Design and Documentation Quality Survey

Designer's Perspective

A Survey Investigating Changes in Design and Documentation Quality within the Australian Construction Industry and its Effect on Construction Process Efficiency

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Executive Summary

Background

The CSIRO Division of Building, Construction and Engineering – in collaboration with the Australian Construction Industry – recently undertook an investigation into the issues affecting design and documentation quality and their impact on the efficiency of the construction process. To carry out this task, a national survey, targeting designers, main contractors and trade contractors, was undertaken. Through this survey, the main factors affecting design and documentation quality, as well as the most significant impacts on the efficiency of the construction process in Australia, have been identified.

To carry out the study, the industry was partitioned into two sectors – designers and contractors – with each being surveyed separately using different survey forms. The various industry organisations representing both designers and contractors were actively involved in the development and distribution of the survey documents.

The overall aims of the study were to:

- identify those issues which affect design and documentation quality;
- determine whether there has been any changes over the past 15 years in the levels of design and documentation quality;
- determine what impact changing design and documentation quality standards may have on construction process efficiency; and
- assess the impact of these changes on project cost and time.

It should be noted however that whilst outlining the aims and objectives of the overall study, this report has been prepared specifically in relation to the results achieved from the designers' survey only. The results of the contractors' survey and a comparative analysis of the two sets of results are the subject of separate reports.

Survey Questionnaire

The designers questionnaire was developed from the results of industry workshops and consisted of eleven sections designed to obtain the following information:

- the level of importance of various design and documentation quality attributes in determining overall design and documentation quality;
- what issues affect design and documentation quality;
- what changes to the quality of design and documentation have occurred over the past 15 years;
- what changes to design fee levels have occurred over the past 15 years;
- whether there is any relationship between changes in design fee levels and changes in design and documentation quality; and
- a comparison between private and public sector clients.

In addition to these issues, the survey also enabled designers to consider a number of concepts relating to the provision of design services and issues affecting the procurement of design services. The survey also provided sections for company profile information and general comments.

Survey

The designer's questionnaire was distributed to just under 3000 design firms comprising Architects, Engineers, Landscape Architects, Quantity Surveyors and Land Surveyors. The response from all disciplines surveyed totalled 491 – an overall response rate of 16.6%. With all states and industry associations being represented, this number of responses ensures that the survey results are generally representative of the designers' sector of the industry.

Results

Overall

The respondents were classified by a number of factors based on information obtained from the organisational profile section of the survey. Based on the analysis carried out, it was determined that of the factors identified, only the organisation association factor was consistently of statistical significance. For the various issues raised in the survey, the architects, engineers and landscape architects were generally in close agreement with each other. Although the number of surveyors was insufficient to be of statistical significance, their responses were also generally in agreement with those of the other design disciplines. The responses from quantity surveyors however, tended to vary in their level of agreement, when compared to the design disciplines. Although there were statistically significant differences between the design disciplines and the quantity surveyors, the magnitude of these differences in relation to the mean responses for the specific issues was only small and as such, the results of the analysis provided in the report are reflective of the respondents collectively. The minimal variation in the responses overall indicated the population was homogeneous and as such any results can be considered as reflective of the entire population.

Design and Documentation Quality

The attributes considered by designers to be most important in determining the overall project *design* were:

- *functionality* (the design effectively serves the purpose for which it was intended); and
- *relevancy* (ensuring that project requirements are met)

The attributes considered to be least important were:

- *innovation* (incorporating innovation in the design solution); and
- *expressiveness* (provides symbolic expression and feeling).

The attributes considered to be most important in determining the overall project *documentation* were:

- *accuracy* (documents being free of errors, conflicts and inconsistencies); and
- *clarity* (documents being legible and easily read and interpreted

The attribute considered to be of least importance was:

- *standardisation* (the use of standard details and specifications).

In addition to looking at the attributes affecting design and documentation quality, designers were also specifically asked to consider whether there had been a decline in the quality of both design and documentation over the past 12 – 15 years. In relation to both design and documentation, designers indicated that there had been a decline in the quality produced and that the decline in documentation quality had been the more significant.

Procurement of Design and Documentation Services

When asked to consider the client's understanding of the value of various aspects of the design function, designers generally felt that neither *public* nor *private* sector clients understood the true value of the design function. Of most concern to designers was:

- the *need to interpret and expand* on inadequate and changing client briefs;
- the *lack of understanding by clients* as to the high litigation risks involved in selecting designers based on minimum cost; and
- that there was *insufficient time being allowed* for designers to not only produce high quality design and documentation, but also to adequately incorporate innovation and life cycle considerations.

It was also the opinion of designers that clients did not associate increases in project costs with poor quality design and that the quality of design and documentation was determined by the level of fees provided and the time available.

When considering the criteria used for design firm selection, the vast majority of designers perceived the level of design fees to be the most important criteria in obtaining work from either client group, with issues such as experience, qualifications and quality assurance being only of secondary consideration.

When the issue of time was considered, designers felt that overall there was insufficient time being allowed for designers to not only produce high quality design and documentation, but also to adequately incorporate innovation and life cycle considerations. Designers also felt that if more time was made available for the process of design and documentation, then the level of quality would be improved.

Design and Documentation Quality

It was the opinion of designers that those issues most frequently affecting design and documentation quality were:

- *unrealistic expectations by clients* – in relation to fees, service, timing, etc.;
- *low fee structures*; and
- *insufficient profits* – being generated to enable the training of staff.

However, when asked to consider which issues had the greatest impact on design and documentation quality, the issues identified were:

- *proliferation of 'backyard' operators* – prepared to work for minimal fees;
- *low fee structures*; and
- *insufficient overall design time.*

Overall the results generally indicate that when the frequency of occurrence of the issues affecting design and documentation quality increase, then their level of effect becomes increasingly detrimental.

Procurement Methods and Design and Documentation Quality

According to the designers the *Traditional* procurement system is still the most widely used procurement method, by a fairly large margin. However, its usage has declined significantly over the past fifteen years. This decline in the use of the *Traditional* procurement system has been taken up by an increase in the use of both *Design and Construct* and *Management* procurement systems, with *Design and Construct* being the more popular method of the two.

When considering the quality of design and documentation achieved under each procurement system, the designers indicated that overall quality has declined under all three procurement methods over the past 15 years, with the level of decline being greatest under the *Traditional* system and least under a *Management* system. In spite of this, the designers still perceive that the *Traditional* method provides the highest standard of design and documentation quality.

This perceived decline in quality may be due in part to a significant decline over the past fifteen years, in the availability of time to carry out the design and documentation function. Designers also indicated that the amount of available time had declined most under the *Traditional* method and least under *Management* systems. Looking at the changes in the level of service required by clients under each procurement system also showed a similar situation, with levels of service required declining most under the *Traditional* method and least under the *Design and Construct* system.

Changes in Levels of Design and Documentation Quality

In contrast to the majority of designers having indicated a decline in overall design quality over the past 12 – 15 years, the combined response for all design quality attributes listed appeared to indicate a small overall improvement in their level of incorporation over the same period. This apparent discrepancy is however explained, with the majority of respondents still indicating a decline in the incorporation of design quality attributes. The attributes that actually showed the greatest improvement were:

- consideration of *ecological sustainability* issues; and
- consideration of *whole life-cycle* issues.

Of the twenty-two attributes listed, eight showed a decline in their level of incorporation over the past 12 – 15 years. The attributes that showed the greatest decline were:

- equitable balance in the *ratio of junior to senior staff* used; and
- ready *availability of experienced design personnel*.

When asked to consider changes to the documentation quality attributes listed, designers indicated a significant overall decline in their level of incorporation over the past 12 – 15 years, which was consistent with the previous results indicating a decline in overall documentation quality. The attributes that showed the greatest decline were:

- *completeness* (drawings and other documents provide all the information required); and
- *final checking* (drawings and other documents are properly checked prior to release).

Of the ten attributes listed, four showed an overall improvement in their level of incorporation over the past 12 – 15 years. The attributes that showed the greatest improvement were:

- *standardisation* (use of standard details and specifications in drawings and other documentation); and
- *conformity* (documents indicate the requirements of standards and statutory regulations).

Changes in Levels of Service Provided

The designers considered that the majority of the design service components – which are required to ensure overall design and documentation quality – have declined over the over the past 12 – 15 years. The areas to have declined the most were:

- *providing complete and accurate documentation* and design detailing;
- *checking that dimensions are correct* and appropriate; and
- *coordinating design details* from various other consultants.

Not unexpectedly, the areas that have shown the greatest improvement over the same period were:

- *using CAD* for the production of drawings; and
- *using information technology* to improve project communications and assist with document transfer.

Changes in Levels of Design Fees

According to designers, the level of design fees required to provide a proper service and produce a quality product, have only declined marginally over the past 12 to 15 years, with the level of fees required for *simple* projects declining the most at just under 5%. These decreases in the required fee levels are most likely due to improvements in information technologies, which allow for improved efficiencies within the design processes.

However, the fee levels which designers considered to be needed to be *submitted* to actually win the work showed an average decline of approximately 21% for all three project complexity levels over the past 12 to 15 years. Similarly, when comparing the difference between the fee levels *submitted* now to the fee levels *required* now, the responses revealed that the disparity between the two fee levels represented an average decline in real designer fee income of approximately 24% for all three project complexity levels. It would appear therefore, that the levels of fees being obtained, are well below those that designers believe are required to provide quality design and documentation services and have been steadily declining over the past 12 to 15 years.

Reduced Fees and Attributes of Design and Documentation

It is the opinion of designers that reduced design fee levels have a highly detrimental effect on most design quality attributes, with the two attributes most affected being:

- *innovation* (incorporating innovation in the design solution); and
- *provision of in-house and external training* (to ensure continuing professional development of design staff).

Similarly, the responses provided in relation to the documentation quality attributes, indicated that reduced design fee levels also have a highly detrimentally effect on documentation quality, with the attributes affected most being:

- *completeness* (drawings and other documents provide all the information required); and
- *certainty* (drawings and other documents do not require changes or amendments).

The overall results correspond very closely with the design and documentation quality attributes considered by designers to have declined most over the past 12 to 15 years.

Other Changes in the Past 15 Years

The industry changes to which the designers indicated the greatest level of agreement, were:

- the trend of clients to *'shop around'* more for design services"; and
- the *tightening of economic conditions*.

When asked to consider what effect these various changes had on design and documentation quality, those changes that were identified as having the greatest benefit were:

- *advances in computer software* improving the level of service able to be provided; and
- the *implementation of Information Technology* improving communication within the industry.

However, those changes indicated by the designers to have the greatest detrimental effect on design and documentation quality were identified as:

- the *design function being de-valued* from a clients perspective; and
- the *tightening of economic conditions*.

Organisational Profile

Design firms responding to the survey generally have the following characteristics:

- they have been in business for *less than 20 years*;

- they employ *less than 10 staff*;
- the majority of the work they undertake is carried out under the *traditional* procurement method, with only about half involved in either *design and construct* or *management* type procurement methodologies;
- the greatest proportion of designer income came from the *civil engineering, government* and *commercial* project sectors;
- a greater proportion of design income in attained from *government and commercial building* and *civil engineering sectors*;
- obtain the majority of their income through *lump sum* fees; and
- are more likely to have their own *in-house QA system or no QA system at all*, than be fully accredited to ISO 9000 standards.

Designer's General Comments

Of the 491 responses received, 204 (42%) included comments, with the number of comments from the various disciplines and states being in proportion to their overall response rates.

Overall, the comments indicated that in the opinion of designers, *low design fees, insufficient time* and *a lack of understanding of the true value of the design professions* have generally led to a decline in design and documentation standards. It is also felt that this decline in design and documentation standards has in turn have led to a reduction in construction process efficiency and increased project costs.

1 Introduction

1.1 Background

For some time, industry analysts have portrayed the Australian construction industry as being uncompetitive and inefficient when compared to overseas, with the quality of design and documentation produced being of major concern to many parties within the industry (Syam, 1995). As the quality of the design and documentation produced has a major influence on the overall performance and efficiency of construction projects (Burati *et al*, 1992; Kirby *et al*, 1988), it is vitally important that issues affecting design and documentation quality be identified and addressed.

Designers provide the graphic and written representations which allow contractors and subcontractors to transform concepts and ideas into physical reality. However, it is the quality of the design and documentation provided which determines how effectively and efficiently this transformation occurs. Inadequate and deficient design and documentation impacts directly on the efficiency of the construction process by leading to delays, rework and variations, which in turn, contribute to increases in project time and cost (Tilley and Barton, 1997).

In an ideal world, the design and documentation provided for construction projects would be complete, precise and unambiguous. Unfortunately, contractors are often supplied with project documentation that is considered to be substandard or deficient due to incomplete, conflicting or erroneous information. Design and documentation quality is greatly determined by the level of professional services provided, with the quality of these services generally being determined by how the services are selected and how the fees are negotiated (DeFraites, 1989). Where designers are selected on the basis of low design fees, then the level and quality of the service provided is likely to be limited and generally translates into additional project costs to the owner.

A recent study of the relationship between fee structure and design deficiency showed that design deficiency had a non-linear inverse relationship with project design fees (Abolnour, 1994) and that project costs due to design deficiency increase sharply when design fees are reduced below their optimal level (Abolnour, 1994; McGeorge, 1988). The concept of reducing total project costs by increasing expenditure on the design process has also been well documented through the principles of value engineering (Green, 1990) and value management (Barton, 1996). It would appear therefore, that the truism, *'you get what you pay for'*, is very appropriate when it comes to procuring design services.

But what is design and documentation quality and how is it measured? One definition relating to design quality (McGeorge, 1988) states:

> *"a good design will be effective (i.e., serve the purpose for which it was intended) and constructable with the best possible economy and safety."*

However, while the design itself needs to be "effective", it also needs to be communicated effectively through the documentation (*i.e.*, drawings, specifications, Bills of Quantities). When documentation quality is considered, a number of attributes – such as timeliness, accuracy, completeness, coordination and conformance – are looked at to determine the level of quality achieved (Tilley *et al*, 1997). Therefore, by measuring the extent to which attributes of design and documentation quality are incorporated, we can determine the quality of design and documentation achieved (Tilley *et al*, 1997).

With this in mind, CSIRO Building, Construction and Engineering investigated design and documentation quality within the Australian construction industry, with the overall aim of the study being to:

- identify those issues which affect design and documentation quality;
- determine whether there has been any changes over the past 15 years in the levels of design and documentation quality;
- determine what impact changing design and documentation quality standards may have on construction process efficiency; and
- assess the impact of these changes on project cost and time.

To carry out this investigation, it was decided to conduct a national survey of both the design professions and the various head and trade contracting organisations. To ensure that the survey addressed only pertinent issues, industry workshops were undertaken as part of the background investigation stage of the study. These workshops, designed to obtain a cross-section of up-to-date industry opinion on the issues, provided valuable industry information that was used in the development of the survey questionnaires.

The purpose of this report is to not only provide project sponsors with the results of the designer's questionnaire conducted by the CSIRO, but also inform the industry as a whole as to the causes and effects of design and documentation deficiency from the designers' perspective.

1.2 Designer's Survey Questionnaire

To study this problem a number of alternatives were considered, however a postal survey was ultimately selected as it was decided that this method would most likely provide the quantity of reliable information required to allow a valid statistical analysis within the budgetary confines of the project. During the development of the questionnaire, special consideration was given to question length and clarity to try to minimise the chance of misinterpretation of the questions and maximise the reliability of the responses. To ensure that the survey only addressed pertinent issues, all the various industry sponsor organisations – through a Project Steering Committee - were actively involved in the development of the survey documents, by providing:

- advice on what information was likely to be available from the industry,
- comments on the development of survey questions and format, and
- information on specific issues that should be included in the questionnaire.

The design professions to which the questionnaires were sent, along with their representative industry associations, are as shown in Table 1.1:

Table 1.1 Design profession and representative industry associations

Design profession	Representative industry associations
• Architects	• RAIA – Royal Australian Institute of Architects
• Engineers	• ACEA – Australian Consulting Engineers Association &
	• IEAust – Institute of Engineers, Australia
• Landscape Architects	• AILA – Australian Institute of Landscape Architects
• Quantity Surveyors	• AIQS – Australian Institute of Quantity Surveyors
• Land Surveyors	• ACS – Association of Consulting Surveyors

The designers questionnaire was set out into eleven sections to obtain from the design professions the following information:

- what issues were important in determining design and documentation quality;
- whether over the past 15 years, there has been any changes in the levels of design and documentation quality and if so, determining the extent of that change;
- those issues which affect the procurement of design services, for both the public and private sectors;
- what issues were affecting design and documentation quality and determining their level of impact;
- whether different procurement methodologies had an impact on the level of design and documentation quality achieved;
- whether there has been any changes over the past 15 years in the levels of service provided by design firms;
- what – if any – changes have occurred to fee levels over the past 15 years and whether there were any differences between the fee levels obtained from public and private sector clients;
- what effect reduced fee levels have on the quality of design and documentation provided;
- how other changes in the industry have impacted on design and documentation quality; and
- an overall profile of design firms within Australia, for comparative purposes.

It is hoped that the information obtained will help to determine not only the major issues directly affecting the quality of design and documentation currently being produced, but also to devise strategies to eliminate the problems or at least minimise their impact.

1.3 Response Demographics

The survey questionnaire was distributed to 2974 design and related consultancy firms nationally. In total 491 responses to the designer's questionnaire were received – which represents a total response rate of 16.6% – with most disciplines being well represented (see Figure 1.1).

As can be seen, the only discipline not to achieve a strong response rate was the surveying discipline, which was only able to provide a 3% response rate. It should be noted however that a number of surveyors who responded indicated that their role in the design process is limited and that a number of issues raised were not relevant to their businesses. These types of concerns are likely to have contributed to their poor response rate.

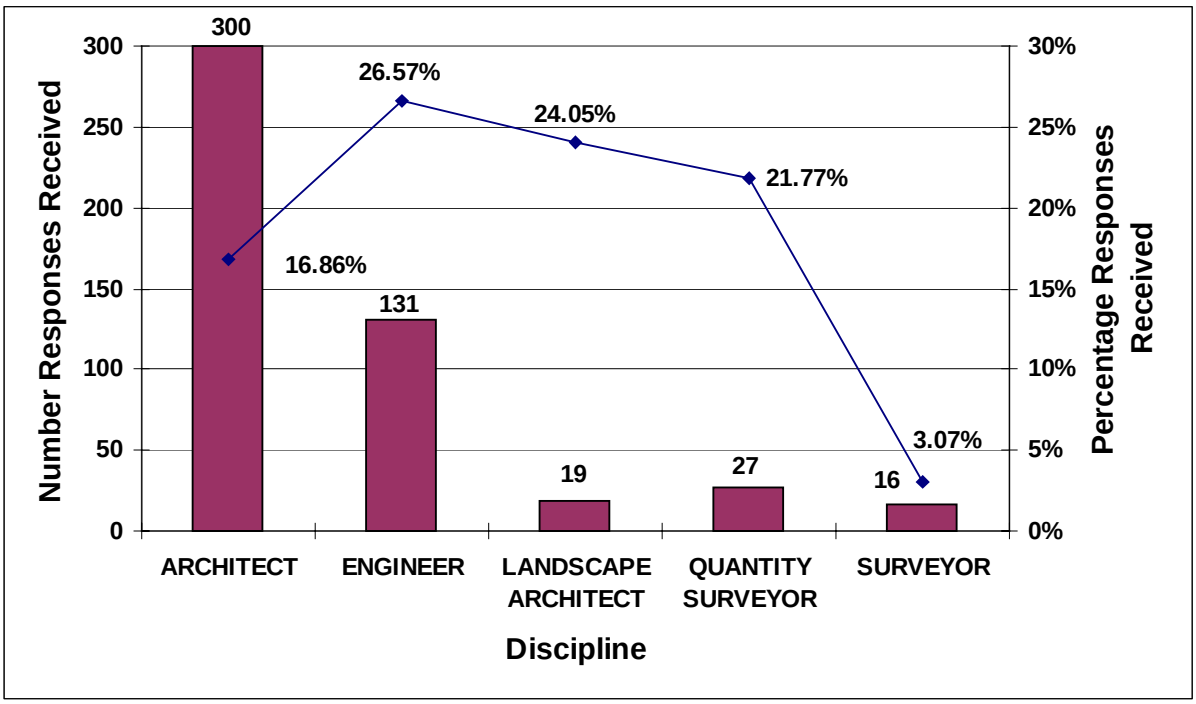

Figure 1.1 Survey responses (by discipline)

It is also important to note that this was a national survey and, as can be seen in Figure 1.2, all states and territories were well represented.

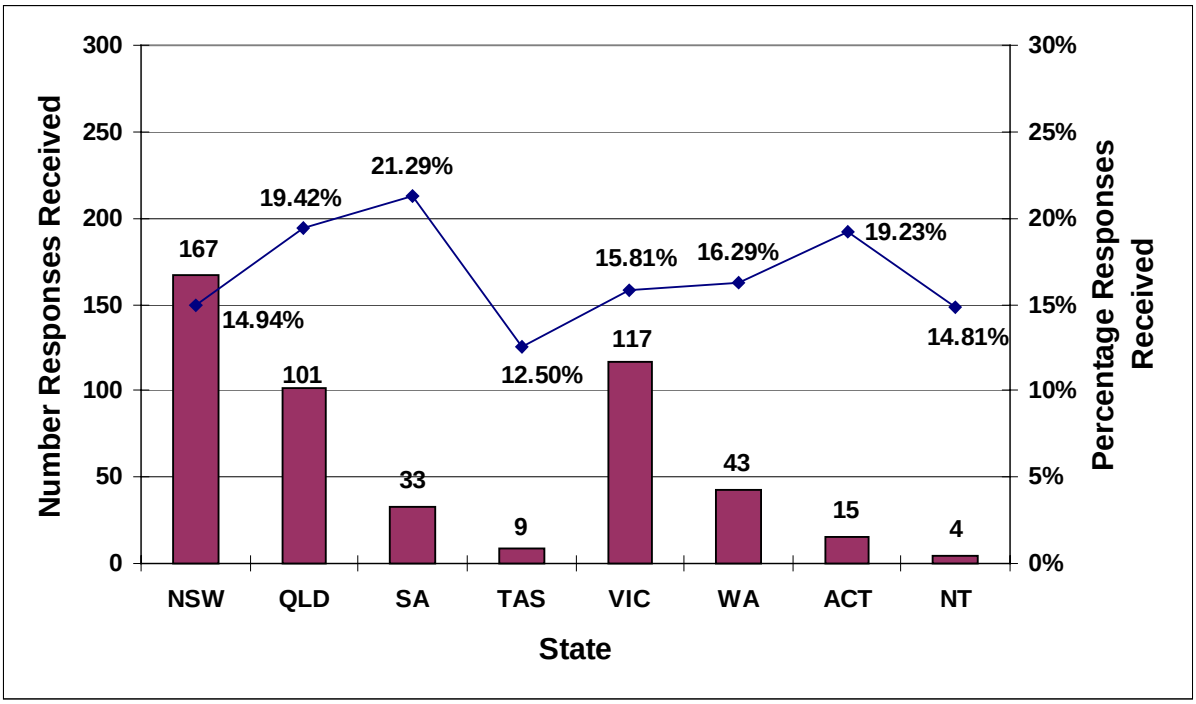

Figure 1.2 Survey responses (by state/territory)

The total number of responses received, although less than hoped for, is still considered quite reasonable for a survey of this type and ensures that the results determined are statistically significant. Therefore, the opinions of the respondents to this survey can be considered to be generally representative of the opinions of the design sector of the industry as a whole.

2 Survey Results

The responses were entered into a simple relational database and a statistical analysis of the data was undertaken to enable a full understanding of the designers' perspective. The results from this analysis are detailed below.

2.1 Section 1 – Design and Documentation Quality

2.1.1 Section 1 – Overview

In this section designers were asked to consider a list of design and documentation quality attributes and rate the level of importance that each attribute had in determining overall project design and documentation quality. The responses indicated that designers believed the most important attributes of design and documentation quality to be:

Design Quality Attributes

- *Functionality* – effectively serves the purpose for which it was intended;
- *Relevancy* – ensuring project requirements are met;

Documentation Quality Attributes

- *Accuracy* – drawings and other documents are free of errors, conflicts and inconsistencies
- *Clarity* – drawings and other documents are legible and are easily read and interpreted

The attributes of design and documentation quality indicated by designers to be the least important, were:

Design Quality Attributes

- *Expressiveness* – provides symbolic expression and feeling;
- *Balance* – in the ratio of junior to senior staff used;

Documentation Quality Attributes

- *Standardisation* – use of standard details and specifications in drawings and other documentation
- *Certainty* – drawings and other documents do not require changes or amendments

The most common rating given by the designers for the level of importance for a design and documentation attribute overall was ten (10), implying that the majority of respondents perceive all attributes of design and documentation quality as being of extremely high importance in determining overall quality.

