missing data for other variables such as the number of employees or the size of the Personnel department have been completed by obtaining the information from secondary sources such as websites and annual reports.

The primary cause of other missing data in the sample is when respondents have answered 'don't know' to any of the questions. The 'don't know' option was included in the questionnaire as it was preferable for respondents to indicate this than for people either to give no response or to take a random guess. Missing data due to this factor are thus unavoidable in this study and are positive as they reduce measurement error. One particular variable – the percentage of institution budget apportioned to Personnel department staffing – shows a very high incidence of 'don't know' responses. Some respondents have noted on the questionnaire that this information is not available to them in the format requested. As 62% of responses to this question were 'don't know' it is fair to assume that this variable will not provide reliable statistics for the intended analyses. Therefore this variable was removed from the sample data set. This can be justified by the variable being one of a number designed to measure the level of power

of the department, and is therefore not crucial to the analysis. It appears that accounting conventions vary considerable between institutions and therefore a comparable figure is difficult to establish across the sample.

The other incidence of 'don't know' responses is when respondents have been asked their opinion about a characteristic of another department. This is most commonly less than 5% of the cases, with occasional questions reaching around 20% of the cases particularly regarding opinions on uncertainty. This missing data is compensated by also having data available from other departments on these characteristics; therefore no correction to the data set has been attempted.

#### *4.3.2.2. Checking for normal distribution*

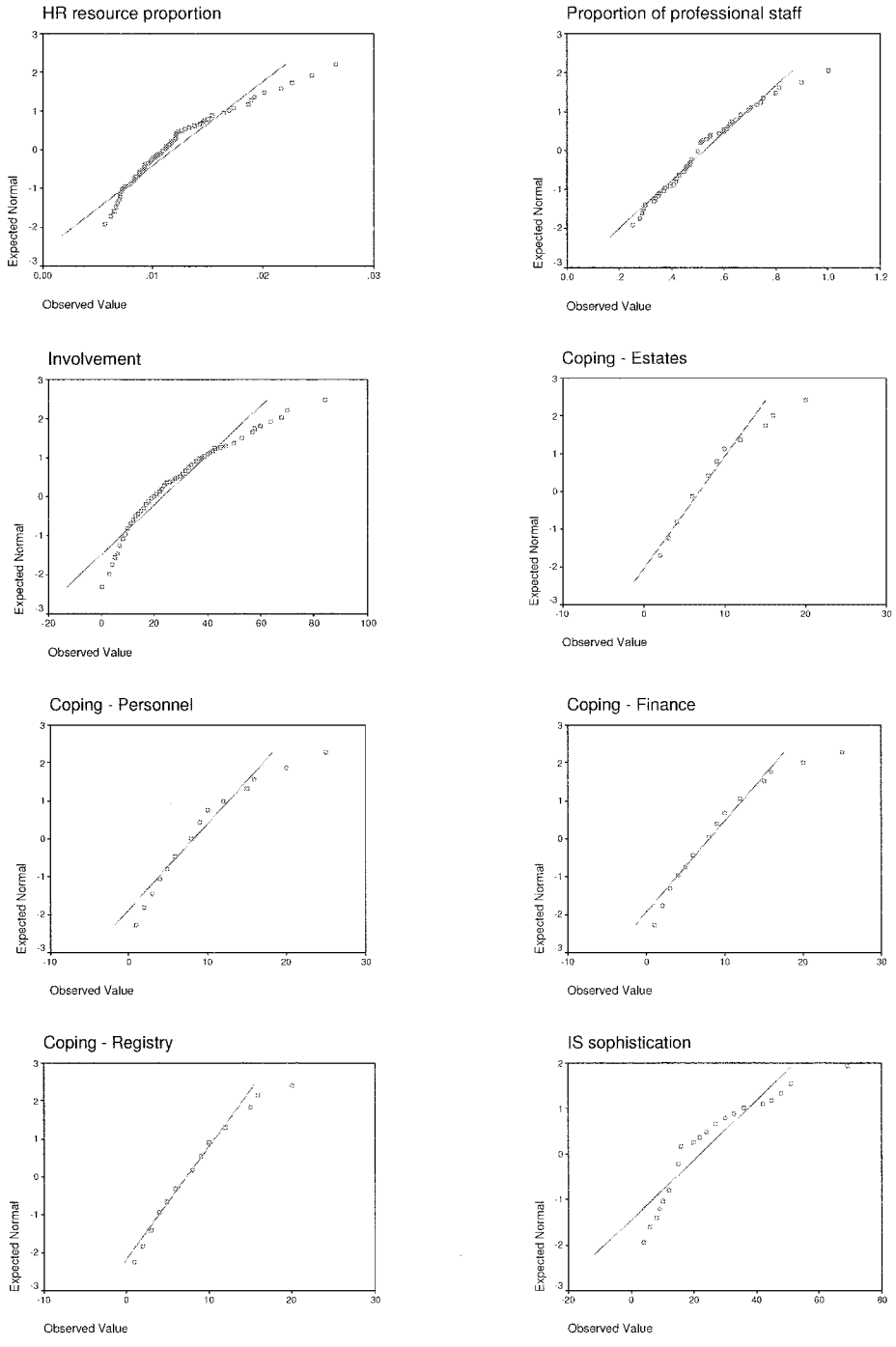
For detailed tests of whether variables approximate the normal distribution, they were first tested for skewness and kurtosis using the following formulae (Hair, *et al.*, 1998: 72): $z_{skewness}$ = [skewness / $\sqrt{}$ (6/*n*)] and $z_{kurtosis}$ = [kurtosis / $\sqrt{}$ (24/*n*)] (where *n* is the number of cases in the sample). Based on a confidence level of .05 of rejecting the assumption about normality of the distribution, the confidence limits of $z_{skewness}$ and $z_{kurtosis}$ are ± 1.96. On this basis the assumption of normality is rejected for the variables with the italicised z-scores in Table 11.

**Table 11: Distribution characteristics: testing for skewness and kurtosis**

| | | Skewness | | Kurtosis | |
|---|---|---|---|---|---|
| *Variable* | *n* | *Statistic* | *z* | *Statistic* | *z* |
| Personnel resource proportion | 70 | 1.103 | *3.767* | 1.025 | 1.751 |
| Proportion of professional staff | 73 | 0.290 | 1.012 | 1.289 | *2.248* |
| Involvement in decision-making | 144 | 1.150 | *5.634* | 1.350 | *3.307* |
| Coping (weighted) - Estates | 131 | 1.026 | *4.794* | 1.586 | *3.705* |
| Coping (weighted) - Finance | 130 | 1.242 | *5.781* | 3.133 | *7.292* |
| Coping (weighted) - Personnel | 128 | 1.291 | *5.963* | 2.568 | *5.931* |
| Coping (weighted) - Registry | 120 | 0.678 | *3.032* | 0.914 | *2.044* |
| IS sophistication | 73 | 1.530 | *5.337* | 2.069 | *3.608* |

Source: analysis of survey data.

Looking also at the normal probability plots for each of the variables (see Figure 7) and using the Kolmogorov-Smirnov with Lilliefors Significance Correction statistic to test for normality, a further description of the distributions is presented in Table 12.




Source: analysis of survey data.

**Figure 7: Normal probability plots of all metric variables (y-axis = no. of cases)**

**Table 12: Distribution characteristics: testing for normality**

| | Normality test | | | Plots |
|---|---|---|---|---|
| *Variable* | *Statistic* | *df* | *Sig.* | *Description* |
| Personnel resource proportion | .149 | 70 | 0.001 | Positive distribution |
| Proportion of professional staff | .121 | 72 | 0.010 | Positive distribution |
| Involvement in decision-making | .117 | 144 | 0.000 | Positive distribution |
| Coping (weighted) - Estates | .219 | 131 | 0.000 | Positive distribution |
| Coping (weighted) - Finance | .131 | 130 | 0.000 | Positive distribution |
| Coping (weighted) - Personnel | .196 | 128 | 0.000 | Positive distribution |
| Coping (weighted) - Registry | .150 | 120 | 0.000 | Positive distribution |
| IS sophistication | .230 | 73 | 0.000 | Positive distribution |

Source: analysis of survey data.