Designers were also specifically asked to indicate whether – in their opinion – the standard of design and documentation had declined over the past 15 years and if it had, was the decline in documentation more significant than the decline in design. Overall, designers indicated that both design and documentation quality had declined and that the decline in documentation quality had been the more significant.

2.1.2 Question 1.1 – Importance of Design Quality Attributes

This question asked designers to rate the level of importance that various issues or attributes of design, have in determining overall project *design quality*. The design quality attributes surveyed are listed in Table 2.1.

Table 2.1 Design quality attributes

	Design Quality Attributes
a)	Consideration of whole life–cycle issues
b)	Happy client and public
c)	Extent of client involvement in the design process
d)	Availability of experienced design personnel
e)	Balance in the ratio of junior to senior staff used
f)	Quality of the place created
g)	Material efficiency – ensuring the efficient use of materials
h)	Economy – ensuring design solutions are cost effective
i)	Relevancy – ensuring project requirements are met
j)	Constructability – incorporating constructability principles
k)	Innovation – incorporating innovation in the design solution
l)	Expressiveness – provides symbolic expression and feeling
m)	Aesthetics – the finished product is visually pleasing
n)	Consideration of ecological sustainability issues
o)	Functionality – effectively serves the purpose for which it was intended
p)	Timelessness and durability – design will gracefully endure the passing of time
q)	Site compatibility – effectively uses and makes due allowance for site conditions
r)	Competence and experience of the person managing the design process
s)	Material selection – ensuring the availability, suitability and compatibility of materials
t)	Proper examination of design proposals (to prevent ambiguity, omissions and errors)
u)	Provision of in-house and external training to ensure continuing professional development of design staff
v)	Design service contracted for, is compatible with the design requirements of the project

The scale used for rating the various attributes, ranged from 0 (*Unimportant*) to 10 (*Very Important*). In the following chart, Figure 2.1, the mean of the responses to Question 1.1 is displayed in relation to the level of importance accorded them by the designers. The mean response allowed an assessment of the overall level of importance given to each of the design quality attributes proposed.

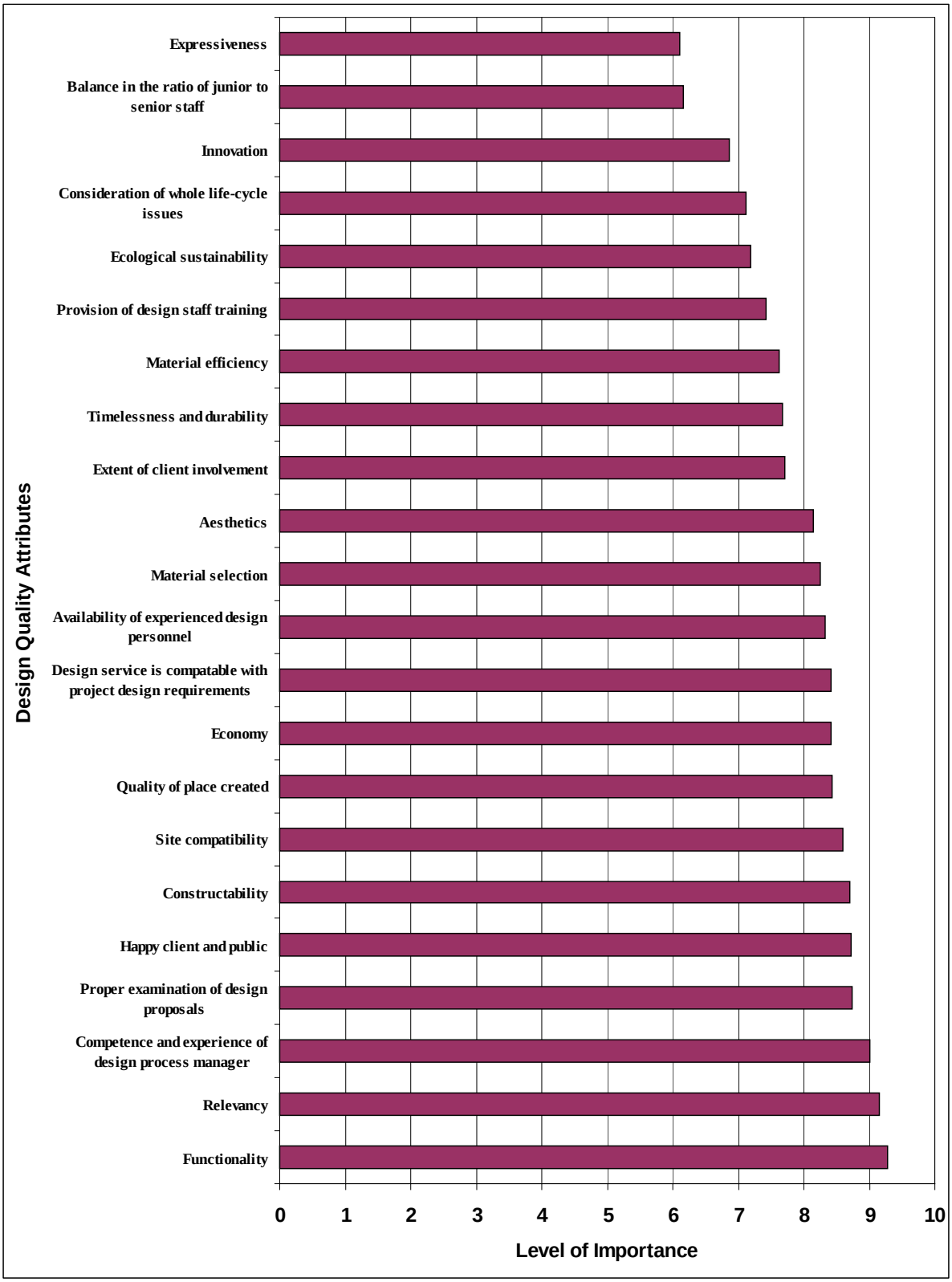

Figure 2.1 Importance ratings for design quality attributes

As can clearly be seen, the attributes of design quality with the highest mean response and which are therefore considered to be the most important in determining overall project design quality, were:

- *Functionality*
- *Relevancy; and*
- *Competence and experience of the person managing the design process;*

The attributes of design quality with the lowest mean response and considered to be the least important were:

- *Expressiveness*;
- *Balance* in the ratio of junior to senior staff used; and
- *Innovation*.

These results were also reasonably consistent across the different design disciplines. Overall, the perception of design attribute importance was very high, averaging just over eight (8.01) out of 10 across all of the attributes, with the most common rating given, being ten (10).

2.1.3 Question 1.2 – Importance of Documentation Quality Attributes

In Question 1.2 designers were asked to rate the level of importance that various issues or attributes of documentation have in determining overall project *documentation* quality. As with the design quality attributes, the scale used to rate documentation quality attributes ranged from 0 (*Unimportant*) to 10 (*Very Important*). The design quality attributes surveyed are listed in Table 2.2.

Table 2.2 Documentation quality attributes

	Documentation Quality Attributes
a)	Completeness – drawings and other documents provide all the information required
b)	Clarity – drawings and other documents are legible and are easily read and interpreted
c)	Accuracy – drawings and other documents are free of errors, conflicts and inconsistencies
d)	Final checking – drawings and other documents are properly checked prior to release to the contractor
e)	Standardisation – use of standard details and specifications in drawings and other documentation
f)	Relevance – trade specifications and details are specific, relevant and appropriate to the project
g)	Timeliness – drawings and other documents are supplied when required, to avoid delays
h)	Coordination – drawings and other documents are thoroughly coordinated between design disciplines
i)	Certainty - drawings and other documents do not require changes or amendments
j)	Conformity – drawings and other documents indicate the requirements of performance standards and statutory regulations

In Figure 2.2 below, the mean responses for the attributes of *documentation* quality are shown, with the attributes being displayed in order of importance based on the mean response provided by the designers.

The attributes of documentation quality considered to be most important by designers, were:

- *Accuracy*;
- *Clarity*; and
- *Final checking*.

The attributes considered to be the least important, were:

- *Standardisation*;
- *Certainty*; and
- *Relevance*.

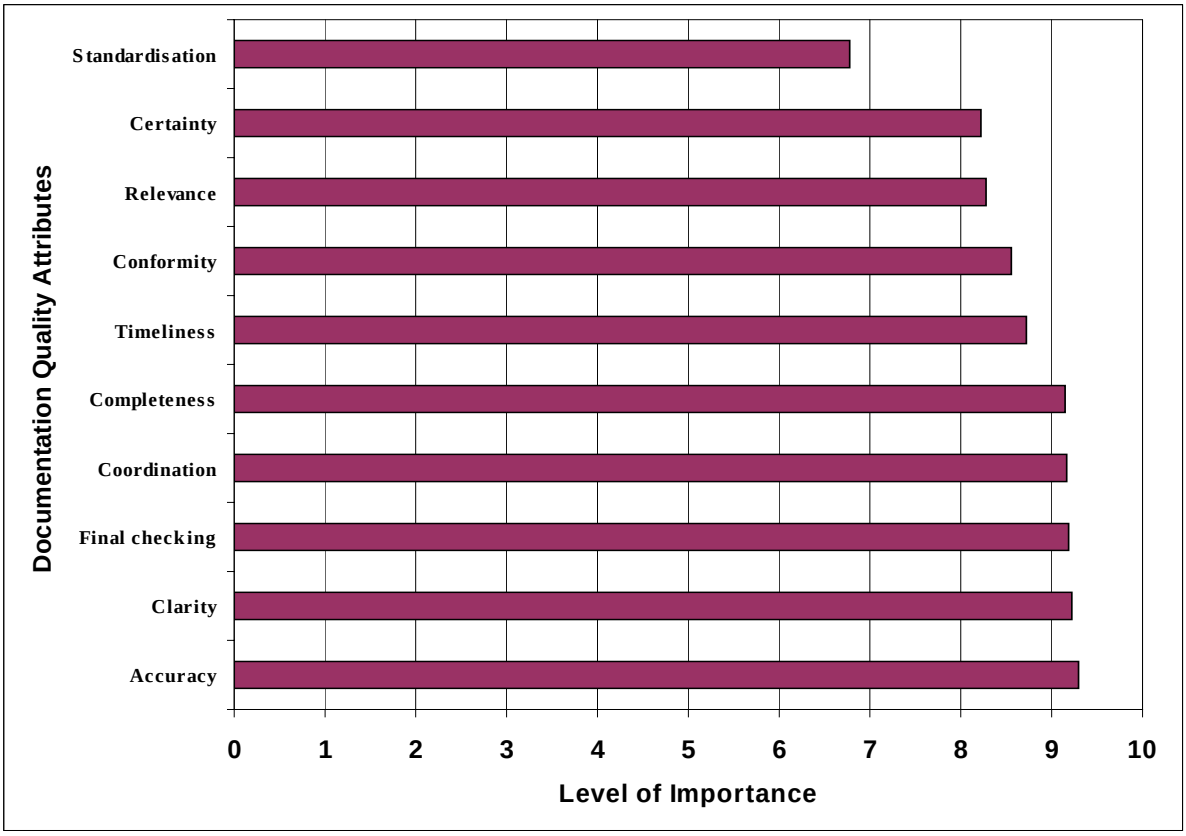

Figure 2.2 Importance ratings of documentation quality attributes

Overall, the designer's perception of the level of importance for documentation quality attributes was also very high, averaging almost nine (8.7) out of a possible 10. Documentation issues generally received a higher rating than the design attributes did and there was a greater level of agreement among designers for documentation issues. Again the most common rating was ten (10), implying that the majority of respondents perceive that overall documentation quality is of extremely high importance.

The precision of the high scoring attribute averages is more distinct than that of the lower scoring attributes. Those attributes considered extremely important, were considered so by all respondents, whereas the attributes perceived as being less important have a weakly defined distribution of responses (i.e.: more variability amongst respondents, therefore less definite about their opinion).

2.1.4 Question 1.3 – Has there been a Decline in Overall Design Quality?

In Question 1.3, designers were asked to consider whether there had been a decline in *design* quality over the past 15 years, with the available responses being either:
a) *Yes*; b) *No*; or c) *Unsure*.

In Figure 2.3 below, we can see that just over half (52%) of the respondents agreed that the overall quality of design had declined over the past 15 years. While just over a third (35%) of respondents disagreed, only 13% were unsure. When checking the results across disciplines, it was found that landscape architects overall, disagreed with the other professions, indicating that quality had not declined over the past 15 years. There was however, no statistical difference in the responses for the other individual disciplines surveyed.

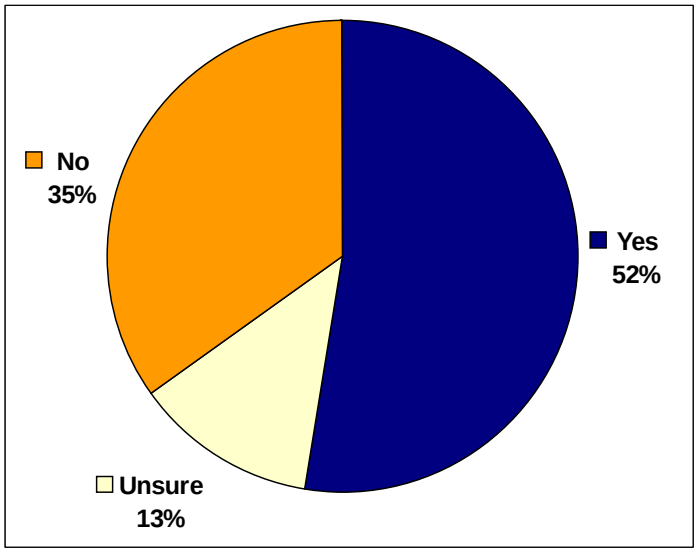

Figure 2.3 Response to whether there had been a decline in overall design quality over the past 15 years

2.1.5 Question 1.4 – Has there been a Decline in Overall Documentation Quality?

In Question 1.4, designers were also asked to consider whether there had been a decline in *documentation* quality over the past 15 years, with the available responses again being either: a) *Yes*; b) *No*; or c) *Unsure*.

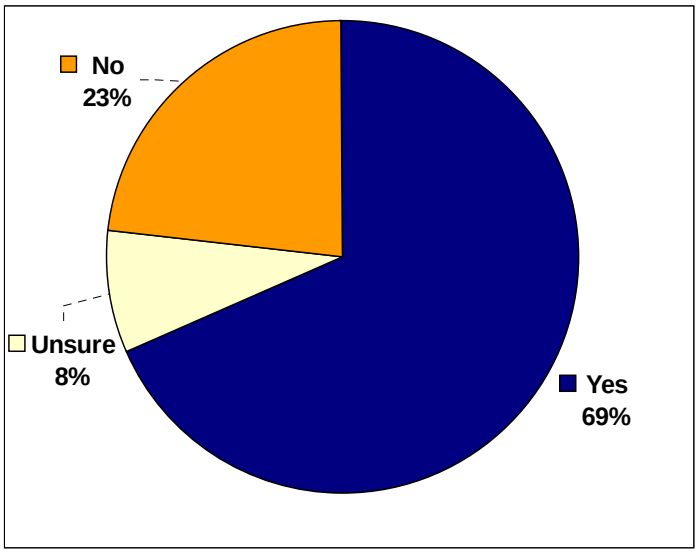

Figure 2.4 Response to whether there had been a decline in overall documentation quality over the past 15 years

As can be seen in Figure 2.4, the respondents were much more definite in their response to this question, with a large majority (69%) indicating that there had been a decline in the quality of documentation over the past 15 years. When comparing the disciplines, it was found that comparatively more engineers suggested that there had not been a decline in documentation quality, however a greater proportion of quantity surveyors were sure that documentation quality had declined.

2.1.6 Question 1.5 – Comparison of the Perceived Decline in Both Design and Documentation

In Question 1.5, those designers who answered '*Yes*' to both Questions 1.3 and 1.4, were asked to consider whether they felt that the overall decline in *documentation* quality had been more significant than the decline in the overall quality of design, with the available responses again being either:
a) *Yes*; b) *No*; or c) *Unsure*.

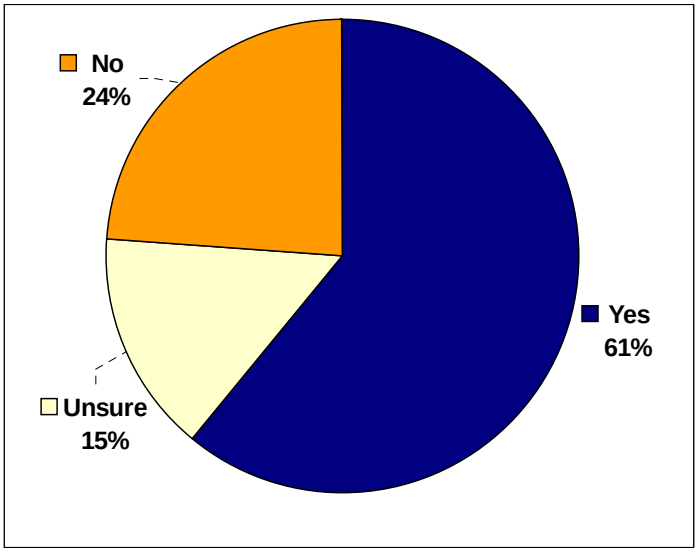

Figure 2.5 Response to whether the decline in documentation quality had been more significant than the decline in design quality

As can be seen from the responses shown in Figure 2.5 the majority (61%) of respondents believe that the decline in documentation quality has been more significant than it has been in design.

However, in Figure 2.6 below, we see that – as a discipline – quantity surveyors were the most certain of all. Although, a large proportion of landscape architects and surveyors believed the decline in documentation was not more significant than the decline in design – as shown by the large number of *Unsure* responses – only the responses from the quantity surveyors were considered statistically significant.

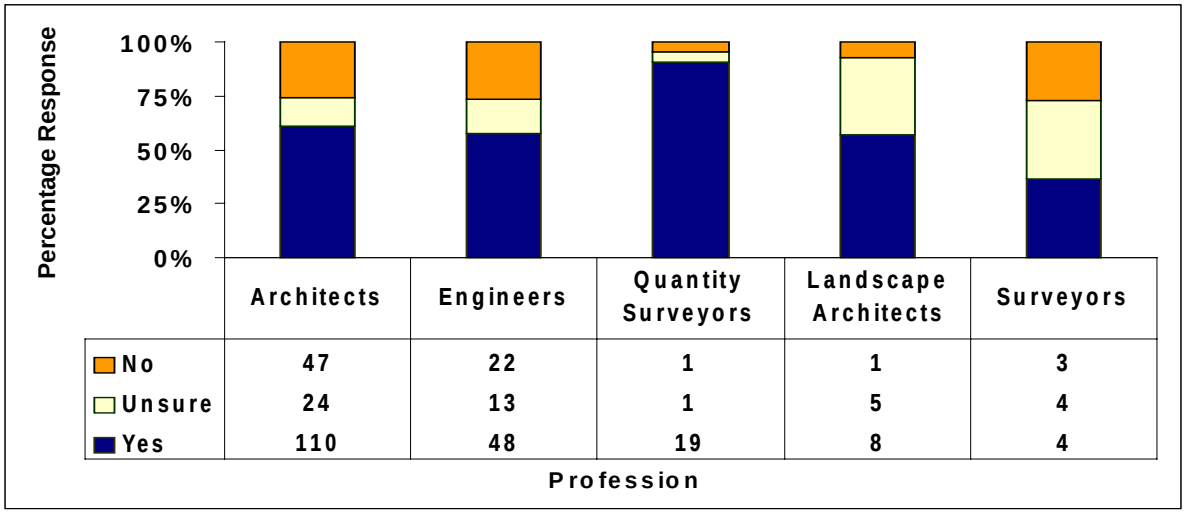

Figure 2.6 Breakdown of responses for question 1.5 (by profession)

2.2 Section 2 – Issues Affecting the Procurement of Design and Documentation Services

2.2.1 Section 2 – Overview

This section deals with the designers' perceptions of various issues concerning the procurement of design and documentation services. Consultants were asked to consider a number of statements relating to the clients understanding of the value of the design function and then indicate their level of agreement to each statement. They were also asked to consider issues in relation to obtaining work and rate their perception of the importance each issue has in obtaining work. For these questions designers were asked to provide a response for both public and private sector clients to enable comparisons between each client group.

In general, it is the opinion of designers that both *private* and *public* clients, do not properly understand the true value of the design function, the cost and time required to carry out the design function properly or their own impact on design process efficiency. Based on the responses provided, the main concerns of designers overall were that:

- clients expect them to be able to interpret and expand on inadequate briefs;
- clients did not understand there are high litigation risks involved in selecting designers based on the minimum cost; and
- clients did not understand that the quality of design and documentation is determined by the level of fees provided and the time available;

It was also the opinion of designers that the main selection criteria for obtaining design work from either client group, was the level of design fees submitted, with issues such as experience, qualifications and quality assurance being only of secondary consideration. When asked to consider issues relating to the availability of actual time to carry out the design function, there was a general consensus that there was insufficient time being allowed for designers to not only produce high quality design and documentation, but also to adequately incorporate innovation and life cycle considerations.

2.2.2 Question 2.1 – Client's Understanding of the Value of the Design Function

In Question 2.1 of the survey document, the designers were asked to consider a number of statements relating to the client's understanding of the value of various aspects of the design function and indicate their level of agreement to each statement. The respondent's level of agreement was measured on a five-point scale, from '*Strongly Disagree*' to '*Strongly Agree*'.

The format of the question also specifically allowed designers the ability to compare the performance of both *public* and *private* sector clients in relation to each issue. A list of the statements relating to the clients understanding of the value of the design function surveyed are shown in Table 2.3.

Table 2.3 Aspects of client's understanding of the value of the design function

Aspects of client's understanding of the value of the design function
a) Clients expect designers to be able to interpret and expand on inadequate briefs
b) Clients possess realistic expectations of fees, services and timing
c) Clients understand there are high litigation risks involved in selecting designers based on the minimum cost
d) Clients understand that the provision of an adequate service is attainable at a sensible fee
e) Clients understand that an increase in project costs can be due to cut backs in the initial time allowed for design
f) Clients understand the time and money saving value of comprehensive and clear documentation
g) Clients understand the importance of design services being compatible with project requirements
h) Clients are generally willing to work with designers to ensure the correct interpretation of the brief
i) Clients understand the impact that a changing design brief has on the efficiency of the design team
j) Clients understand the importance of the compatibility of the design firms and their ability to work together cooperatively
k) Clients understand that the quality of design and documentation is determined by the level of fees provided and the time available
l) Clients understand that money spent early, properly defining project requirements, saves money later in the design and documentation process
m) Clients understand the importance of a clear and concise brief to assist the efficiency of the design and documentation process
n) Clients understand that poor quality design and documentation leads to variations, delays and rework in the construction process, which causes increases in construction costs

The results – as shown in Figure 2.7 – are based on the overall frequency of the responses for each of the specific issues raised. The chart produced, shows the various overall levels of agreement indicated by the designers, to each statement and as they relate to each client type. Based on the responses provided, the top five concerns of designers overall were that:

- clients expected them to be able to interpret and expand on inadequate briefs;
- clients did not seem to understand that there are high litigation risks involved in selecting designers based on the minimum cost;
- clients did not seem to understand that an increase in project costs can be due to cut backs in the initial time allowed for design;
- clients did not seem to possess realistic expectations of fees, services and timing; and
- clients did not seem to understand that the quality of design and documentation is determined by the level of fees provided and the time available;

When considering these results as a whole, the overall perception provided by designers was that clients in general – both *private* and *public* – did not appear to understand the true value of the design function, in relation to overall project outcomes. However, when comparing the differences between the two different client types, the results show that overall, there was an perception by designers that *private* sector client's had less understanding than did *public* sector clients.

Although the responses provided for each client type were proportionately comparable, it should be noted that there were fewer responses for the statements in relation to the public sector, as not all design firms surveyed carried out work in this segment of the market.