Given these characteristics of the data, remedies for non-normal distribution were sought by transforming variables through their square root or natural logarithm. Table 13 shows the transformation that was applied where this resulted in the best adjustment of the variable to meet the requirements of normal distribution. The significance of the normality test (Kolmogorov-Smirnov with Lilliefors Significance Correction statistic) following the transformation is also presented. Where the transformation did not result in any improvement of the normality of the distribution, no transformation was applied. With regard to the non-metric variables, non-parametric tests do not have assumptions of normality, so exploratory analysis of the data is not necessary.

**Table 13: Distribution characteristics: remedies for non-normal distributions**

| | Remedies | |
|---|---|---|
| *Non-normal variable* | *Transformation* | *Sig. after remedy* |
| Personnel resource proportion | $Log_e$ | > 0.200 |
| Proportion of professional staff | $Log_e$ | > 0.200 |
| Involvement in decision-making | $Log_e$ | > 0.200 |
| Coping (weighted) - Estates | None | |
| Coping (weighted) - Finance | None | |
| Coping (weighted) - Personnel | None | |
| Coping (weighted) - Registry | None | |
| IS sophistication | None | |

All variables meet the requirement for transformations of the ratio of the mean to the standard deviation of the variable being less than 4.0.

Source: analysis of survey data.

#### *4.3.2.3. Checking for multicollinearity, linearity and homoscedasticity*

Carrying out intercorrelations of items within questions enables checking that multiple variables are not all measuring the same thing. Table 14 shows the non-parametric intercorrelations for the involvement variables for all departments.

**Table 14: Intercorrelation of participation in decision-making variables on key issues**

| | | BS | SP | QA | ND | SR | PR | PU | MP | IS |
|---|---|---|---|---|---|---|---|---|---|---|
| **Budget setting (BS)** | $\rho$ | 1.000 | | | | | | | | |
| | *Sig.* | . | | | | | | | | |
| **Strategic planning (SP)** | $\rho$ | 0.518 | 1.000 | | | | | | | |
| | *Sig.* | **0.000** | . | | | | | | | |
| **Quality assurance (QA)** | $\rho$ | 0.019 | 0.276 | 1.000 | | | | | | |
| | *Sig.* | 0.820 | **0.001** | . | | | | | | |
| **New degrees (ND)** | $\rho$ | 0.159 | 0.123 | 0.437 | 1.000 | | | | | |
| | *Sig.* | 0.059 | 0.143 | **0.000** | . | | | | | |
| **Student recruitment (SR)** | $\rho$ | 0.349 | 0.154 | 0.273 | 0.531 | 1.000 | | | | |
| | *Sig.* | **0.000** | 0.066 | **0.001** | **0.000** | . | | | | |
| **Pricing (PR)** | $\rho$ | 0.445 | 0.169 | 0.147 | 0.297 | 0.349 | 1.000 | | | |
| | *Sig.* | **0.000** | **0.043** | 0.079 | **0.000** | **0.000** | . | | | |
| **Purchasing (PU)** | $\rho$ | 0.604 | 0.371 | 0.020 | 0.090 | 0.231 | 0.495 | 1.000 | | |
| | *Sig.* | **0.000** | **0.000** | 0.810 | 0.288 | **0.006** | **0.000** | . | | |
| **Staff planning (MP)** | $\rho$ | 0.225 | 0.469 | 0.205 | 0.024 | 0.063 | 0.179 | 0.144 | 1.000 | |
| | *Sig.* | **0.007** | **0.000** | **0.014** | 0.773 | 0.455 | **0.032** | 0.086 | . | |
| **IS** | $\rho$ | 0.198 | 0.363 | 0.258 | 0.339 | 0.309 | 0.166 | 0.188 | 0.354 | 1.000 |
| | *Sig.* | **0.018** | **0.000** | **0.002** | **0.000** | **0.000** | **0.046** | **0.025** | **0.000** | . |

Sig.: 2-tailed, $\alpha = .05$, significant statistics are highlighted in bold.
n = 144 (missing cases are excluded pairwise)

Source: analysis of survey data.