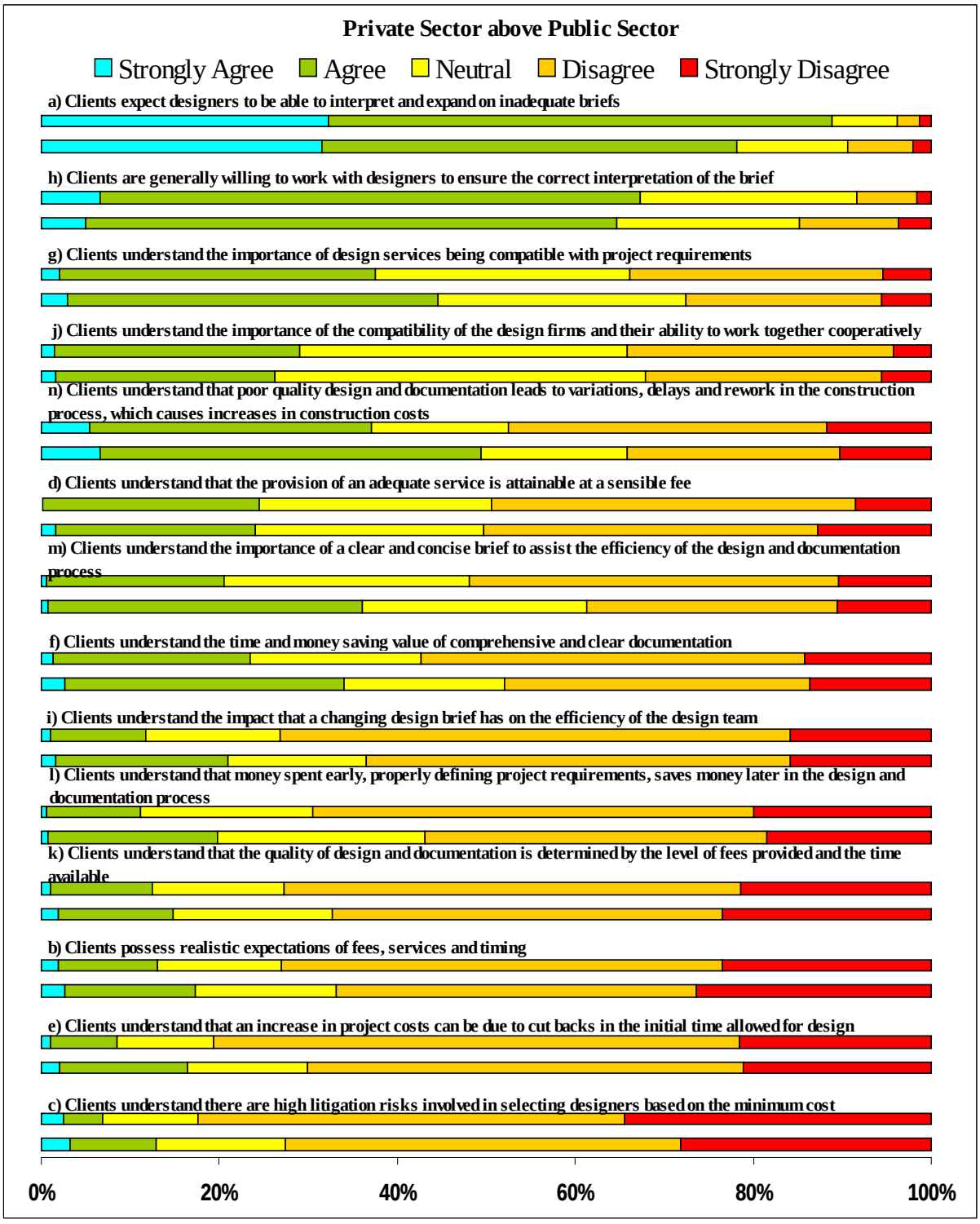

Figure 2.7 Level of agreement for selected issues relating to the client's understanding of the design function

2.2.3 Question 2.2 – Importance of Designer Selection Criteria

In Question 2.2 of the survey document, the designers were asked to consider a number of issues in relation to obtaining work from clients and to provide their perceptions of the relative importance clients appear to place on those issues. The respondent's level of importance was measured on a five-point scale, from '*Very Low*' to '*Very High*'.

Again the format of the question specifically allowed designers to compare both *public* and *private* sector clients in relation to each issue. The selection criteria issues surveyed are shown in Table 2.4.

Table 2.4 Client criteria for the selection of design services

Client criteria for the selection of design services
a) Design firm's reputation, capabilities, experience and qualifications
b) Level of design fees submitted for the project
c) Level of design and documentation quality required
d) Level of contractual risk accepted by the designer
e) Quality Assurance accreditation of the design firm
f) Stability of design firm's recent financial history
g) Current workload of design firm
h) Acceptance of contractual arrangements that are incompatible with project requirements

The chart below, Figure 2.8 shows, in order of perceived importance, the responses given by the designers for the level of importance of each issue. Again, the responses for both the public sector and private sector clients are displayed for comparative purposes.

When considering all the various selection criteria, it was the *"level of design fees submitted for the project"* that designers believed to be the most important factor in obtaining work, for both *public* and *private* sector clients. It is also interesting to note that both Architects and Engineers – the bulk of the respondents – consider the level of design fees was of relatively more importance to clients from the *public* sector than from the *private* sector.

When considering a *"design firm's reputation, capabilities, experience and qualifications"* as a factor in obtaining work, designers believed it was perceived by clients – both *public* and *private* sector – to be the next most important issue. The figures show however, that designers perceive this issue to be of more significance to *private* sector clients than it was to *public* sector clients.

An issue that has had a large impact on design firms over the past 10 years or so - the *"quality assurance accreditation of the design firm"* – was not considered all that important as a factor in obtaining work. Designers did however indicate that this factor was seen as being of much more importance to *public* sector clients than to *private* sector clients, even though its overall level of importance was only a little above average. Interestingly, further analysis showed that those firms who either did not have quality assurance, or were in the process of becoming quality assured, believe it was of more important than those who had already achieved certification, especially in relation to *public* sector clients.

It is also interesting to note that an issue one would generally consider to of relatively high importance – the *"stability of design firm's recent financial history"* – was actually considered by designer's to be the least important issue in a client's selection process.

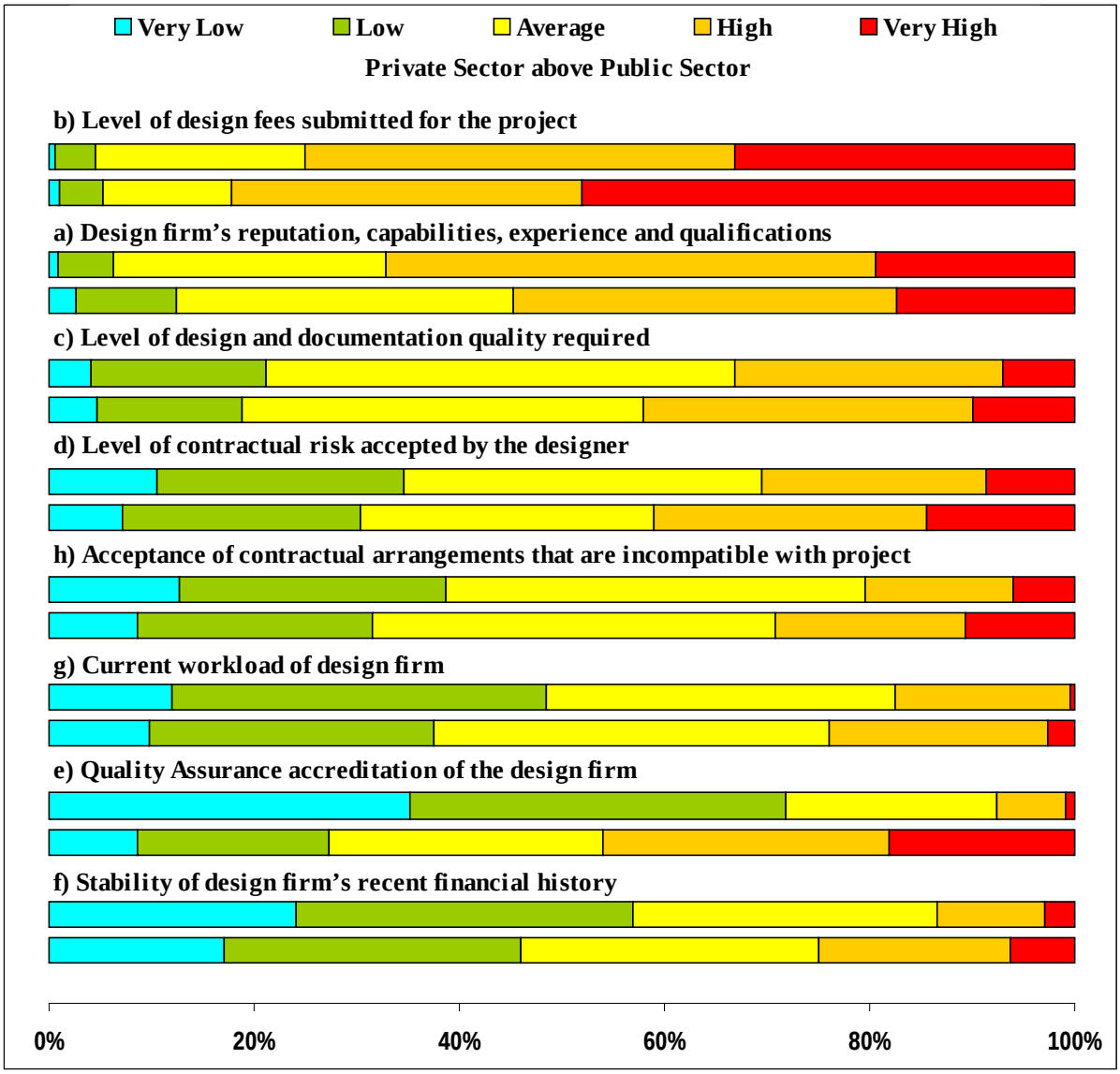

Figure 2.8 Perceived level of importance placed by clients on selection issues

2.2.4 Question 2.3 – Availability of Time to Carry Out the Design Function

In Question 2.3 of the survey document, the designers were asked to consider a number of statements relating to the availability of actual time to ensure the production of quality design and documentation and to provide their level of agreement to each statement. The respondent's level of agreement was measured on a five-point scale, from '*Strongly Disagree*' to '*Strongly Agree*'.

Unlike the previous questions in this section, the format of this question made no allowance for designers to compare the differences between *public* or *private* sector clients in relation to time availability on projects. A list of the statements relating to time availability which were surveyed, are shown in Table 2.5:

Table 2.5 Statements relating to the availability of design time

Statements relating to the availability of design time	
a)	The time spent with clients, establishing project requirements, is sufficient to ensure understanding
b)	Time available for each key phase of the design process is sufficient to ensure high quality
c)	There is sufficient time to compare and discuss project details with other design disciplines
d)	Sufficient time is provided early in the design stage to consider whole life-cycle issues
e)	There is an adequate amount of time to properly check drawings and specifications
f)	If more time was made available for design and documentation, the level of quality would be higher
g)	There is adequate time available to promptly and accurately respond to contractor RFIs
h)	Time available is adequate to allow basic training for junior staff to be provided
i)	There is adequate time available to investigate innovative approaches to better meet the specific requirements of the project
j)	The amount of time necessary to complete the design and documentation process, is adequately accounted for within the fee structure

In Figure 2.9 below, the level of agreement given by the respondents to each statement is shown, with the chart arranged in order of the perceived level of agreement.

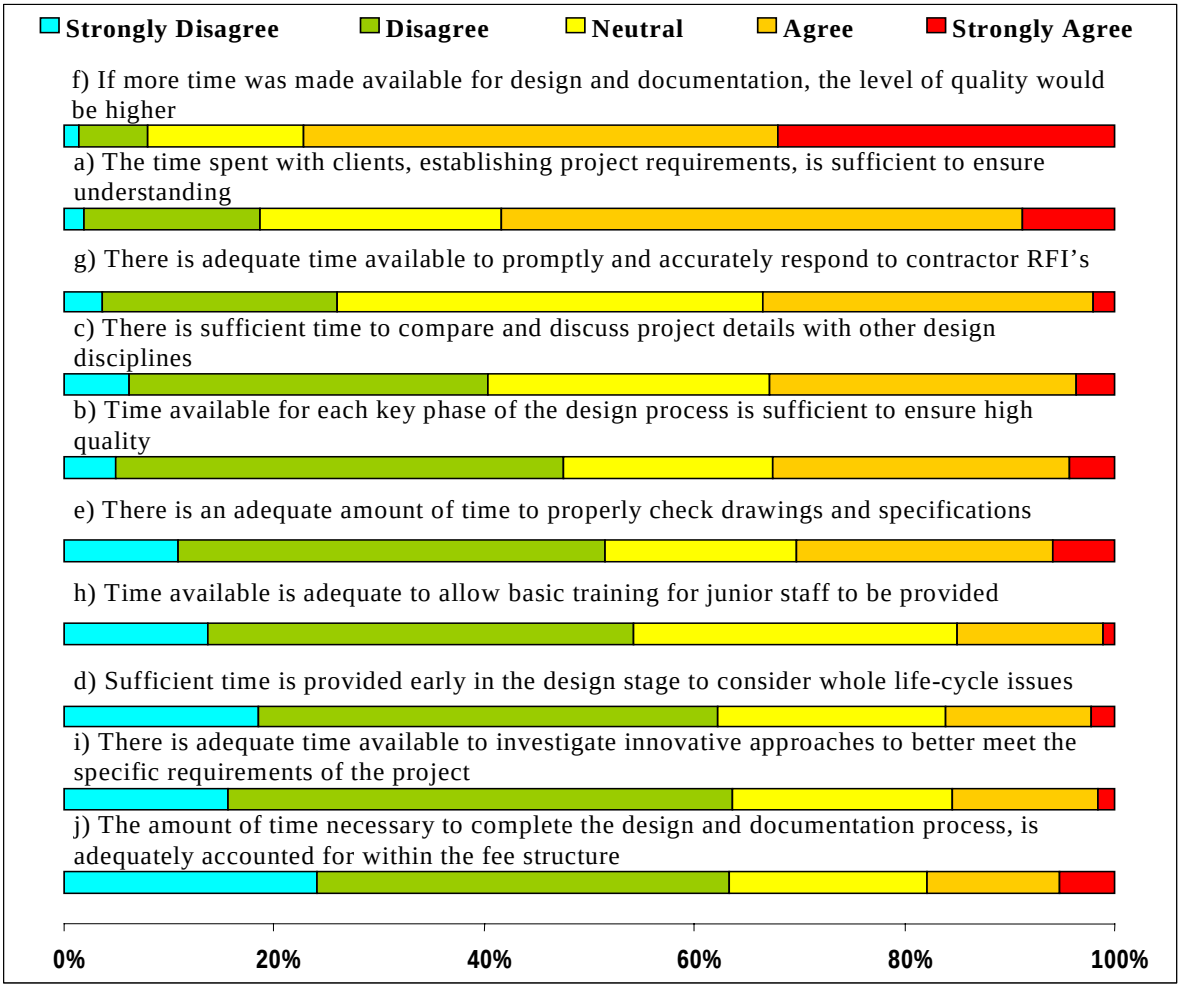

Figure 2.9 Overall level of agreement for availability of time issues

As can be seen from Figure 2.9, the greatest level of agreement overall, was achieved by the following two (2) statements:

- If more time was made available for design and documentation, the level of quality would be higher; and
- The time spent with clients, establishing project requirements is sufficient to ensure understanding.

Further analysis indicated there was also a high level of consistency of agreement between the disciplines with regard to the need for extra time to ensure higher quality. However there was some variability in the level of agreement between the disciplines with regard to the time needed to establish project requirements, with Architects providing a significantly higher level of agreement than from either Engineers or Quantity Surveyors. In fact the response from Quantity Surveyors to the statement was overall, just below neutral and leaning towards disagreement.

The greatest level of disagreement however, was achieved by the following three (3) statements:

- The amount of time necessary to complete the design and documentation process, is adequately accounted for within the fee structure;
- There is adequate time available to investigate innovative approaches to better meet the specific requirements of the project; and
- Sufficient time is provided early in the design stage to consider whole life-cycle issues.

For all three (3) statements there was reasonable consistency between the majority of the disciplines with regard to their level of disagreement, however in all instances, the Quantity Surveyors were significantly more negative.

Overall therefore, these results would appear to indicate that designers believe that there is insufficient time being allowed to enable the production of high quality design and documentation and to adequately incorporate innovation and life cycle considerations.

2.3 Section 3 – Issues Affecting Design and Documentation Quality

2.3.1 Section 3 – Overview

Section 3 looks at a number of issues previously identified at the designer's workshop, as being detrimental to design and documentation quality. This section was designed to not only determine the frequency with which these issues occur, but also the level of effect that they had on quality, when they occurred. Designers were asked to rate the frequency of occurrence of the issues identified, as well as the level of effect that each issue had on design and documentation quality, when it occurred.

Overall, it was the opinion of designers that "*unrealistic expectations by clients – in relation to fees, service, timing, etc.*" and "*low fee structures*" were the issues affecting design and documentation quality, that occurred most frequently. It was also the opinion of the designers that these issues, along with "*the proliferation of 'backyard' operators*", "*insufficient overall design time*" and "*inadequate or moving client brief*" that had the greatest detrimental effect on design and documentation quality.

Further analysis looking at the correlation between frequency and effect showed that as the frequency of occurrence of the issues effecting design and documentation quality increase, the level of effect also becomes increasingly detrimental.

2.3.2 Question 3.1 – Issues Affecting Design and Documentation Quality

In Question 3.1, the designers were asked to consider a number of issues – previously identified at the designer's workshop, as being detrimental to design and documentation quality – and provide not only their perception of the frequency that each issue occurs, but also the level of effect that each issue has on design and documentation quality, when it occurs. The frequency of occurrence was measured on a five-point scale, from '*Not at All*' to '*Always*', while the level of effect was rated on a scale from 0 (*no detrimental effect*) to 10 (*highly detrimental effect*). A list of the issues to be rated are shown in Table 2.6 below:

As can be clearly seen in the following chart (Figure 2.10), the issues identified as occurring most frequently, were:

- Unrealistic expectations by clients - in relation to fees, service, timing etc.;
- Low fee structures;
- Insufficient profits being generated to enable the training of staff.

However, the issues that designers believed occurred the least were:

- Improper implementation of CAD;
- No one person or office being responsible for design coordination; and
- Difficulty in interfacing between varying contractual relationships.

Overall, these results also appear to be consistent with the responses to Section 2. By looking at the two sections together, it may be reasonable to conclude that the designer's perception of clients having unrealistic expectations of the design team and an inability to provide comprehensive and consistent project briefs could be grounds for their assertions that clients have a lack of understanding of the design process.

Table 2.6 Issues impacting on design and documentation quality

Issues impacting on design and documentation quality
a) Low fee structures
b) Insufficient overall design time
c) Inadequate or moving client brief
d) Requests for unpaid design submissions
e) Uncertainty of design brief at bid stage
f) Improper implementation of CAD
g) High cost of 'Expression of Interest' (EOI) and D & C submissions
h) Unrealistic expectations by clients – in relation to fees, service, timing, etc.
i) Inadequate or insufficient project estimates or budgets
j) Builder-employed design managers instigating design changes
k) Insufficient profits being generated to enable the training of staff
l) No one person or office being responsible for design coordination
m) Difficulty in finding good staff (eg. Spec. writers and construction detailers)
n) Additional work necessary to meet 'Quality Assurance' (QA) requirements
o) Clients requesting design changes, without being prepared to pay for them
p) High volume of builder-initiated design changes (under D & C system)
q) Architectural consultants being engaged on a 'design only' basis
r) Proliferation of 'backyard' operators prepared to work for minimal fees
s) Lack of understanding by the client of the value of Bills of Quantities
t) Difficulty in interfacing between varying contractual relationships
u) Fellow consultants not clearly defining exactly what is required
v) Difficulty in convincing clients of the value of comprehensive and clear documentation
w) Fellow consultants having reduced service – incompatible with overall project team requirements

In Figure 2.11, the chart provides an overall rating in relation to the *effect* that each of the problem issues has on design and documentation quality, when they occur. The issues indicated by designers as having the greatest effect on design and documentation quality were:

- Proliferation of 'backyard' operators prepared to work for minimal fees;
- Low fee structures;
- Insufficient overall design time;
- Inadequate or moving client brief; and
- Unrealistic expectations by clients – in relation to fees, service, timing, etc.

All five of these issues had an average rating between 7.3 and 7.5 and were perceived by the designers as having a significantly greater effect on design and documentation quality than the other issues.

Those issues perceived to effect design and documentation quality the least were:

- Improper implementation of CAD;
- Additional work necessary to meet 'Quality Assurance' (QA) requirements; and
- Difficulty in interfacing between varying contractual relationships.

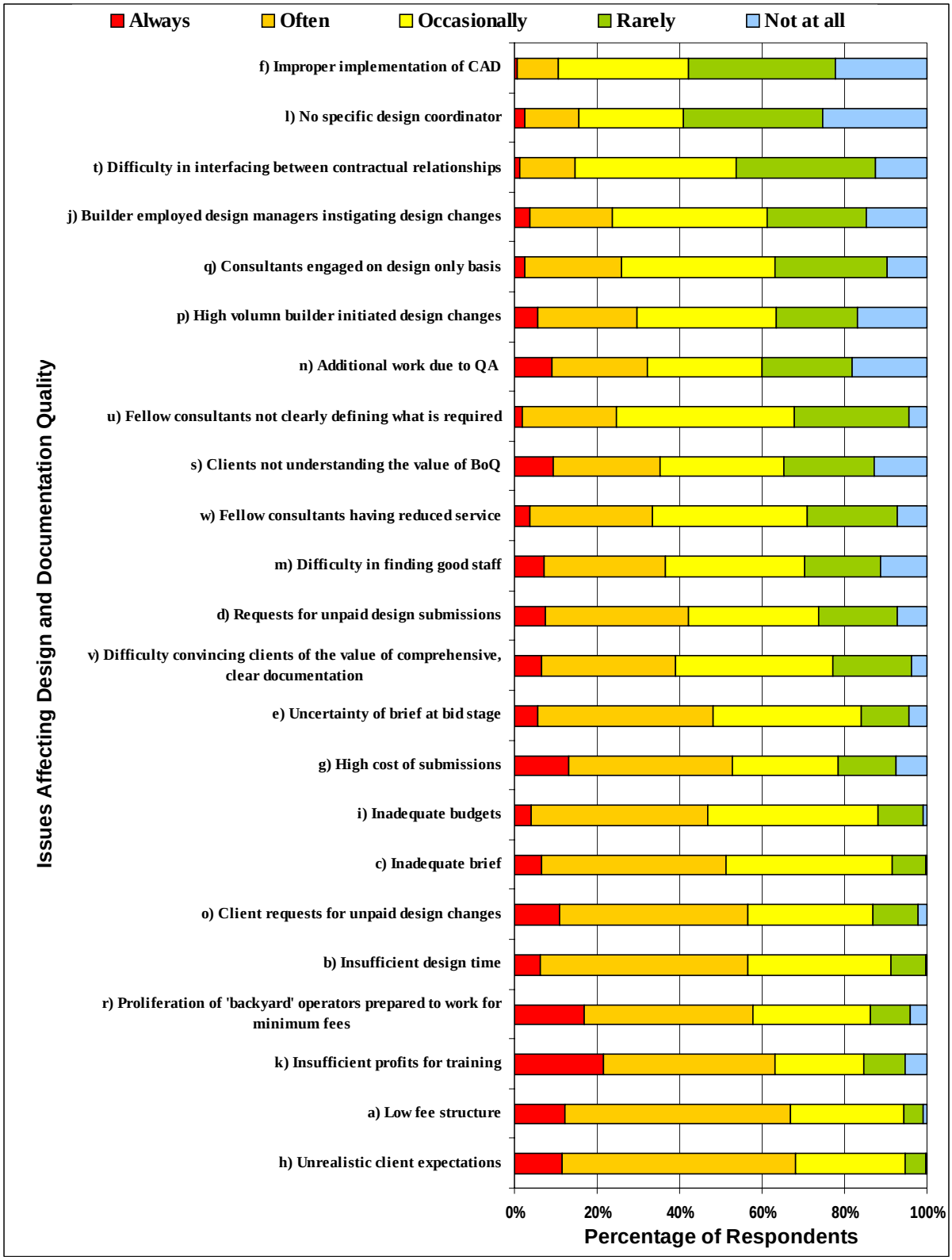

Figure 2.10 Frequency of occurrence of issues affecting design and documentation quality

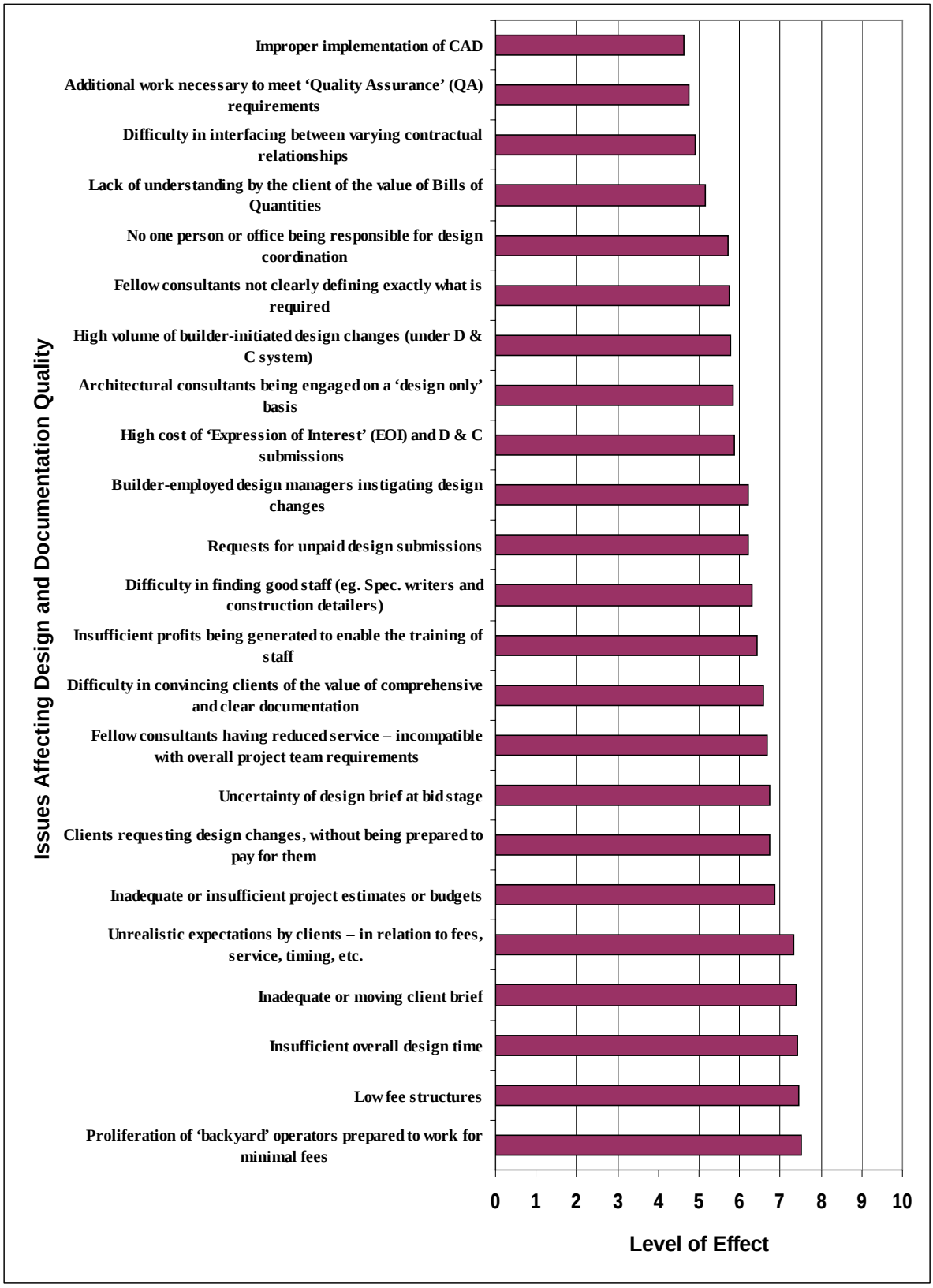

Figure 2.11 Effect of issues on design and documentation quality

To try to determine the strength of the relationship between frequency and effect, a correlation test was done. The results of this test showed a correlation coefficient – where 1 is the strongest relationship and 0 is the weakest – of 0.57, which indicates that there was a positive correlation between frequency and effect. Figure 2.12 shows graphically how the level of effect becomes increasingly detrimental, as the frequency of occurrence of the issues effecting design and documentation quality, increase.

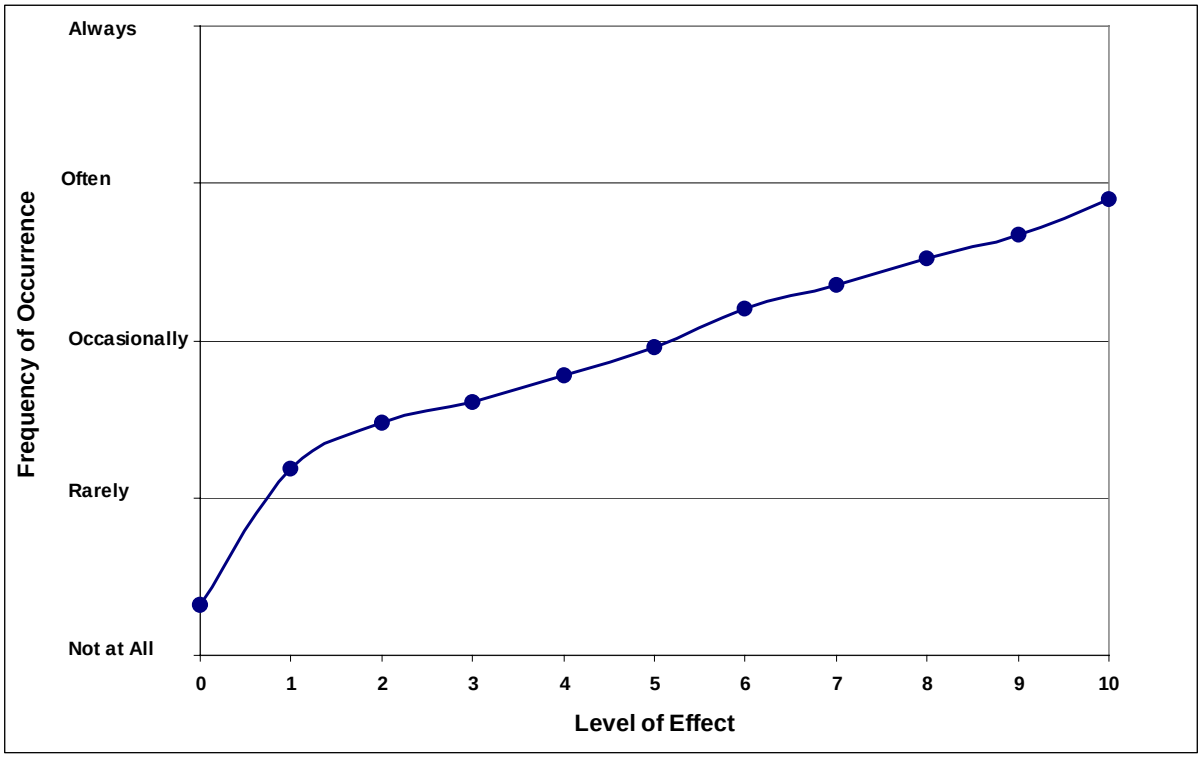

Figure 2.12 Correlation of frequency with effect

A cross-discipline analysis was also carried out, however the results indicated that there were no significant differences in the overall responses between the various disciplines, or across the range of factors measured.

2.4 Section 4 – Effect of Procurement Methods on Design and Documentation Quality

2.4.1 Section 4 – Overview

Section 4 was included to determine whether the type of procurement method used has an impact on the level of design and documentation quality likely to be attained. Designers were asked to indicate the percentage of work carried out under three different procurement methodologies, at three specified time periods and then to rate the quality of design and documentation being produced for the systems at those time periods. The designers were also asked to rate both the adequacy of the time available to carry out the design function and the level of service requested by the clients, for each procurement method and each time period. By including the different time periods into the questions, it was possible to determine trends in not only the usage of the different procurement methodologies, but also the changes in design and documentation quality, time availability and service requested.

Overall, the results indicated that the *Traditional* procurement method was – by quite a large margin – still the most widely used method, but that its usage has steadily declined over the past fifteen years. Although both the *Design and Construct* and *Management* procurement methods have seen an increase in their usage over the same period, there was a slightly greater increase in the *Management* procurement system.

When considering the impact of the various procurement methodologies on design and documentation quality, the results show that designers overall consider quality to be greater under the *Traditional* procurement method than either *Design and Construct* or *Management.* However, the results also indicate that under all three procurement methods, design and documentation quality has declined over the past 15 years and that the greatest decline has been under the *Traditional* method.

In relation to the adequacy of time available for the design and documentation function, designers felt that it was greater under the *Traditional* procurement method, than under either the *Management* or *Design and Construct* procurement methods over all time periods. However, under all three procurement methods, the adequacy of time available for the design and documentation function has significantly declined over the past 15 years, with the greatest decline occurring under the *Traditional* method.

The level of design and documentation service requested by clients was also perceived by designers to be greater under the *Traditional* procurement method, than under either the *Management* or *Design and Construct* procurement methods. Although there had also been a decline in the levels of service being requested over the past fifteen years, the extent of this decline was less than that shown for design and documentation quality, or for the adequacy of time available for the design and documentation function.

When comparing all the results for this section it is interesting to note that while the adequacy of time available to carry out the service required had declined significantly, the level of service required had itself only declined slightly by comparison. This disparity may well provide some insight as to one of the underlying causes of the perceived decline in the quality of design and documentation being produced.

2.4.2 Question 4.1 – Changes in Procurement Method Usage

In Question 4.1, the designers were asked to indicate the percentage of work carried out under three different procurement methodologies – *Traditional*, *Design and Construct* and *Management* procurement methods – at three different time periods – *Now*, *5 – 7 Years Ago* and *12 – 15 Years Ago*. In Figure 2.13 below, the responses to this question are graphically displayed and the changes in the extent of use of each procurement method over the past 15 years can be clearly seen.

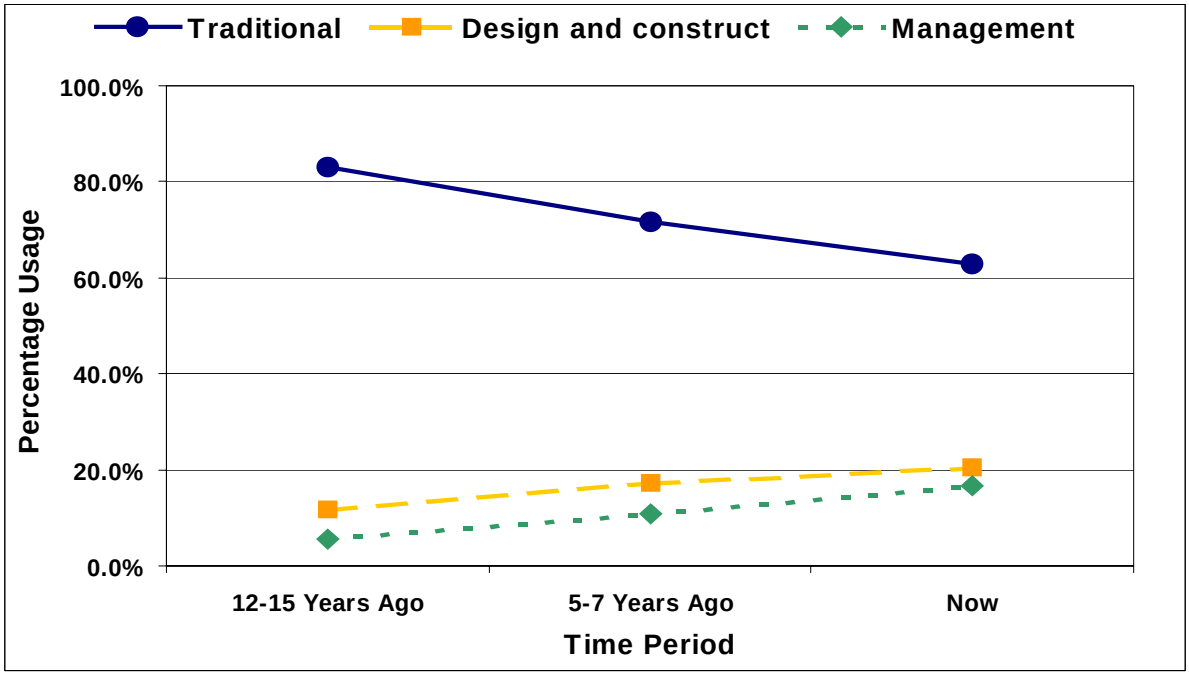

Figure 2.13 Extent of use of each procurement method

The chart clearly shows that the *Traditional* procurement system was – by quite a large margin – the most widely used method of procurement over the past fifteen years, but that its usage has steadily declined over that time frame, with the extent of that decline being just over 24%. To counteract this decline, there have been significant increases in the use of both the *Design and Construct* method (176%) and the *Management* procurement method (303%).

When comparing the results across disciplines, Quantity Surveyors showed a more significant decline in the use of the *Traditional* method of procurement and therefore showed a greater increase in the use of both *Design and Construct* and *Management*.

2.4.3 Question 4.2 – Impact of Procurement Method on Changes in Design and Documentation Quality

In Question 4.2, the designers were asked to rate their perception of the overall *quality* of design and documentation produced under each of the three different procurement methodologies and at each of the three different time periods. The level of quality was measured on a nine-point scale, from 1 (*Very Poor*) to 9 (*Excellent*). In Figure 2.14 below, the responses to this question graphically display the changes in overall design and documentation quality for each procurement method over the past 15 years.

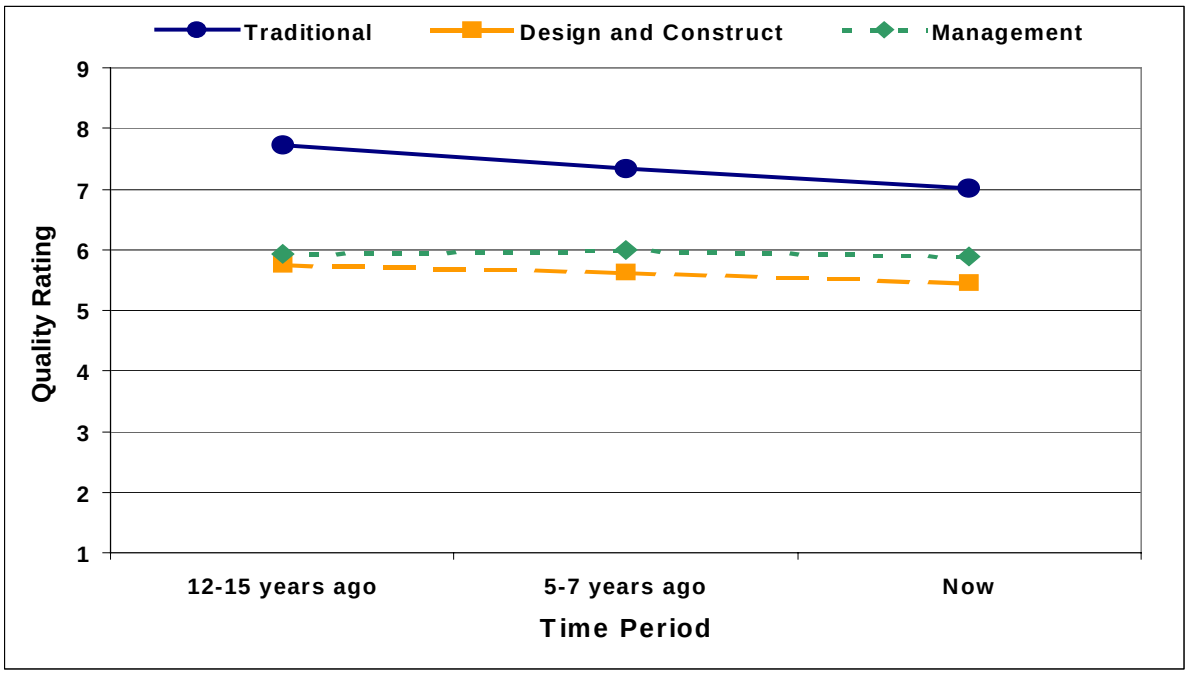

Figure 2.14 Ratings for overall design and documentation *quality* for each procurement method

Although the graph shows that the *Traditional* procurement method was perceived to provide the highest quality standards of the three procurement methods over the past 15 years, it also showed the greatest decline over that period, with the extent of that decline (nearly 10%) being statistically significant. Design and documentation quality under the *Management* procurement method was next best and showed virtually no change over time according to the designers as a whole. The respondents however saw the *Design and Construct* procurement method as providing the lowest levels of design and documentation quality and indicated that quality levels had also declined over time, but only by a small amount.

Engineers and quantity surveyors had indicated that the decline in quality under all procurement methods had been significant. Architects however only agreed with this assessment in relation to the traditional method. The mean response for the quantity surveying profession was below the rating indicated by other disciplines for all procurement methods at all times. This indicated that they feel the quality is below the standard designers generally believed. Conversely architects considered the quality of design and documentation was better under the traditional procurement method than the other professionals surveyed.

2.4.4 Question 4.3 – Impact of Procurement Method on Adequacy of Time to Carry Out the Design and Documentation Function

In Question 4.3, the designers were asked to rate their perception of the overall *adequacy* of time available to carry out the design and documentation function under each of the three different procurement methodologies and at each of the three different time periods. The adequacy of time was also measured on a nine-point scale, from 1 (*Totally Inadequate*) to 9 (*More than Adequate*). Figure 2.15 below, displays the responses to this question and graphically shows the perceived changes in the overall adequacy of design time for each procurement method over the past 15 years.

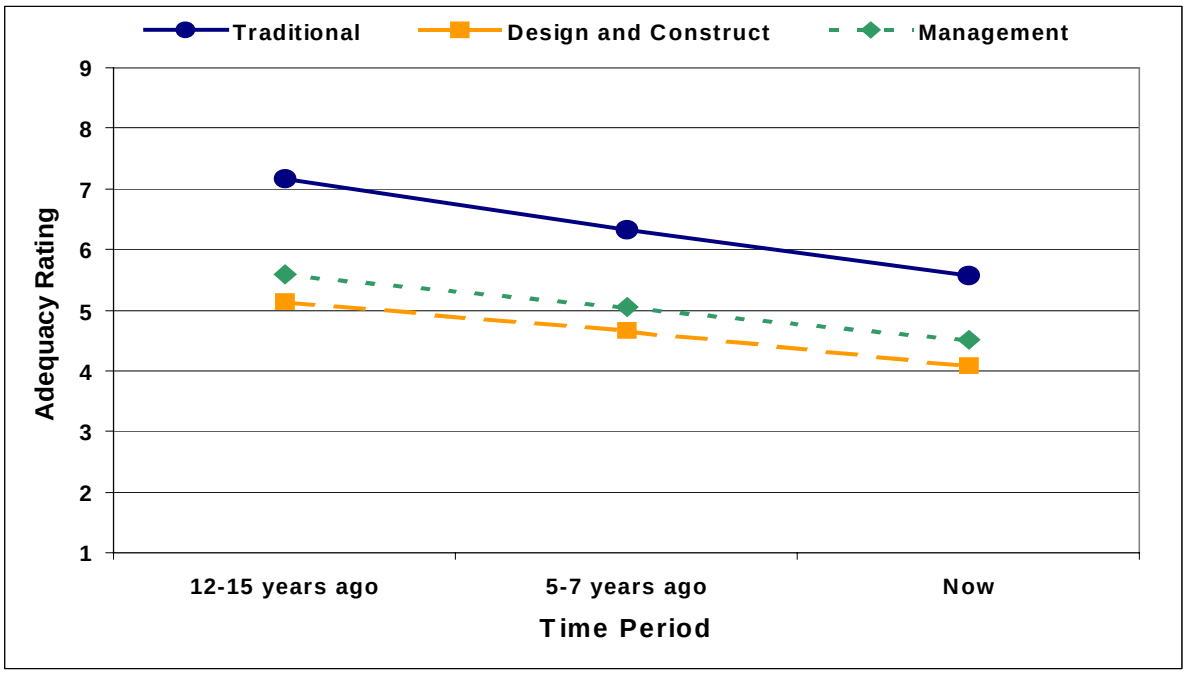

Figure 2.15 ***Adequacy*** **of time available to carry out design and documentation function for each procurement method**

This chart shows that the adequacy of time available for the design and documentation function was greater under the *Traditional* procurement method, than under either the *Management* or *Design and Construct* procurement methods at all time periods. However the graph also shows that the designers considered that there had been a significant decline in the availability of time to carry out the design and documentation function over the past fifteen years and that the level of decline was fairly consistent – at around 20% – for all three procurement methods.

When checking the results across disciplines, it was found that the mean response for quantity surveyors was significantly below the mean response for the other disciplines which indicates that they generally believe the actual time available had been inadequate under all procurement methods at all time periods. Engineers had indicated the actual time available under the management procurement method was more adequate than the other disciplines did for the earlier time periods, but agreed with the assessment of the other disciplines for the current time period.

2.4.5 Question 4.4 – Impact of Procurement Method on Level of Design and Documentation Service Requested

In Question 4.4, the designers were asked to rate their perception of the overall level or extent of the design and documentation service requested by clients, under each of the three different procurement methodologies and at each of the three different time periods. The extent of service was measured on a nine-point scale, from 1 (*Minimal Service*) to 9 (*Complete Service*). Figure 2.16 below, displays the responses to this question and graphically shows the perceived changes in the overall extent of the design and documentation service requested for each procurement method over the past 15 years.

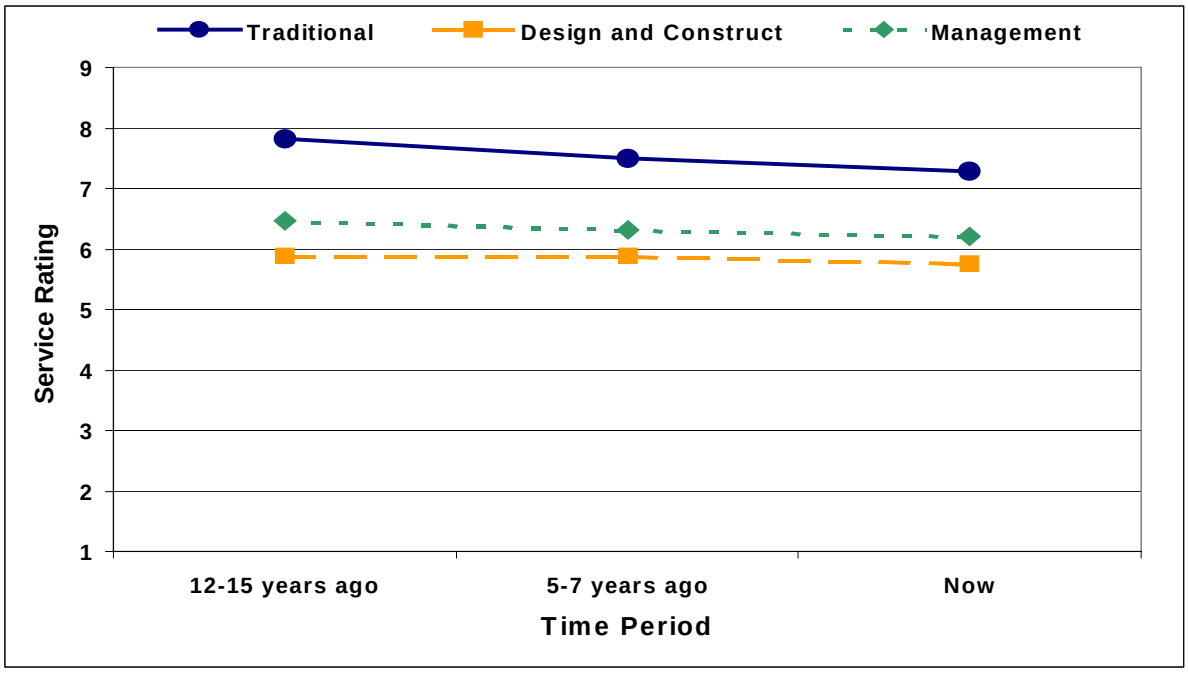

Figure 2.16 Overall level of design and documentation *service* requested by clients

The chart shows that the level of design and documentation service requested by clients was perceived by designers to be greater under the *Traditional* procurement method, than under either the *Management* or *Design and Construct* procurement methods. The graph also shows that for all three procurement methods, the designers consider that there had been a slight decline in the levels of service being requested over the past fifteen years but only the decline for the traditional method – at around 7% – was considered statistically significant.

Engineers had indicated that the level of service requested by clients under the design and construct procurement method had been greater than other disciplines had indicated. This was however contrary to quantity surveyors, who indicated for all procurement methods that clients had requested a much lower level of service than other disciplines had suggested. Both the quantity surveyors and the architects agreed that the level of service requested now was significantly less than that requested by clients 15 years ago.

When comparing the results for this section it is apparent that the time available to carry out the level of service required has declined significantly over the past fifteen years, while the level of service required has itself, only declined slightly by comparison. It is this disparity that the authors believe may well be a major contributing factor in the perceived decline in the quality of design and documentation. From this, it is reasonable to deduce that the main reason why the quality of design and documentation produced under the *Traditional* procurement method is perceived to be greater than that produced under the other methods, is directly related to the extra time available to carry out the design and documentation function.

Further analysis showed almost perfect correlation between the decline in both the adequacy of time and in design and documentation quality, therefore if quality is to be improved, more time (person hours) or greater efficiency is required in the design and documentation process.