There are a number of significant correlations displayed. This multicollinearity is to be expected as the extent of a department's participation in decision-making in one domain may be similar to participation in other domains due to being a member of the relevant decision-making body. Due to this wide extent of multicollinearity, this can lead to

unreliable parametric statistical analysis, as other variables may not necessarily remain constant when one of the variables changes. Therefore, only the total score for involvement in decision-making is used in analyses when exploring the study propositions. Conceptually this is also appropriate, as the question is designed to get an overall picture of a department's involvement in strategic decision-making across a range of key issues as an indicator of power. It is also common to measure involvement in decision-making by gathering a picture across a range of key issues (Hambrick, 1981).

Looking then at the level of power variables adopted for the study (see Table 15) there are only two incidences of significant correlations, both with correlation coefficients of below .36. There is therefore no reason to believe that multicollinearity will be an issue when using these variables in parametric analyses (Hair, *et al.*, 1998: 191).

**Table 15: Intercorrelation of level of power variables**

| | **Resource** | | **Hierarchy** | | **Involvement** | | **Influence** | |
|---|---|---|---|---|---|---|---|---|
| | *ρ* | *Sig.* | *ρ* | *Sig.* | *ρ* | *Sig.* | *ρ* | *Sig.* |
| **Resource** | 1.000 | . | | | | | | |
| **Hierarchy** | 0.197 | 0.102 | 1.000 | . | | | | |
| **Involvement** | 0.005 | 0.967 | 0.122 | 0.308 | 1.000 | . | | |
| **Influence** | 0.143 | 0.238 | 0.351 | **0.002** | 0.223 | **0.009** | 1.000 | . |

Sig.: 2-tailed, $\alpha = .05$, significant statistics are highlighted in bold.
n =144 (missing cases are excluded pairwise)

Source: analysis of survey data.

In Table 16 and Table 17 the correlations between the determinants of power are shown. The significant correlations that are observed do not have a coefficient greater than .30 and will therefore not be problematic in statistical analyses.

Looking at the patterning of significant correlations amongst the determinants of power, these occur most frequently where the variables for specific departments intersect. For example, the centrality of the Registry department only correlates significantly with the Registry department's ability to cope with uncertainty and not with other departments' ability to cope with uncertainty. This indicates patterns of relationships between the

determinants of power, which will be explored in further detail when considering the propositions of strategic contingencies theory in the following chapter.

**Table 16: Intercorrelations of determinants of power variables**

| | | | Centrality | | | |
|---|---|---|---|---|---|---|
| | | | *Estates* | *Finance* | *Personnel* | *Registry* |
| **Non-substitutability** | Estates | $\rho$ | 0.049 | 0.064 | -0.181 | -0.055 |
| | | *Sig.* | 0.574 | 0.477 | **0.044** | 0.550 |
| | Finance | $\rho$ | 0.065 | 0.085 | -0.057 | 0.068 |
| | | *Sig.* | 0.472 | 0.343 | 0.531 | 0.455 |
| | Personnel | $\rho$ | 0.015 | 0.072 | 0.099 | 0.167 |
| | | *Sig.* | 0.867 | 0.424 | 0.272 | 0.065 |
| | Registry | $\rho$ | 0.119 | 0.074 | 0.082 | 0.253 |
| | | *Sig.* | 0.200 | 0.429 | 0.382 | **0.006** |

Sig.: 2-tailed, $\alpha = .05$, significant statistics are highlighted in bold.
n =144 (missing cases are excluded pairwise)

Source: analysis of survey data.