2.5 Section 5 – Changes in Levels of Design and Documentation Quality

2.5.1 Section 5 – Overview

Having previously been asked to rate the level of importance of a number of attributes relating to design and documentation quality, designers were now asked in this section, to rate the level of incorporation of those attributes, for three distinct time periods covering the past 15 years. As the overall quality of design and documentation can, to a large extent, be determined by the level of incorporation of the various attributes of design and documentation quality, the results of this section would give a further indication of the overall changes in design and documentation quality. The responses to the questions would also enable the assessment of the changes in the level of incorporation for each individual attribute and help identify those issues that need improvement.

An analysis of the responses indicated that designers believe the overall level of incorporation for all design issues had improved slightly over the past 15 years, which – contrary to the designer's own perceptions – would seem to indicate an improvement in the overall quality of design. In contrast the designer's perception was that the overall level of incorporation of documentation issues had declined slightly over the same time period, indicating that the quality of documentation had also declined.

When considering the design quality attributes individually, the issues showing the greatest improvement, related to *ecological sustainability* and *whole life-cycle* issues. However, the issues showing the greatest decline, related to the availability of *experienced senior staff*.

When considering the documentation quality attributes, the issues showing the greatest improvement, related to *standardisation* of documents and *conformity* to statutory requirements. However, the issues showing the greatest decline, related to the *completeness* of documents and *final checking* of documents prior to release.

2.5.2 Question 5.1 – Changes in the Level of Incorporation of Design Quality Attributes

Question 5.1 looks at a number of attributes of design quality and investigates whether there have been any significant changes to those attributes over the past 15 years by asking the designers to rate the level of incorporation of each attribute at three specific time periods. To measure the level of incorporation of each attribute, the rating scale ranged from 0 (*Not at all*) to 10 (*Completely*). The attributes surveyed are the same as those listed in Question 1.1 and shown in Table 2.1.

As can be seen in Figure 2.17, the design quality attributes that showed the greatest increase in their level of incorporation were:

- Consideration of ecological sustainability issues;
- Consideration of whole life-cycle issues; and
- Economy – ensuring design solutions are cost effective.

Although *consideration of whole life-cycle issues* showed the second greatest increase over the past 15 years, its actual level of incorporation was the lowest overall. In contrast, the main issues to record a significant decline, were:

- Equitable balance in the ratio of junior to senior staff used;
- Ready availability of experienced design personnel; and
- Design service contracted for is compatible with the design requirements of the project.

These results clearly highlight that one of the major concerns of the design sector within the construction industry, relates to the availability of quality, qualified staff.

The issues perceived to have attained the highest levels of incorporation were:

- Relevancy – ensuring the project requirements are met; and
- Functionality – effectively serves the purpose for which it was intended.

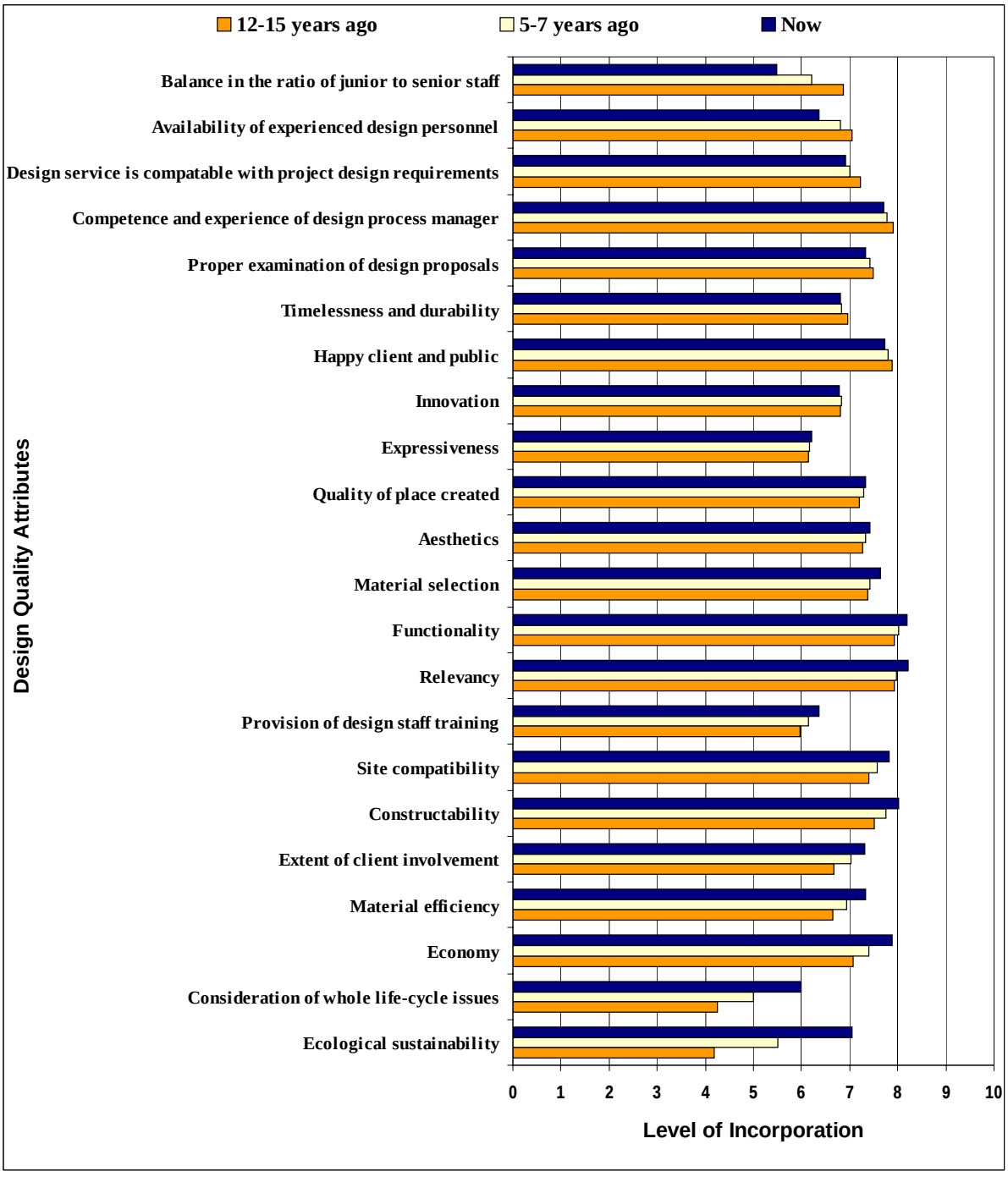

Figure 2.17 Changes in levels of incorporation of design quality attributes over the past 15 years

Although the majority of the design quality attributes showed only marginal change in their level of incorporation over the past 15 years, actually showing a slight improvement, this was contrary to the designer's previous perceptions – as indicated in Question 1.3 – which indicated an overall decline in the quality of design. Due to this apparent discrepancy in the perceptions of the changes to design quality, further analysis was undertaken.

An analysis of the responses for the design issues, which compared those respondents that answered "yes" to Question 1.3 to those who answered "no", revealed that there was a statistically significant difference in the mean responses. Overall there were 255 respondents who believed that the quality of design had declined, 170 who believed the quality had not declined and 61 who were unsure.

The mean response for those who indicated that the quality of design had declined over the past 15 years was approximately 6.9 over all time periods, with all issues pooled, suggesting that any change was only marginal. The mean response for those who indicated there had not been a decline in the quality of design was 7.5 for the current period up from 6.8 for the period 12 – 15 years ago, again with all issues pooled, thereby supporting their assertion that design quality had actually improved.

Assessing the differences in the mean responses by issue, showed that those who indicated the quality of design had not declined had a slightly more positive response for all issues than those who indicated the quality of design had declined, even though they started from a slightly lower position. This therefore provides an explanation for the apparent discrepancy in the overall perceptions. Figure 2.18 below illustrates the differences.

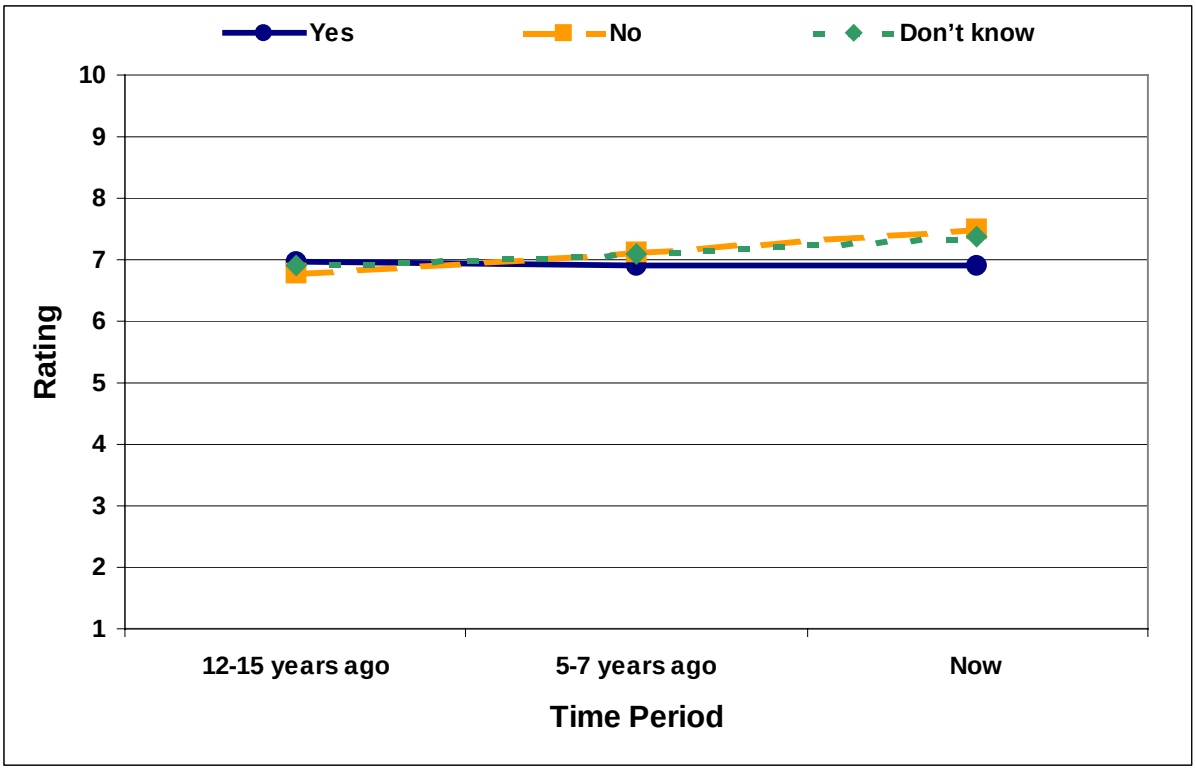

Figure 2.18 Mean overall response for design issues

2.5.3 Question 5.2 – Changes in the Level of Incorporation of Documentation Quality Attributes

Question 5.2 looks at a number of attributes of documentation quality and investigates whether there have been any significant changes to those attributes over the past 15 years by asking the designers to rate the level of incorporation of each attribute at three specific time periods. To measure the level of incorporation of each attribute, the rating scale ranged from 0 (*Not at all*) to 10 (*Completely*). The attributes surveyed are the same as those listed in Question 1.2 and shown in Table 2.2.

As can be seen in Figure 2.19, the documentation attributes that showed the greatest increase in their level of incorporation, were:

- Standardisation – use of standard details and specifications in drawings and other documentation; and
- Conformity – documents indicate the requirements of standards and statutory regulations.

These results would appear to indicate that designers – in order to try to improve efficiency in the design process – are increasingly using standard details and designs. While this may help reduce the time spent producing the documentation for a project, care needs to be taken to ensure that the standard details are relevant to the particular project and that innovation and material efficiency do not suffer.

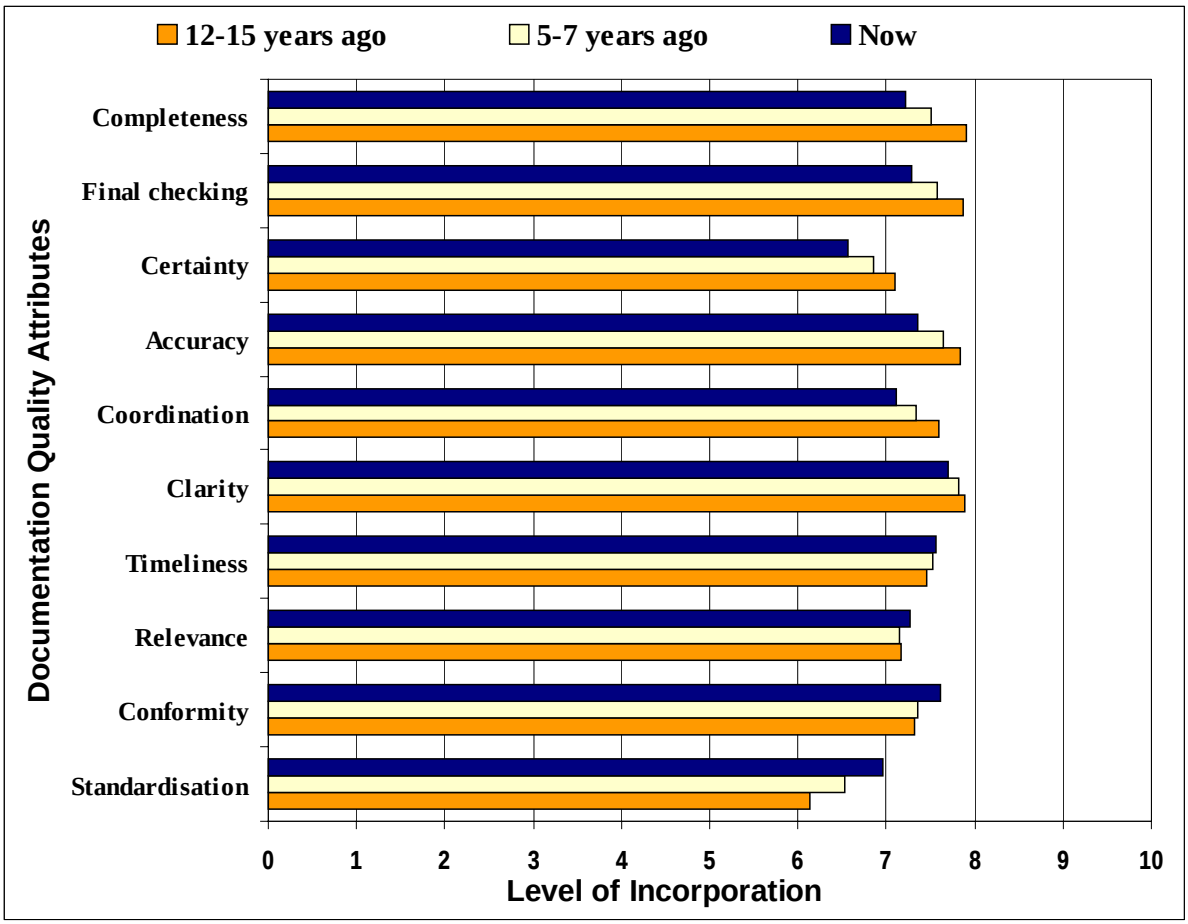

Figure 2.19 Changes in levels of incorporation of documentation quality attributes over the past 15 years

As can also be seen in Figure 2.19, the documentation attributes that showed the greatest decline in their level of incorporation, were:

- Completeness – drawings and other documents provide all the information required;
- Final checking – drawings and other documents are properly checked prior to release to the contractor; and
- Certainty – drawings and other documents do not require changes or amendments.

Based on these results, it would appear that problems relating to the quality of documents being sent to contractors are increasing. Comparing these results with those from Question 5.1, the authors believe that it is reasonable to conclude that a major contributing factor in declining documentation quality standards, may be related to the declining availability of quality staff.

Overall, the results indicated a statistically significant decline in the incorporation of documentation quality attributes over the past 15 years and confirms the designer's previous perceptions (in Question 1.4) that the overall quality of documentation has declined.

When comparing the overall trends in design and documentation quality attribute incorporation, Figure 2.20 shows the closeness of the mean ratings for the issues over the past 15 years. The chart also indicates the consultants perception of the level of incorporation for both design and documentation quality attributes is high and that there has been little change in the level of incorporation over the past 15 years. The results also show that while the level of incorporation of design attributes has attained a marginal increase over the past 15 years, the level of incorporation of documentation attributes has marginally declined.

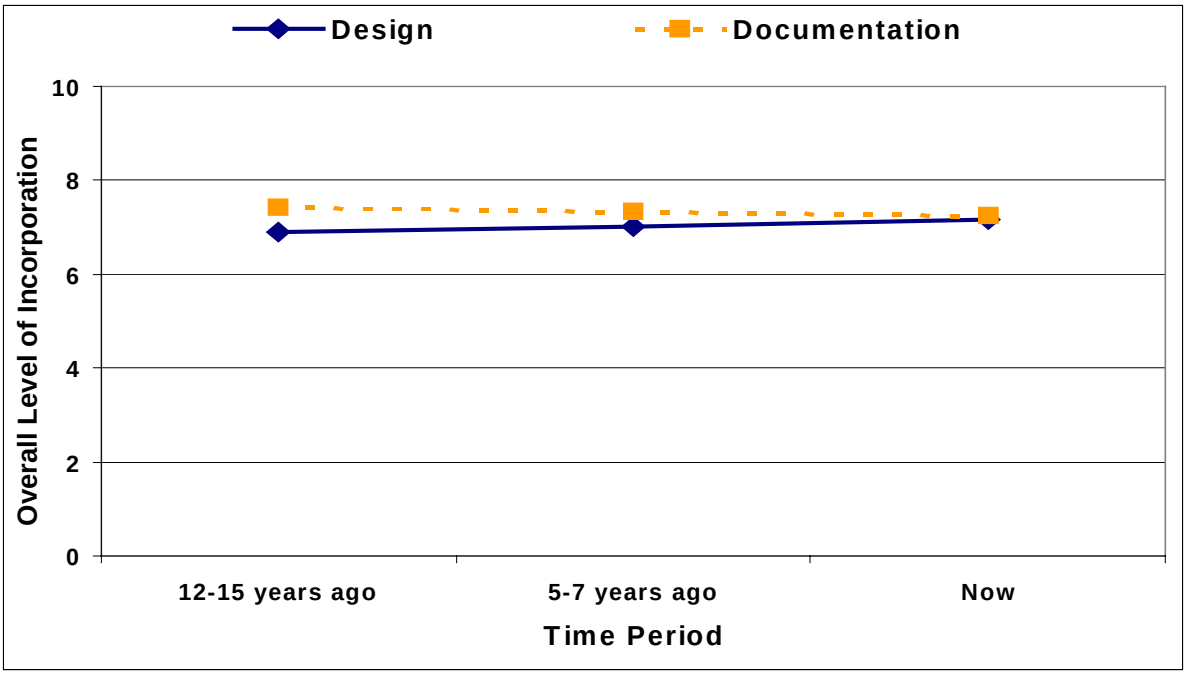

Figure 2.20 Overall comparison of the changes in design and documentation quality attributes

2.6 Section 6 – Changes in Levels of Service Provided

2.6.1 Section 6 – Overview

In this section designers were asked to consider various aspects of design service and to rate the extent to which each aspect had been fulfilled during each of the three specific time periods. Apart from being able to identify problem areas relating to specific design service issues, this section also provided an opportunity to compare the overall design service results with those provided in Section 4.

Although the majority of the design service issues showed a decline over the past 15 years, the overall mean result actually showed an increase in the extent of design services. This overall result was however clearly influenced by the results for the design service issues relating to *using CAD for the production of drawings* and *using information technology to improve project communications*, both of which have shown dramatic increases due to the rapid growth of computerisation and information technology (IT) during this period.

If these two issues were excluded from the analysis the overall change in level of service provided shows a statistically significant decline over time, which is more consistent with the results shown in Section 4. Apart from the two IT related issues, the design service issue relating to *obtaining of clearances from statutory bodies, prior to commencement on site,* showed the greatest improvement over time. Showing the greatest decline however, was the design service issue relating to *providing complete and accurate documentation and design detailing*, which again is consistent with the results shown in other sections of the survey.

2.6.2 Question 6.1 – Changes in Level of Design Service

Question 6.1 looks to measure the changes in the levels of design service provided over the past 15 years, by determining to what extent each issue has been fulfilled at each time period. The rating scale for this question ranged from 0 (*Not done at all*) to 10 (*Carried out completely*). The design service issues surveyed are listed in Table 2.7.

Table 2.7 Design service attributes

Design Service Attributes	
a)	Coordinating design details from various other consultants
b)	Investigating alternative designs and comparative cost analyses
c)	Providing practical design detailing and construction methods
d)	Providing complete and accurate documentation and design detailing
e)	Being involved in the production and development of the design brief
f)	Checking that dimensions are correct and appropriate
g)	Ensuring that trade specifications are both appropriate and up-to-date
h)	Ensuring the availability and compatibility of proposed building materials
i)	Maintaining a thorough knowledge of local by-laws and BCA requirements
j)	Maintaining a thorough knowledge and understanding of the latest construction methods
k)	Using CAD for the production of drawings
l)	Using information technology to improve project communications and assist with document transfer
m)	Obtaining of clearances from statutory bodies, prior to commencement on site.
n)	Other (specify):

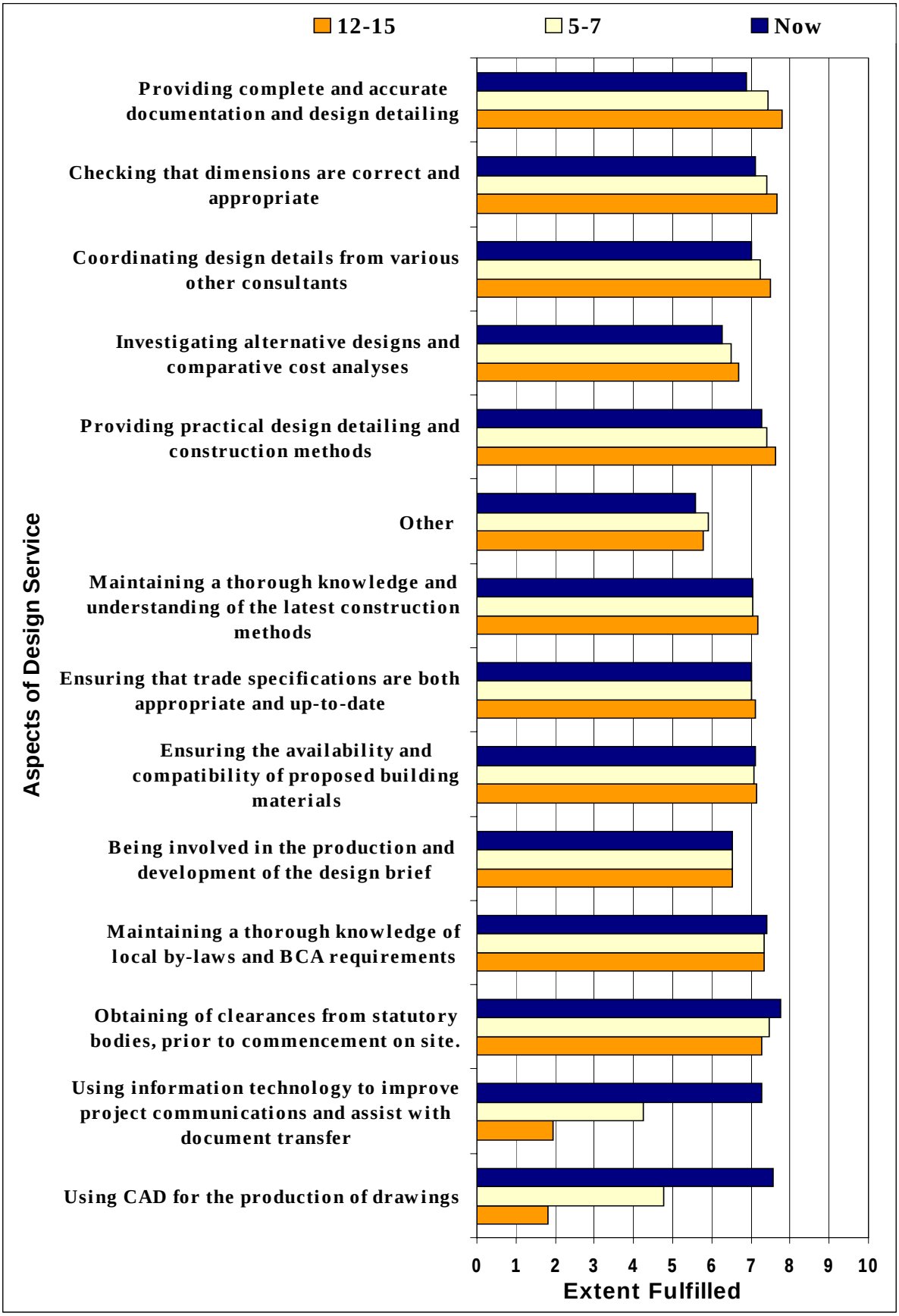

Figure 2.21 Extent to which design service issues were fulfilled

As can be seen in Figure 2.21 above, the majority of the design service issues showed a decline in the extent to which they were fulfilled, over the past 15 years. However, despite this the overall mean result for all issues, actually showed an increase in the extent of design services. This apparent anomaly was due to the dramatic increases in the following two design service issues:

- Using CAD for the production of drawings; and
- Using information technology to improve project communications.

The tremendous growth in both of these issues has obviously been influenced by the rapid growth of computerisation and information technology (IT) during this period. However, if these two issues are excluded from the analysis, the overall change in level of design services provided shows a statistically significant decline over time, which is more consistent with the results shown in Section 4.

Apart from the two IT related issues, the only other design service showing any significant improvement over the past 15 years, was:

- Obtaining of clearances from statutory bodies, prior to commencement on site.

The design service issues showing the greatest level of decline over the past 15 years however, were:

- Providing complete and accurate documentation and design detailing;
- Checking that dimensions are correct and appropriate; and
- Coordinating design details from various other consultants.

These results are consistent with the results shown in other sections of the survey and indicate that there is a growing problem with the documentation being produced for construction projects.

2.7 Section 7 – Changes in Levels of Design Fees

2.7.1 Section 7 – Overview

This section was designed to look specifically at the changes to the levels of project design fees over the past 15 years. Designers were asked to nominate not only the level of fees they considered necessary to provide a quality service, produce quality design and documentation and make a reasonable profit, but also indicate the level of fees they believed were required to be submitted to clients to actually obtain the work. To ensure that the results were truly representative, the designers were asked to provide their responses for projects of differing complexity levels and budget ranges.

In addition to this, the section also asked designers to indicate whether the level of fees able to be obtained on projects, differed between public and private sector clients and if so, by what percentage.

The overall results indicated that over the past 15 years, the overall fee levels *required* by a designer to provide a proper service, produce quality work and make a reasonable profit, remained fairly consistent, with an average decline of just 2.6%. However, when considering the fee levels required to be *submitted* to actually obtain the work, the results show that there has been a significant decline over the past fifteen years, averaging around 26.4%. These results were also fairly consistent across the different project budget ranges and levels of complexity, although it was noted that as projects became smaller and simpler, the decline in fee levels and difference between *required* fee levels and *submitted* fee levels, became greater.

When considering the differences in fee levels between *public* and *private* sector clients, a greater proportion of respondents considered that the level of fees able to be obtained from *public* sector clients was generally lower than those able to be obtained from *private* sector clients. Of those who considered that fee levels from the *public* sector were lower than from the *private* sector, the most common response given for the extent to which the fee levels differed was 20% lower, with the overall average being 15.85% lower.

2.7.2 Question 7.1 – Changes in Designer Fee Levels

This question required respondents to provide an estimate of project fee levels (expressed as a percentage of project costs) for a range of project budget levels (from *$0-1M* to *$100+*) and complexity levels (*simple*, *conventional* and *complex*), at three time periods over the past 15 years. Respondents were also asked to differentiate between the level of fees considered necessary to provide a quality service, produce quality design and documentation and make a reasonable profit and those they believed were required to be submitted to clients to actually obtain the work. The analysis of this data would not only enable the differences between *required* and *submitted* fees to be assessed for each budget and complexity level at each time period, but also to identify any trends that had occurred over the past 15 years. In addition, the analysis would also determine what impact the project's level of complexity had on influencing the level of fees obtained.

The following chart (Figure 2.22) looks at the overall responses to Question 7.1 and summarises the differences between the design fee levels *required* to provide the level of design service needed and the fee levels which are *submitted* to obtain the work. This section required extensive analysis due to the amount of different combinations of information stored within the data set. In this report, we will only look at those issues that describe the major trends.

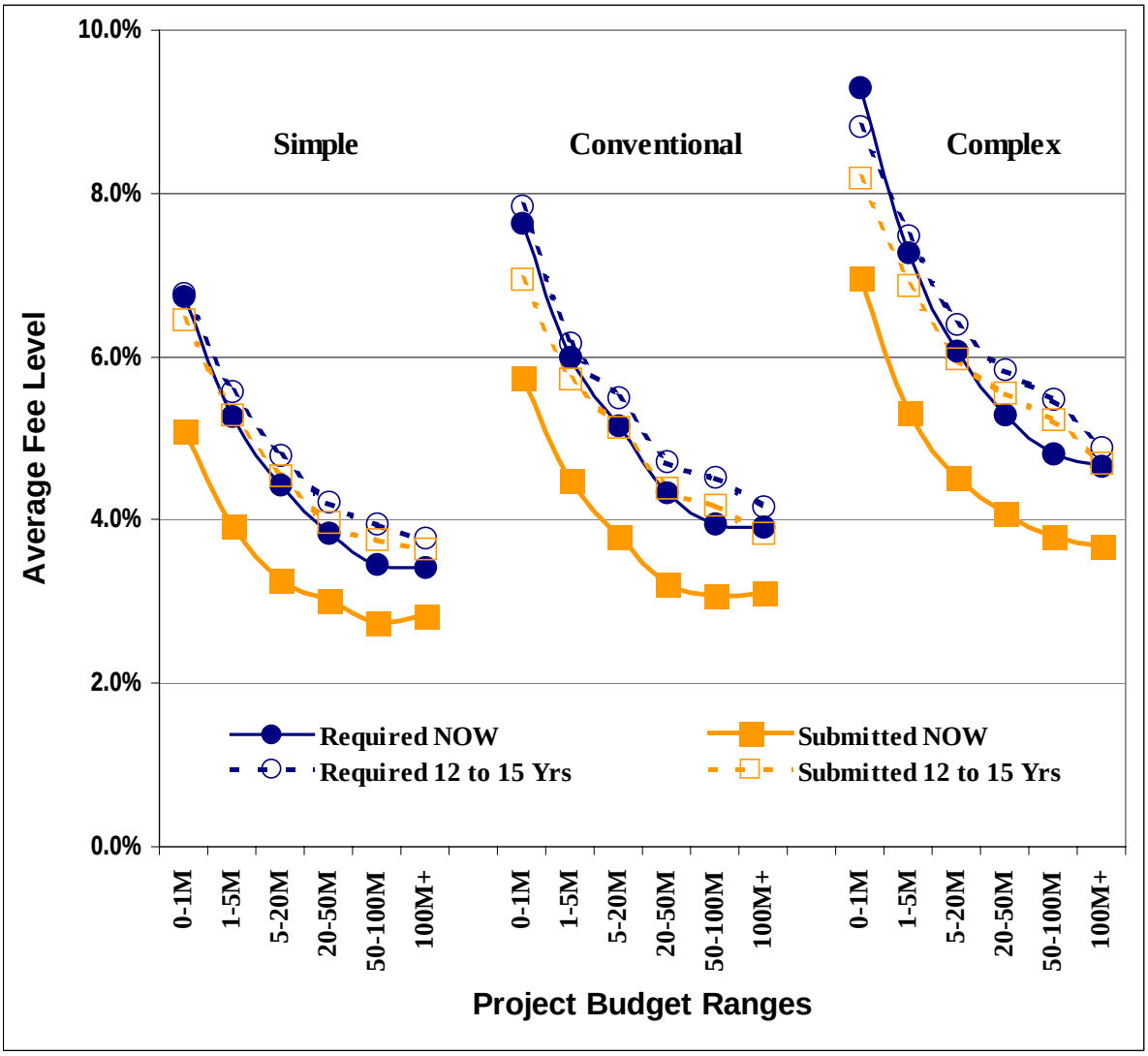

Figure 2.22 Difference in level of design fees required to be submitted

As can also be seen in Figure 2.22, the *required* and *submitted* percentage fee levels decay exponentially, depending on the budgeted project value, to an overall minimum rate. The chart also shows that as the projects become more complex, the percentage rates for corresponding project budget ranges also increase. However, for each of the different project complexity levels, the rates of decay are similar.

Overall, the results indicate that while the *required* percentage fee levels have only declined marginally between each time period and for each level of project complexity, the percentage fee levels *submitted* to obtain the work have significantly declined over the past fifteen years – for all project budget ranges and levels of complexity. While the decline in the *required* fee levels may be due in part to the increased use of technology, which would compliment other areas of improved efficiency, increased competition and client fee bidding practices would appear to be influencing the decline in *submitted* fee levels.

When considering the current time frame, simple and conventional project types with project values ranging from $5M to $20M showed the greatest disparity between *required* fee levels and *submitted* fee levels. On average however, the fee levels currently being *submitted* are over 32% (32.32%) below the fee levels considered necessary by designers, to provide a quality service.

2.7.3 Question 7.2 – Comparison of Designer Fee Levels Between Public and Private Sector Clients

In Question 7.2, respondents were asked to consider whether or not the level of fees able to be obtained from *public* sector clients were generally higher, lower or the same as those able to be obtained from *private* sector clients.

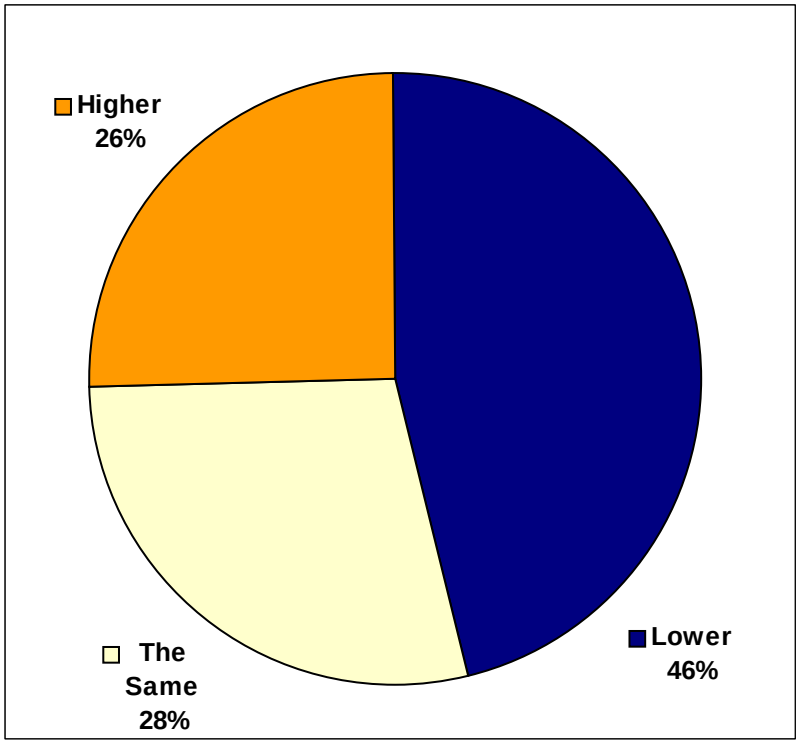

Figure 2.23 Level of fees obtained from public versus private sector clients

Although there was a fair level of inconsistency in the responses, Figure 2.23 shows that overall, a greater proportion of designers (46%) consider that the level of fees able to be obtained from *public* sector clients was generally lower than for *private* sector clients. Further analysis of this section shows that there were differences in opinion between the states, with N.S.W, Victoria and W.A. actually having a majority of respondents (greater than 50%) indicating a lower level of fees being obtained from *public* sector clients. All other states were either split on the issue or believe there was no difference.

2.7.4 Question 7.3 – Extent of Difference Between Public and Private Sector Clients

In Question 7.3, those respondents who indicated either *higher* or *lower* to Question 7.2, were asked to consider to what extent (expressed as a percentage) the level of fees able to be obtained from *public* sector clients were *higher* or *lower* than those able to be obtained from *private* sector clients. In Figure 2.24 below, a breakdown of the responses given by those respondents who considered the fee levels provided by the *public* sector were *higher*, are shown. Figure 2.25 however, a breakdown of the responses given by those respondents who considered the fee levels provided by the *public* sector were *lower*, are also provided.

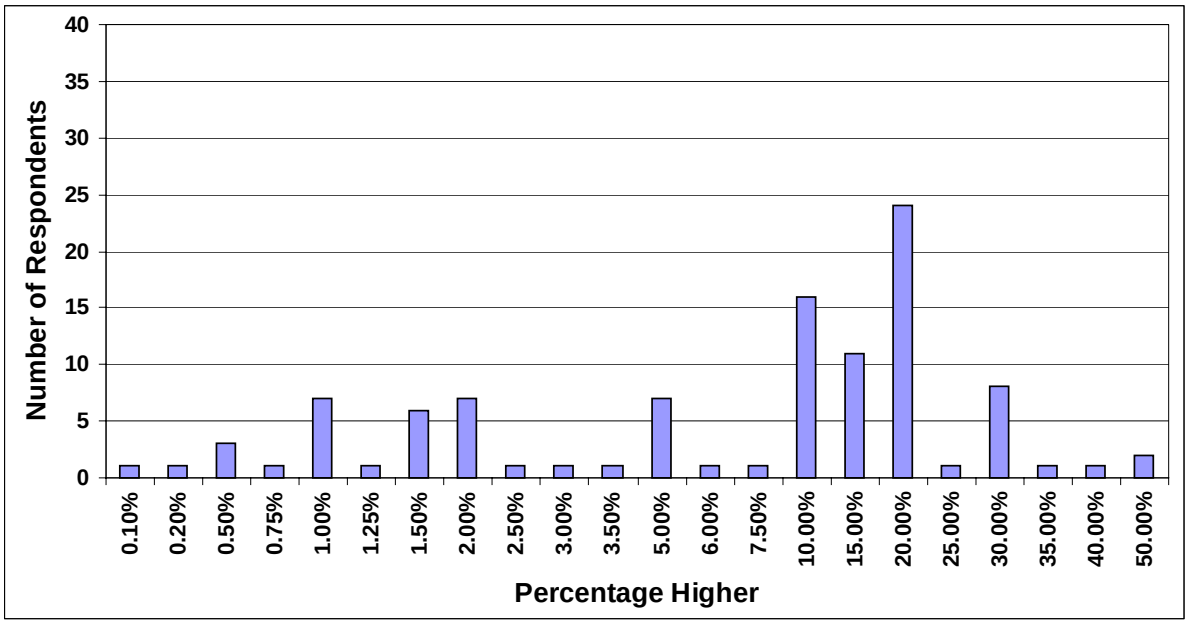

Figure 2.24 Extent to which percentage fees were higher

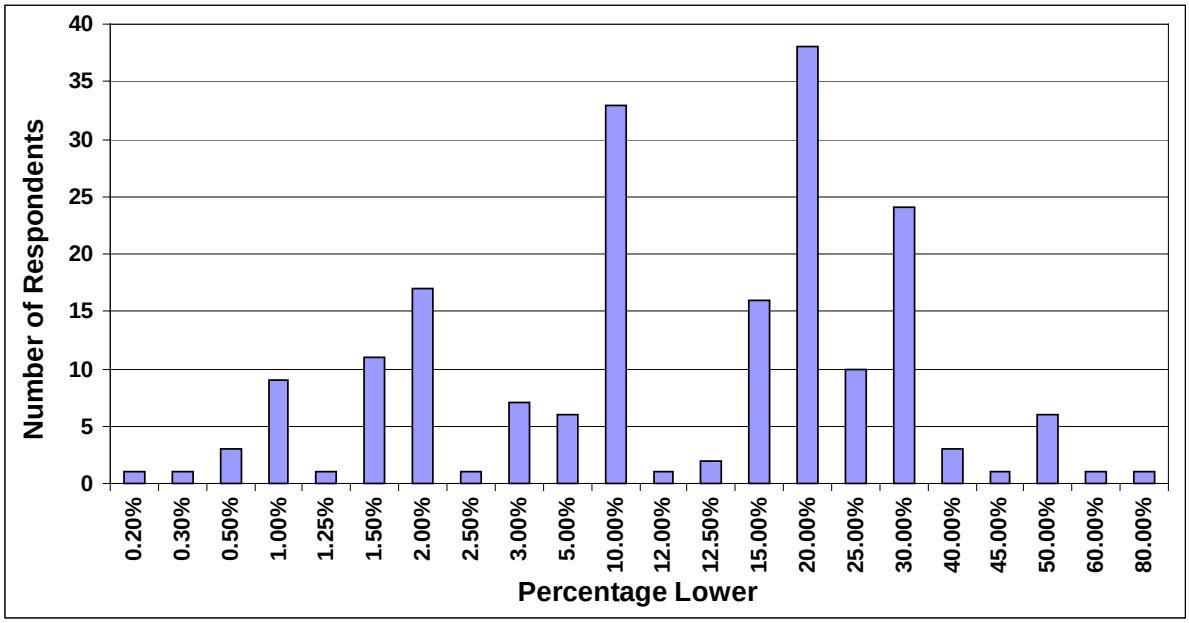

Figure 2.25 Extent to which percentage fees were lower

As can be seen from the two charts there was a large discrepancy between the responses given. For those respondents who indicated that the fee levels from *public* sector clients were *higher* than those available from the *private* sector, the most common response was 20% - with the overall average coming to just under 13% (12.97%). For those respondents who indicated that the fee levels from *public* sector clients were *lower* than those available from the *private* sector, the most common response was again 20% - with the overall average coming to just under 16% (15.85%). When all responses are assessed together, the results indicate that the fee levels from *public* sector clients were – on average – *lower* than those available from the *private* sector, by just under 6% (5.80%).

2.8 Section 8 – Effect of Reduced Fees on Attributes of Design and Documentation

2.8.1 Section 8 – Overview

Section 8 deals with the perceived effects that a reduction in overall design fees, has on the quality of design and documentation produced. To determine the areas affected most, designers were asked to rate the level of effect that reduced design fees had on a number of attributes of design and documentation quality – the same as those listed in Tables 1 and 2.

When considering the effects on *design* quality, the mean responses for all the issues lie above the midpoint, indicating that designers perceive reduced design fee levels as having a significantly detrimental effect on all of the design quality attributes. However, the attributes shown to be affected most, were *innovation*; *provision of in-house and external training*; and *proper examination of design proposals*. Those with the lowest mean response and therefore considered to be least affected were *the extent of client involvement in the design process*; *functionality*; and site *compatibility*.

When considering the effects on *documentation* quality, again the mean responses for all the issues lie above the midpoint, indicating that designers perceive reduced design fee levels as having a significantly detrimental effect on all of the documentation quality attributes. The attributes affected most by reduced design fees were noted as being *completeness*, *certainty* and *final checking*, while *standardisation*, *relevance* and *timeliness* were considered to be the least affected. When comparing the results for both design and documentation it is evident consultants believe reduced design fees had affected documentation attributes slightly more than design attributes.

Designers were also asked to consider a number of issues that have been proposed as being indicators of design and documentation quality and indicate whether there had been an increase in the occurrence of each of these issues over the past fifteen years. From the designer's responses and based on the premise that an increase in the occurrence of these issues represents a decline in quality standards, there is again agreement between the disciplines that quality standards have declined over the past 15 years.

2.8.2 Question 8.1 – Effect of Reduced Design Fees on Design Quality Attributes

In Question 8.1, designers were asked to consider a number of attributes of *design* quality – the same as those listed in question 1.1 (Table 2.1) – and to rate the effect that a reduction in design fee levels would have on each attribute. The rating scale used for this question ranged from 0 (*no detrimental effect*) to 10 (*highly detrimental effect*).

The following chart (Figure 2.26), looks at the responses to question 8.1 and provides an indication as to the level of *effect* that a reduction in design fee levels has on each of the listed attributes of *design* quality. These results show that the attributes of design quality affected most by reduced design fee levels, were:

- Innovation;
- Provision of in-house and external training; and
- Proper examination of design proposals.

However, the results also show that the attributes of design quality affected least, were:

- Extent of client involvement in the design process;
- Functionality; and
- Site compatibility.

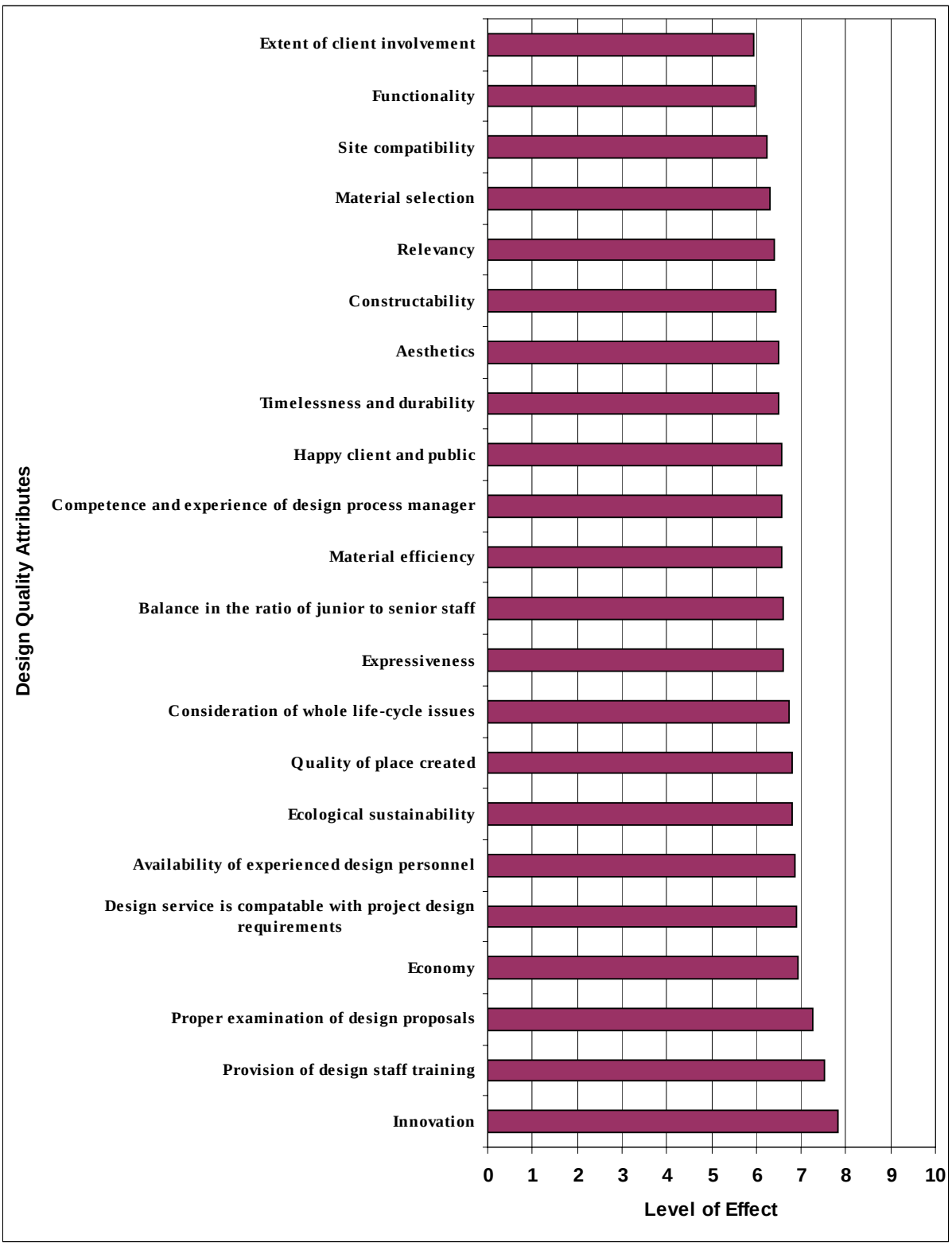

Figure 2.26 Effect of reduced fees on attributes of design quality

It is also important to note that all results lie above the midpoint and that in the opinion of designers, reduced design fee levels have a significant detrimental effect on all the design quality attributes listed. These results also provide much concern for the future, in so far as where innovation is stifled and training does not occur, there is a potential for the design professions to stagnate due to a lack of growth and development.

2.8.3 Question 8.2 – Effect of Reduced Design Fees on Documentation Quality Attributes

In Question 8.2, designers were asked to consider a number of attributes of *documentation* quality – the same as those listed in question 1.2 (Table 2.2) – and to rate the effect that a reduction in design fee levels would have on each attribute. The rating scale used for this question also ranged from 0 (*no detrimental effect*) to 10 (*highly detrimental effect*).

The following chart (Figure 2.27), looks at the responses to question 8.2 and provides an indication as to the level of *effect* that a reduction in design fee levels has on each of the listed attributes of *documentation* quality. These results show that the attributes of documentation quality affected most by reduced design fee levels, were:

- Completeness;
- Certainty; and
- Coordination.

However, the results also show that the attributes of documentation quality affected least, were:

- Standardisation;
- Relevance; and
- Conformity.