**Table 17: Intercorrelations of determinants of power variables (continued)**

| | | | Ability to cope with uncertainty | | | |
|---|---|---|---|---|---|---|
| | | | *Estates* | *Finance* | *Personnel* | *Registry* |
| **Centrality** | Estates | $\rho$ | 0.298 | 0.121 | 0.019 | 0.112 |
| | | *Sig.* | **0.001** | 0.169 | 0.835 | 0.229 |
| | Finance | $\rho$ | 0.224 | 0.277 | 0.165 | 0.159 |
| | | *Sig.* | **0.013** | **0.002** | 0.068 | 0.089 |
| | Personnel | $\rho$ | 0.017 | 0.008 | 0.230 | 0.000 |
| | | *Sig.* | 0.855 | 0.925 | **0.010** | 0.996 |
| | Registry | $\rho$ | 0.018 | 0.116 | 0.069 | 0.206 |
| | | *Sig.* | 0.843 | 0.201 | 0.452 | **0.026** |
| **Non-substitutability** | Estates | $\rho$ | 0.110 | 0.048 | -0.178 | -0.032 |
| | | *Sig.* | 0.224 | 0.594 | **0.050** | 0.738 |
| | Finance | $\rho$ | 0.056 | 0.209 | 0.035 | 0.084 |
| | | *Sig.* | 0.551 | **0.022** | 0.710 | 0.382 |
| | Personnel | $\rho$ | -0.100 | 0.066 | 0.119 | -0.083 |
| | | *Sig.* | 0.287 | 0.473 | 0.197 | 0.388 |
| | Registry | $\rho$ | 0.005 | 0.124 | -0.125 | 0.249 |
| | | *Sig.* | 0.961 | 0.191 | 0.195 | **0.009** |

Sig.: 2-tailed, $\alpha = .05$, significant statistics are highlighted in bold.
n =144 (missing cases are excluded pairwise)

Source: analysis of survey data.

Another set of variables used in exploring the study's propositions is around the issue of professionalism. Table 18 details the intercorrelations between the two professionalism variables adopted (Spearman's *rho* correlation coefficient is used for the non-parametric correlation). The two variables are not significantly correlated and are thus suitable to use together in further analyses.

**Table 18: Intercorrelation of professionalism variables**

| | Professional grade staff | | CIPD membership | |
|---|---|---|---|---|
| | *ρ* | *Sig.* | *ρ* | *Sig.* |
| **Professional staff** | 1.000 | . | | |
| **CIPD** | 0.054 | 0.652 | 1.000 | . |

Sig.: 2-tailed, α = .05, significant statistics are highlighted in bold.
n =73 (missing cases are excluded pairwise)

Source: analysis of survey data.

Correlation analysis is also used to check for instances of multicollinearity between the IS-related variables. As the variables IS sophistication and REPORTS are metric though non-normal, Spearman's *rho* correlation coefficient is used for the non-parametric correlation. The results are displayed in Table 19 (bivariate two-tailed correlation where α = .05, using pairwise exclusion). The intercorrelation between the frequency of reports provided by the Personnel department and IS sophistication is statistically significant (sig. = .000). It is also logical to assume that the more functionality that is available to managers to use a Personnel system themselves, the less they have to rely on the Personnel department to provide information in the form of reports. For these reasons, the REPORTS variable has not been used any further in the analyses.

**Table 19: Intercorrelation of information system variables**

| | IS sophistication | | Reports provided | |
|---|---|---|---|---|
| | *ρ* | *Sig.* | *ρ* | *Sig.* |
| **IS sophistication** | 1.000 | . | | |
| **Reports provided** | 0.402 | **0.000** | 1.000 | . |

Sig.: 2-tailed, α = .05, significant statistics are highlighted in bold.
n =73

Source: analysis of survey data.

Finally, in addition to exploring multicollinearity, another implicit assumption of correlation is linearity and homoscedasticity. Analysis of the scatterplots between pairs of independent and dependent metric variables can indicate any non-linear or heteroscedastic relationships. Plots were produced for all relationships presented above looking at the bivariate correlations. None indicated a non-linear relationship between variables. The plots did highlight issues of heteroscedasticity between some variables; these will be addressed as appropriate when carrying out the statistical analyses of the propositions in the following chapter.

## 4.4. Summary

This chapter has presented in detail the process of data collection, showing how the samples were achieved and how they compare to the population for the study. Statistical tests for representativeness showed how well the sample matches the population, and that there is very little issue of response bias detected in the data. Multiple tests carried out on the metric variables from the questionnaire data have checked that the assumptions for both multivariate and univariate statistical analysis are met. Where this is not the case, non-parametric analysis techniques are used instead.

In the following chapter the full analysis of both the quantitative and qualitative data is presented. The analysis addresses the application of the strategic contingencies theory model in the Higher Education context, and then considers each of the research propositions in turn in order to provide answers to the overarching research questions.