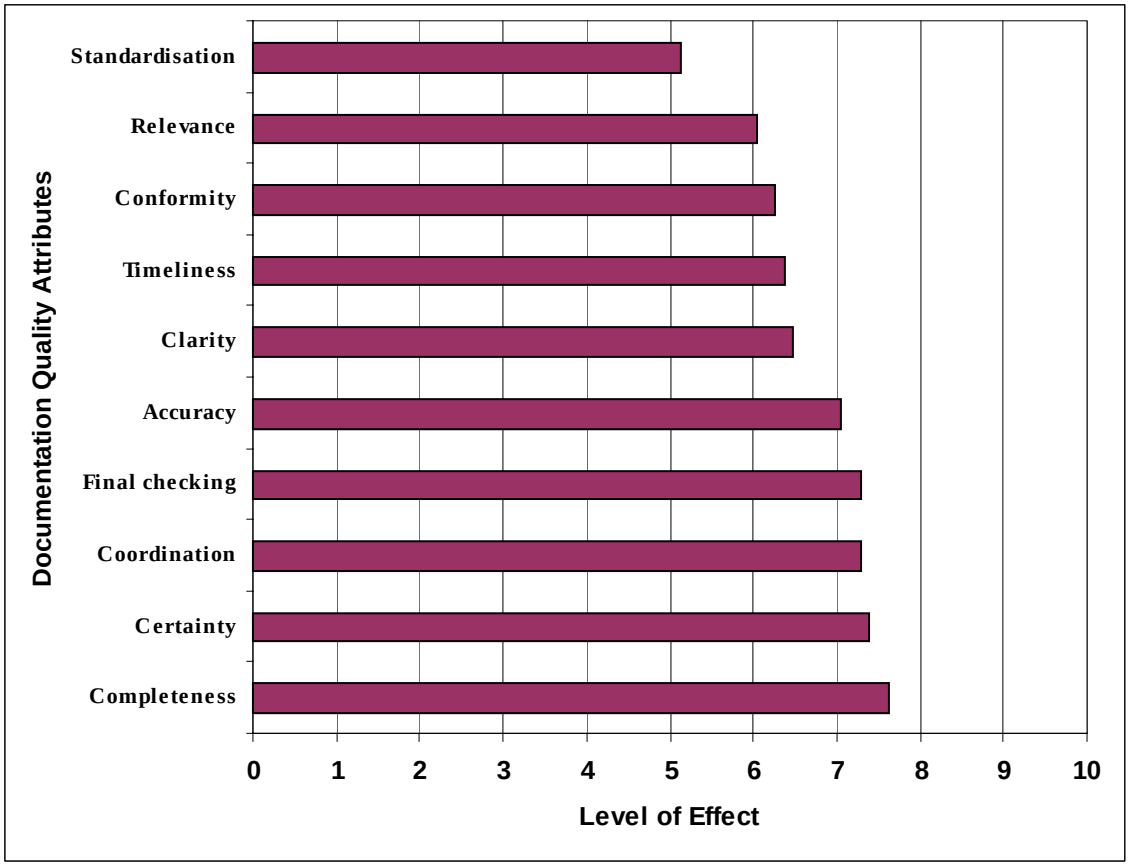

Figure 2.27 Effect of reduced fees on attributes of documentation quality

Again all the results lie above the midpoint, depicting reduced design fees as having a highly detrimental effect on all documentation quality attributes. When comparing the results for design and documentation it is evident that reduced design fees had affected documentation quality attributes slightly more than design quality attributes.

2.8.4 Question 8.3 – Indicators of Design and Documentation Quality

In Question 8.3, designers were asked to consider a number of issues that have previously been proposed as being indicators of design and documentation quality and to indicate whether in their experience, there had been an increase in the occurrence of each of these issues over the past fifteen years. This question is based on the premise that the occurrence of these issues highlights a deficiency in the design and documentation produced and that an increase in these issues over time, represents a decline in quality standards over that same period. A list of the proposed indicators is shown in Table 2.8.

Table 2.8 Indicators of design and documentation quality

Indicators of Design and Documentation Quality	
a)	Number of additional (new) drawings required during a project
b)	Number of drawing revisions
c)	Extent of contractual claims
d)	Number of contract variations
e)	Number of contractor RFIs requesting design clarifications
f)	The extent of rework caused by design and documentation deficiencies
g)	The extent of building component clashes, due to insufficient coordination

As can be seen in Figure 2.28 below, the majority of designers (between 55% and 67%) believe that there has been an increase in each of the indicators representing deficiencies in design and documentation quality, over the past 15 years. However, while 22% to 32% of respondents indicated there had not been an increase in the occurrence of the various issues, between 9% and 18% of respondents were unsure.

When determining if there were any differences in the responses by the disciplines for the various issues, it was apparent for the most part they were in agreement. The exceptions to this were engineers, where a higher percentage indicated there had not been an increase in the number of additional drawings required during a project than other disciplines. Additionally more engineers indicated the extent of contractual claims had increased than other disciplines. The only other notable difference was that more architects had indicated there had not been an increase in the number of contractor RFI's requesting design clarifications over the past 15 years than other disciplines. It should be noted that although these differences exist between the disciplines, a proportionately higher percentage for each profession indicated that there had been increases in the extent of occurrence of all issues over the past 15 years.

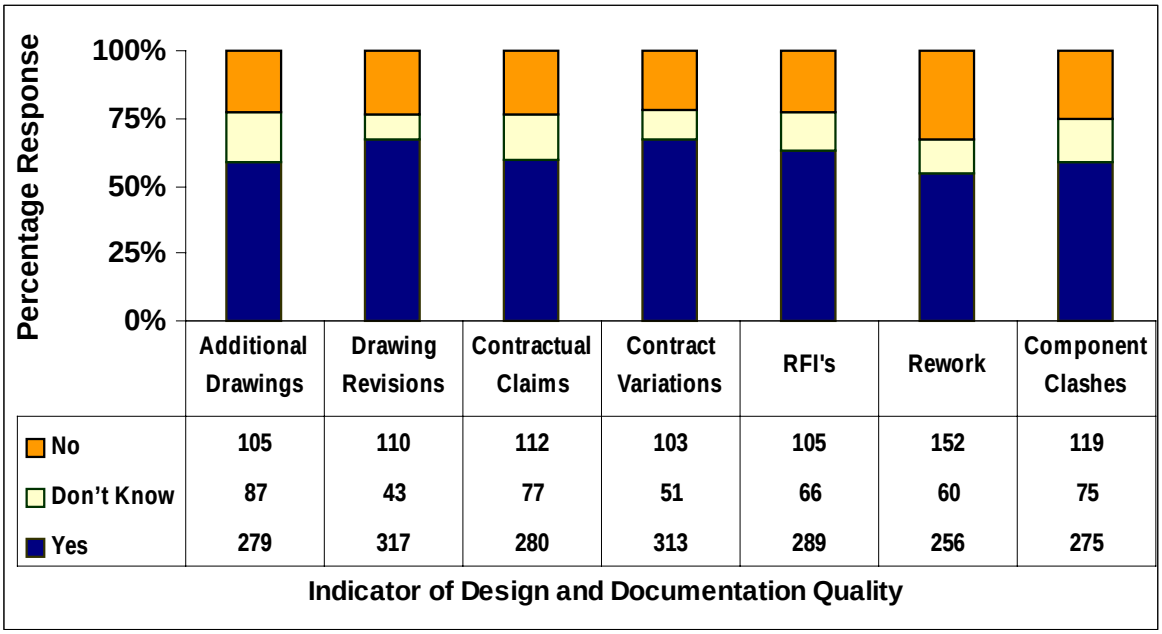

Figure 2.28 Changes in the occurrence of indicators of design and documentation quality

2.9 Section 9 – Other Changes in the Past 15 Years

2.9.1 Section 9 – Overview

In Section 9, designers were asked to consider a number of statements relating to changes to the construction industry over the past 15 years and to provide an indication of how those industry changes may have affected design and documentation quality. Respondents were asked to provide both their level of agreement in relation to each statement and their perception as to the level of effect that those changes have had on the quality of design and documentation produced.

From the responses received, the statements receiving the greatest overall level of agreement included; that *clients tend to 'shop around' more for design services*, *economic conditions have tightened* and that *there has been an increase in the likelihood of legal action*. However, when considering the statements in relation to their affect on the design and documentation process, the issues having the greatest detrimental effect on quality included; *the design function has been down-graded/de-valued from a client perspective*, *economic conditions have tightened* and that *clients tend to 'shop around' more for design services*. As can be seen, there is a strong correlation between the issues receiving the highest level of agreement and those having the greatest detrimental effect on design and documentation quality.

Although the only statement to which the majority of designers actually disagreed with as a whole, was that; *quality assurance requirements have helped improve the efficiency of those firms that have adopted it*, when considering its impact on design and documentation quality, designers did indicate that quality assurance did have a slightly beneficial effect. While there was not total agreement among designers with regard to the technological issues, consultants generally agreed that the advances in computer and information technology, have had a beneficial effect on design and documentation quality.

2.9.2 Question 9.1 – Other Changes in the Past 15 Years

In Question 9.1, designers were asked to consider a number of statements relating to changes that had previously been identified as having occurred in the construction industry over the past 15 years and to provide an indication of how those industry changes may have affected design and documentation quality. Respondents were asked to provide not only their level of agreement in relation to each statement relating to those changes, but also to determine the level of effect that those changes have had on the quality of design and documentation produced. The level of agreement was rated on a five point scale, ranging from strongly disagree to strongly agree while the level of effect was also measured on a five point scale, ranging from highly detrimental effect to highly beneficial effect.

A list of the statements relating to the industry changes is shown in Table 2.9.

In Figure 2.29, the responses indicating the level of agreement to the statements relating to the industry changes over the past 15 years are summarised and listed in increasing order of agreement. As can be seen from the chart, the statements receiving the greatest level of agreement, were:

- Clients tend to *shop around* more for design services;
- Economic conditions have tightened; and
- There has been an increase in the likelihood of legal action.

Table 2.9 Statements relating to industry changes over the past 15 years

Statements Relating to Industry Changes Over the Past 15 Years	
a)	There has been an increase in the likelihood of legal action
b)	Clients 'shop around' more for design services
c)	Economic conditions have tightened
d)	Quantity Surveying standards have declined
e)	There has been a change in the attitude to 'copyright'
f)	More practices have become nationally focused
g)	Professional relationships and trust have come under threat
h)	Interstate and international competition has increased
i)	Stricter trade practice requirements have been implemented
j)	There has been a decline in the level of 'in-house' training within design firms
k)	Changes to the state purchasing policy have affected the way business is obtained
l)	There has been a increased difficulty in getting paid by clients
m)	The design function has been de-valued from a clients perspective
n)	Advances in computer software have helped improve the level of service able to be provided
o)	The introduction of CAD has improved the efficiency of the design and documentation process
p)	Quality Assurance requirements have helped improve the efficiency of those firms that have adopted it
q)	Implementation of Information Technology has improved communication within the industry

From the chart it can also be seen that the statements receiving the least level of agreement, were:

- Quality Assurance requirements have helped improve the efficiency of those firms that have adopted it;
- Quantity Surveying standards have declined; and
- The introduction of CAD has improved the efficiency of the design and documentation process.

From these results, it is interesting to note that the two of the most significant changes designed to help improve design and documentation quality standards and process efficiency – Quality Assurance and CAD – are not, in the opinion of designers, achieving those desired outcomes.

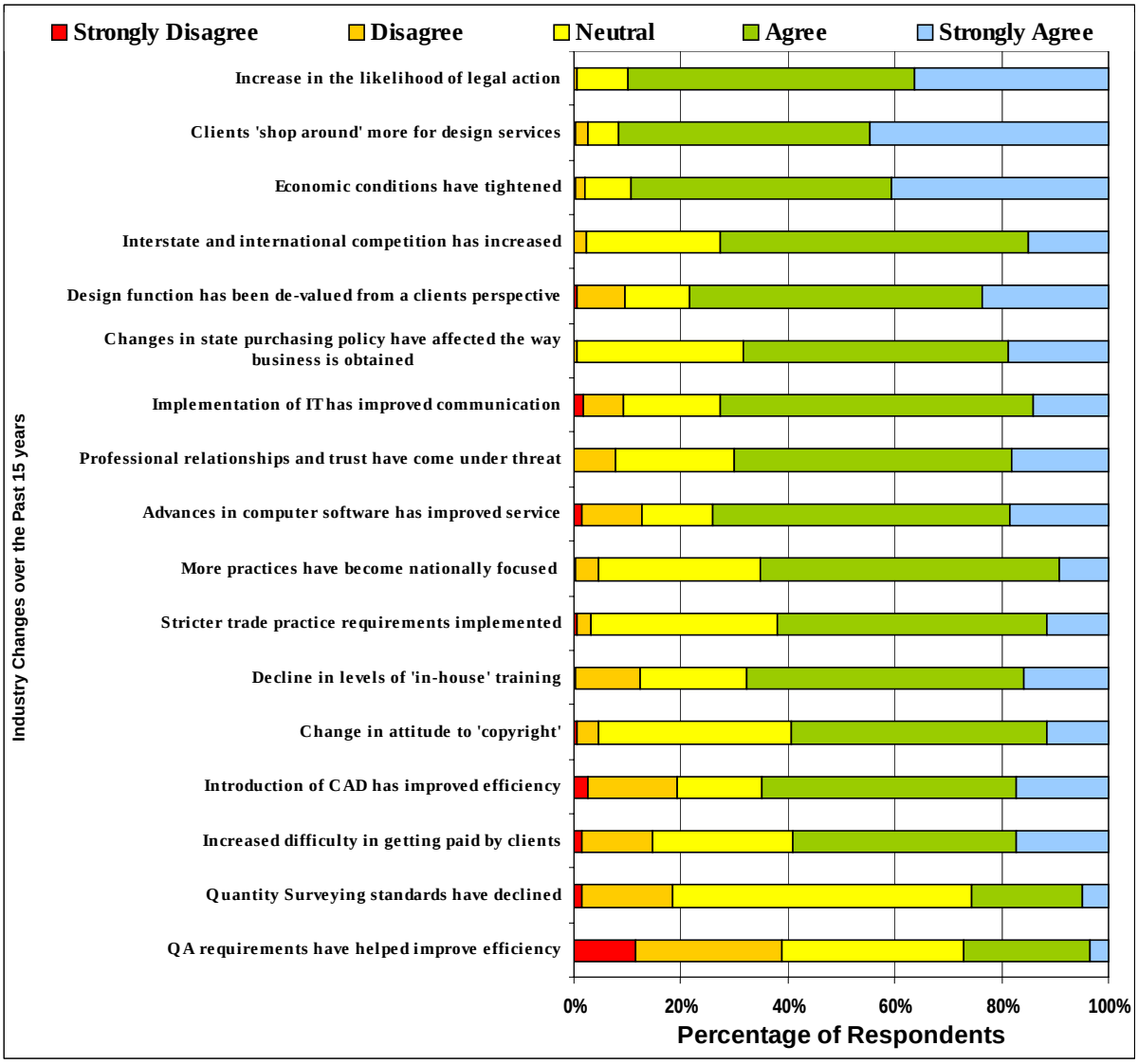

Figure 2.29 Level of agreement for statements relating to industry changes

In Figure 2.30, the responses relating to the level of effect that each of the industry changes has had on design and documentation quality over the past 15 years are summarised and listed in increasing order of beneficial effect. As can be seen from the chart, the changes which have provided the greatest benefit, were:

- Advances in computer software;
- Implementation of Information Technology; and
- The introduction of CAD.

From the chart it can also be seen that the changes which have provided the greatest detrimental impact, were:

- The design function being de-valued from a clients perspective;
- Economic conditions having tightened; and
- Clients tending to *shop around* more for design services;

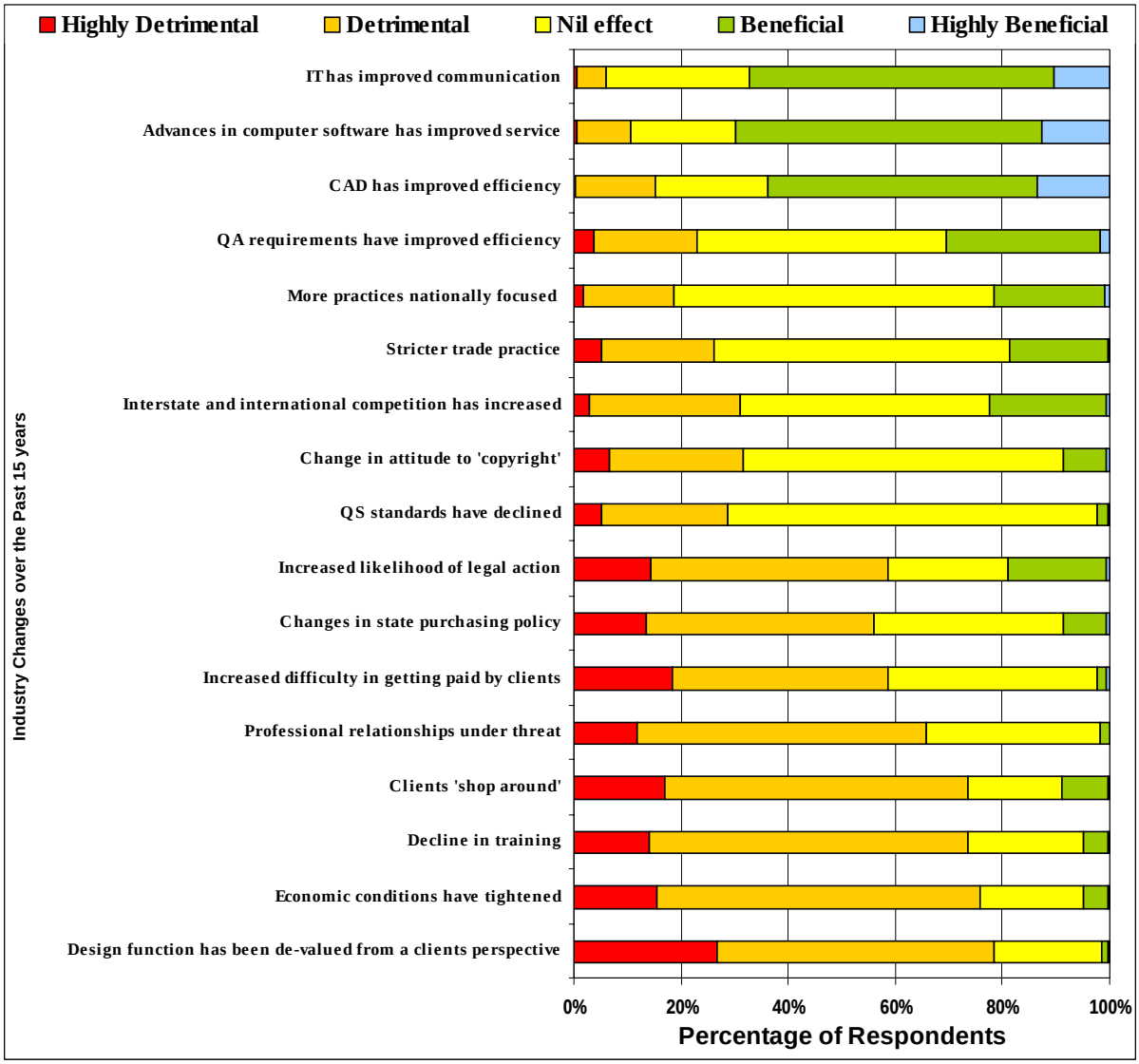

Figure 2.30 Industry changes and their effect on design and documentation quality

When comparing the two charts, it is again interesting to note that even though there was general disagreement in relation to the statement indicating that CAD had improved the efficiency of the design and documentation process, designers still believe that CAD has a significantly high beneficial effect.

To try to determine whether there was any correlation between the responses relating to the level of agreement and to the level of effect, Figure 2.31 below, was produced.

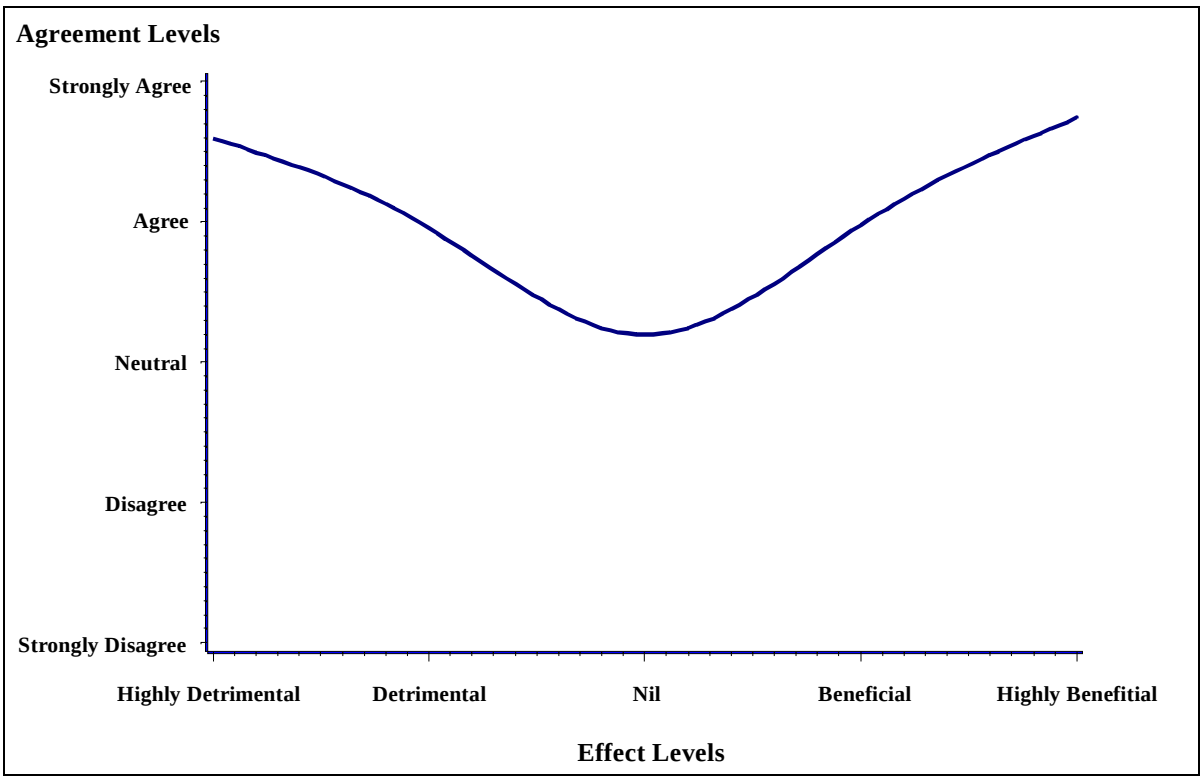

Figure 2.31 Correlation between level of agreement and level of effect

As can be clearly seen above, there is a strong positive correlation between both the level of *agreement* and the level of *effect* and that when the level of *effect* is at the extremes the level of *agreement* is quite strong and visas versa.

2.10 Section 10 – Organisational Profile

2.10.1 Section 10 – Overview

Section 10 of the survey was specifically included to try to obtain some additional data relative to the organisations in which the respondents work. This data is expected to be valuable in trying to determine additional trends in relation to the previous sections.

Of the firms who responded to the survey, over 65% have been in business for more than eleven years while the most common size of firms were those employing only between two to five people (approximately 33%), with more than half employing over five people. When considering the extent of fees obtained under the different procurement systems, although almost all respondents indicated that they carry out some work under the *traditional* procurement method, just over half indicated they carried out work using *design and construct*, while just under half were involved in projects using some form of *management* procurement methodology.

While all of the diverse market segments of the construction industry listed were adequately represented, *civil engineering*, *government* and *commercial* projects represented the greatest proportion of the designer income – although the greatest proportion of designers were involved in the *residential* sector. When considering the different payment options, the results indicated that just over half of design fee income was derived by lump sum fees, with nearly 30% based on a percentage of the construction value and the remainder mostly coming from hourly rates.

When asked to consider the level of quality assurance (QA) implementation by design firms, approximately 45% have or were implementing QA to ISO 9000 standards, approximately 20% did not utilise any form of QA, while around 33% of firms utilised their own in-house quality system.

2.10.2 Question 10.1 – Years of Operation in Each State

In Question 10.1, respondents were asked to indicate how long (in years) their organisations had been in operation in their state. As can be seen in Figure 2.32, over 65% of the respondent's organisations have been in business for at least eleven years, while just over 30% have been operating for less than ten years.

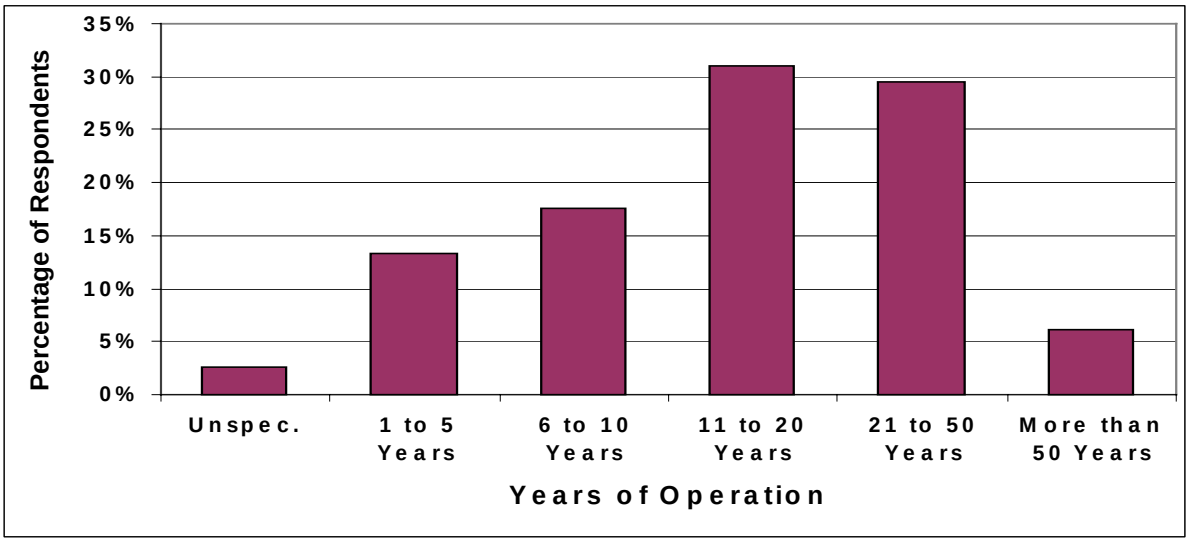

Figure 2.32 Number of years each organisation has been in operation

2.10.3 Question 10.2 – Number of Employees in Each State

In Question 10.2, respondents were asked to indicate how many people their organisations employed in their state. As can be seen in Figure 2.33, although the survey responses have encompassed a wide range of organisational sizes, smaller firms were by far the most common with approximately one-third (34.2%) of all the respondent organisations only having between two to five employees.

Figure 2.33 Number of people employed by each organisation

2.10.4 Question 10.3 – Breakdown of Design Income by Procurement Methodology

In Question 10.3, respondents were asked to indicate what proportion of their organisation's total design income was derived from each of the nominated procurement methodologies – *traditional*, *design and construct* and *management*. As can be seen in Figure 2.34, the traditional method provides a much greater proportion of overall design firm income than either of the design and construct or management methods, however this proportion is much less than was previously indicated in Question 4.1. The chart also shows that around the extreme ends of the income scale the three methods are quite similar. Both of these observations would appear to indicate that for larger projects, non-traditional methods are used to a much greater degree, than may have been previously considered.

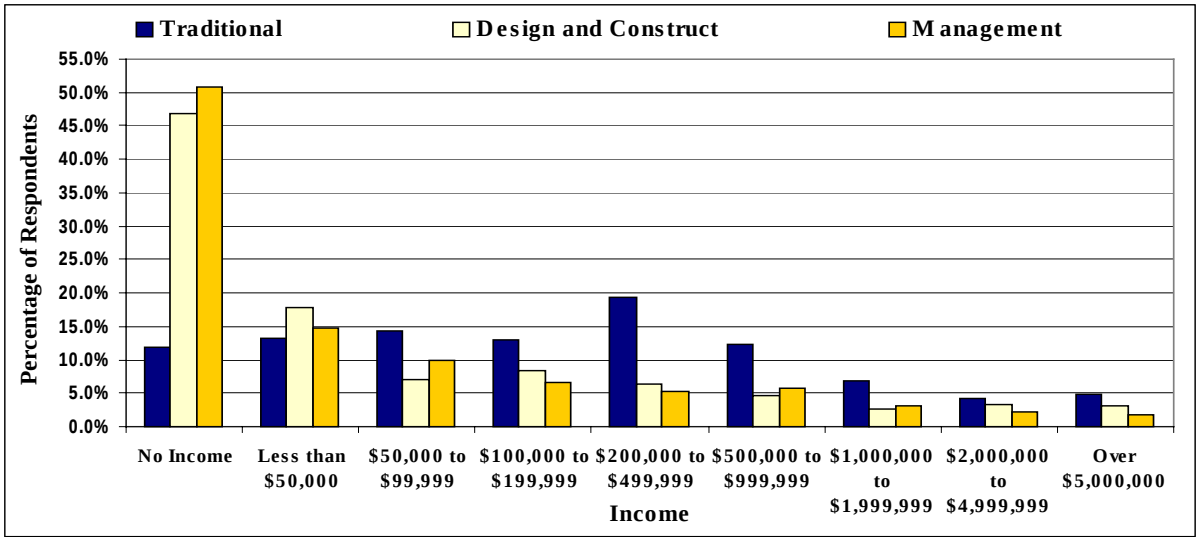

Figure 2.34 Percentage of design income derived from each procurement method

2.10.5 Question 10.4 – Breakdown of Design Income by Market Area

To further determine the makeup of the designer group, Question 10.4 asked the respondents to indicate what proportion of design income was derived from each of a number of different market areas, as listed in Table 2.10.

Table 2.10 Market Areas Listed

Market Areas Listed	
a)	Light industrial buildings
b)	Government buildings
c)	Commercial buildings
d)	Hotels/Resorts
e)	Recreational facilities
f)	Apartment blocks
g)	Residential housing
h)	Shopping centres
i)	Heavy industrial projects
j)	Civil engineering projects
k)	Other (specify)

As can be seen in Figure 2.35, the market area providing the greatest overall proportion of design fee income, was *civil engineering* followed by *government buildings*. *Commercial buildings* and *heavy industrial* were the next largest areas. *Light industrial* was responsible for the lowest proportion of the total design income.

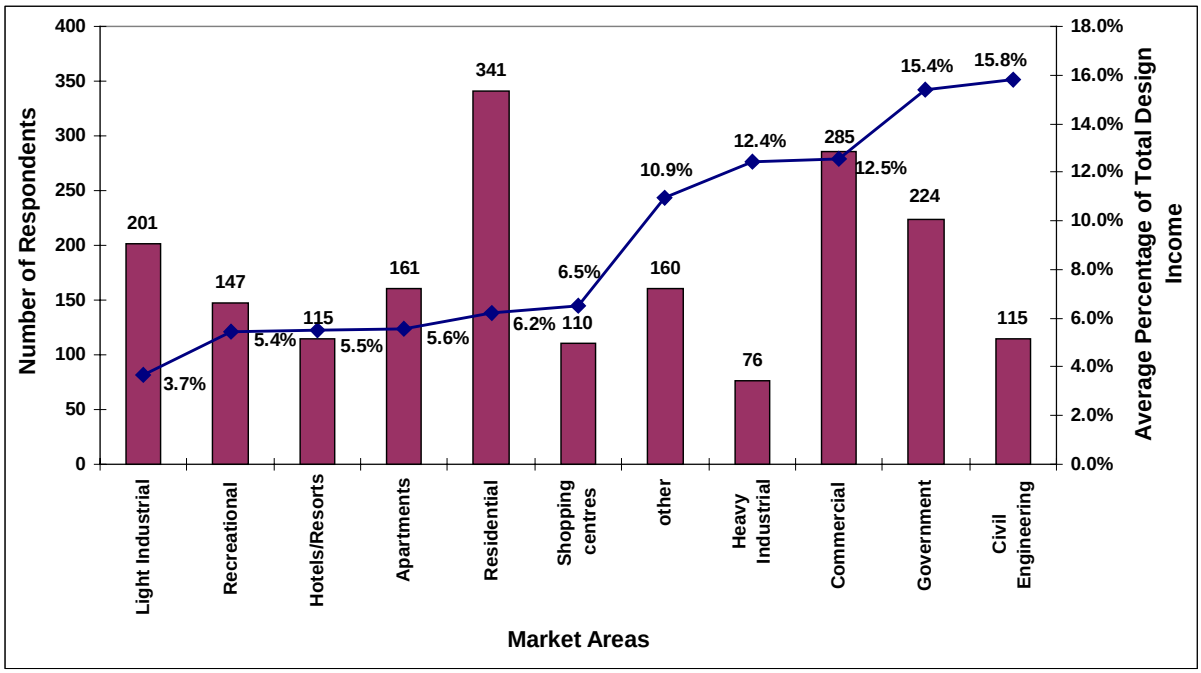

Figure 2.35 Number of designers working in each market sector and average percentage of total design income that each sector represents

Figure 2.35 illustrates that while nearly 70% (341) of the respondents operate in the *residential housing* sector it represents only 6.2% of the total design income of the respondents. Conversely, only 15% (76) of respondents work in the *heavy industrial* sector.

Further analysis was also undertaken to try to determine what proportion of the total designer income was made up by the different project delivery methods within each market area. As can be seen in Figure 2.36, the *traditional* method had the highest proportion of industry turnover within all market sectors. These results are based on an average for the responses from the individual contractors and assume that the percentage of work achieved for the particular sector was proportional to the value achieved for each delivery system.

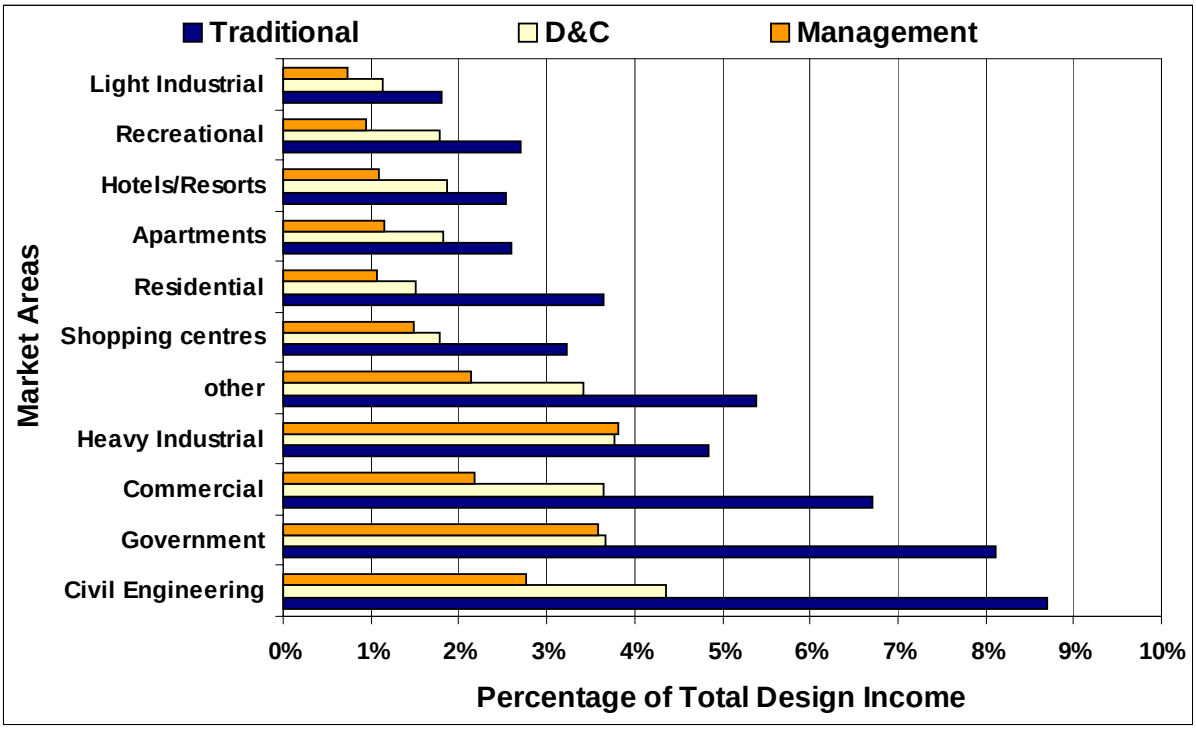

Figure 2.36 Proportion of income attained through the different project delivery methods within each market area

2.10.6 Question 10.5 – Breakdown of Design Income by Billing Method

In Question 10.5, respondents were asked to indicate what proportion of their organisation's total design income was derived from each of the nominated billing/fee-setting methods.

As can be seen in Figure 2.37, the lump sum fee is the most predominant method used for setting fees and is almost double that of the more traditional method, which is based on a percentage of the construction value. Although billing fees based on the hourly rate method is the least preferred method of billing, at nearly 20%, it still provides a significant contribution.

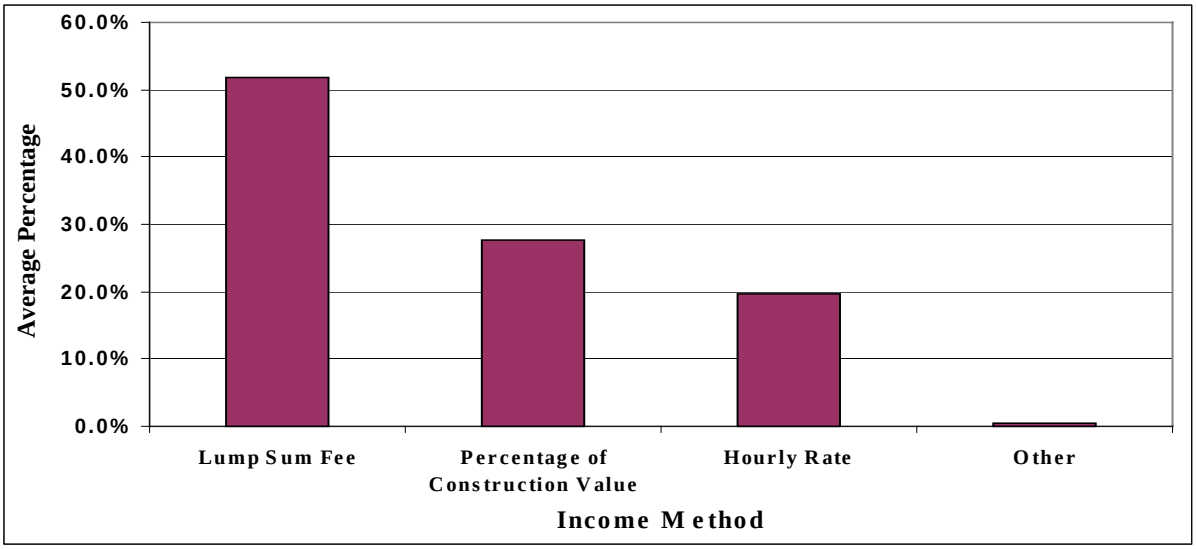

Figure 2.37 Percentage of design income derived from differing methods of billing

2.10.7 Question 10.6 – Breakdown of Quality Assurance Implementation

In Question 10.6, respondents were asked to indicate what level of Quality Assurance (QA) accreditation their organisation had attained. As can be seen in Figure 2.38, only just over 20% of all respondents indicated that their organisations had full QA accreditation to ISO 9000 standards, while well over half of the respondents' organisations either had no form of QA at all or utilised their own form of QA.

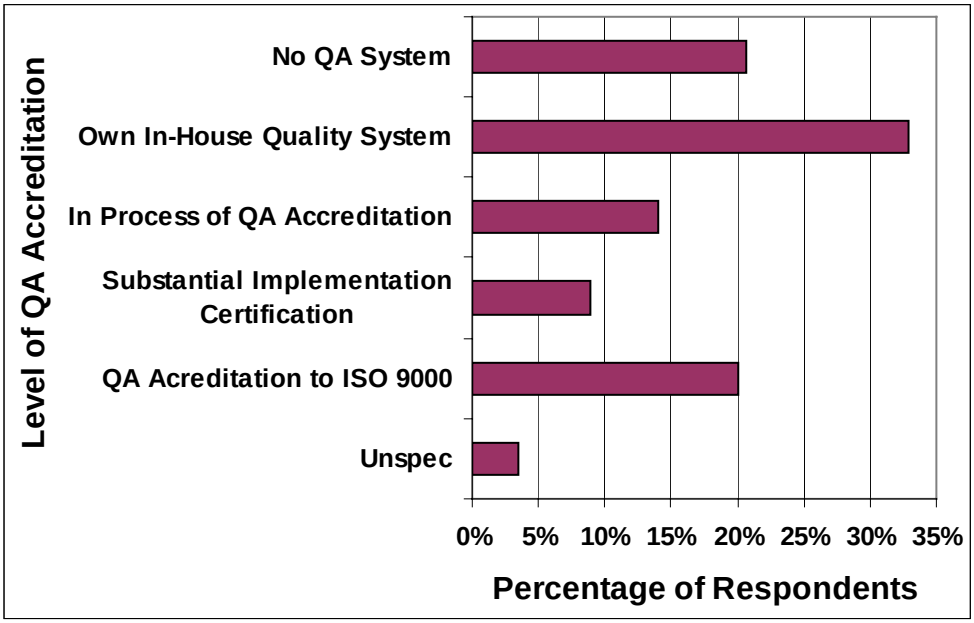

Figure 2.38 Level of quality assurance (QA) accreditation

The higher frequency of in-house quality systems and no QA accreditation procedures would appear to provide additional supporting evidence to the designer's responses indicating their belief that QA accreditation is not the answer, and that it is generally more trouble and costs more than it is worth. As recent research has suggested that a greater adherence to QA standards is likely to improve design and documentation quality, an apparent lack of commitment by the design industry to adopt these standards may be contributing to the declining quality levels.

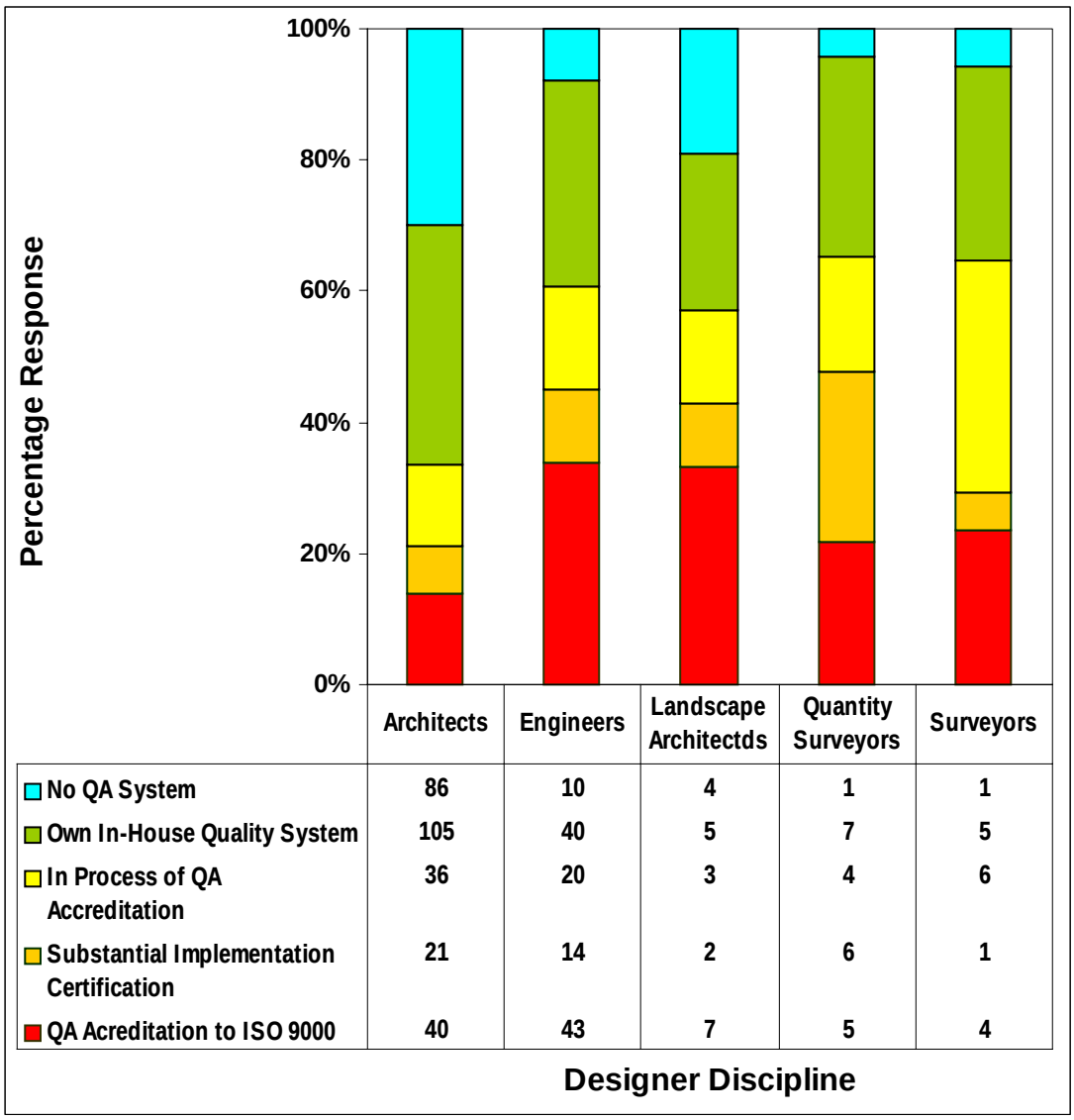

Figure 2.39 Level of quality assurance of the designers

To see if there were any major differences between the different designer disciplines, further analysis was carried out. In Figure 2.39 we can see that proportionally there were more architects in the "no QA system" and "In House QA" categories. Further analysis however, showed that 83% of architects who had did not appear to have started on any quality system and 70% of architects who had their own in-house quality system had five or less employees. Generally it followed that those respondents that had either their own in-house quality system or did not appear to have started on any quality system, were on average, smaller than those that were fully accredited.

2.11 Section 11 – Designer's General Comments

Section 11 was included to give the respondents the opportunity to provide their comments – not only in relation to the questionnaire itself, but also on the issues that it raised. Respondents were also asked to provide details of any issues that they considered were not covered in the questionnaire, but which had a significant impact on design and documentation quality.

The total number of comments provided was 204, which is approximately 42% of the total number of responses. As can be seen in Figure 2.40, Architects provided the majority (approximately 63%) of the comments, however it should be noted that the number of comments provided by the other disciplines was in proportion to the overall response rates for each discipline – as shown in Figure 1.1. Similarly, the breakdown of the comments by State, was also in proportion with the overall response rates shown in Figure 1.2.

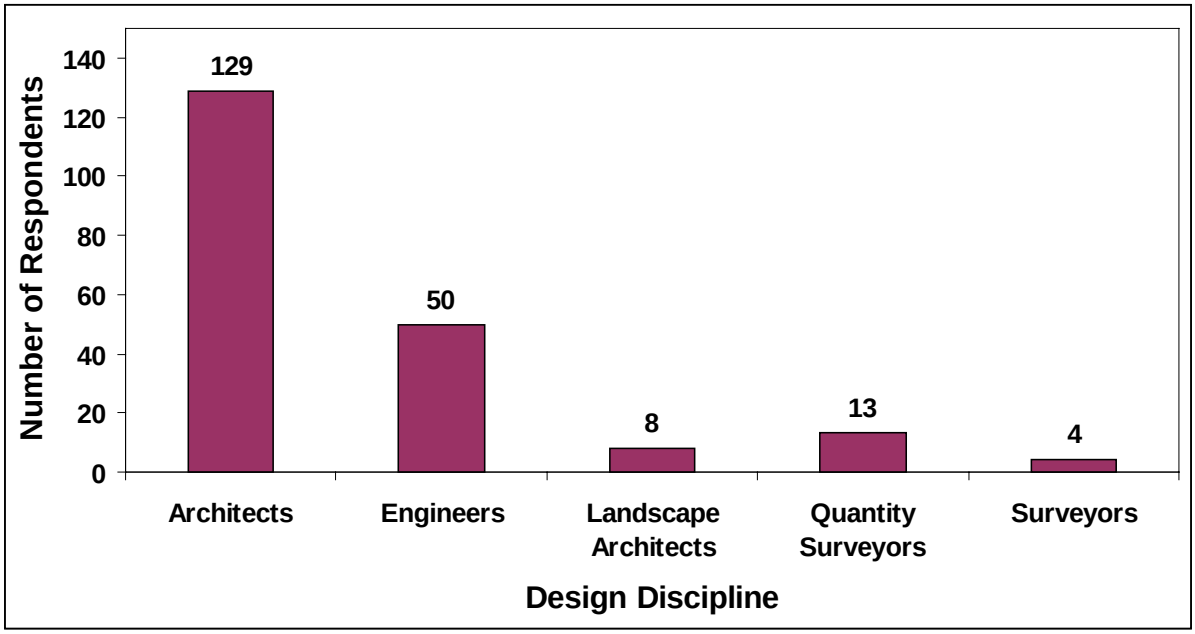

Figure 2.40 General comments by designers

An analysis of the actual responses was carried out and as can be clearly seen in Figure 2.41, the comments generally supported the view that the low design fees, insufficient time and a general lack of understanding of the true value of the design professions has led to a reduced standard of design and documentation. These comments are – not unexpectedly – consistent with the results from previous sections of the questionnaire.

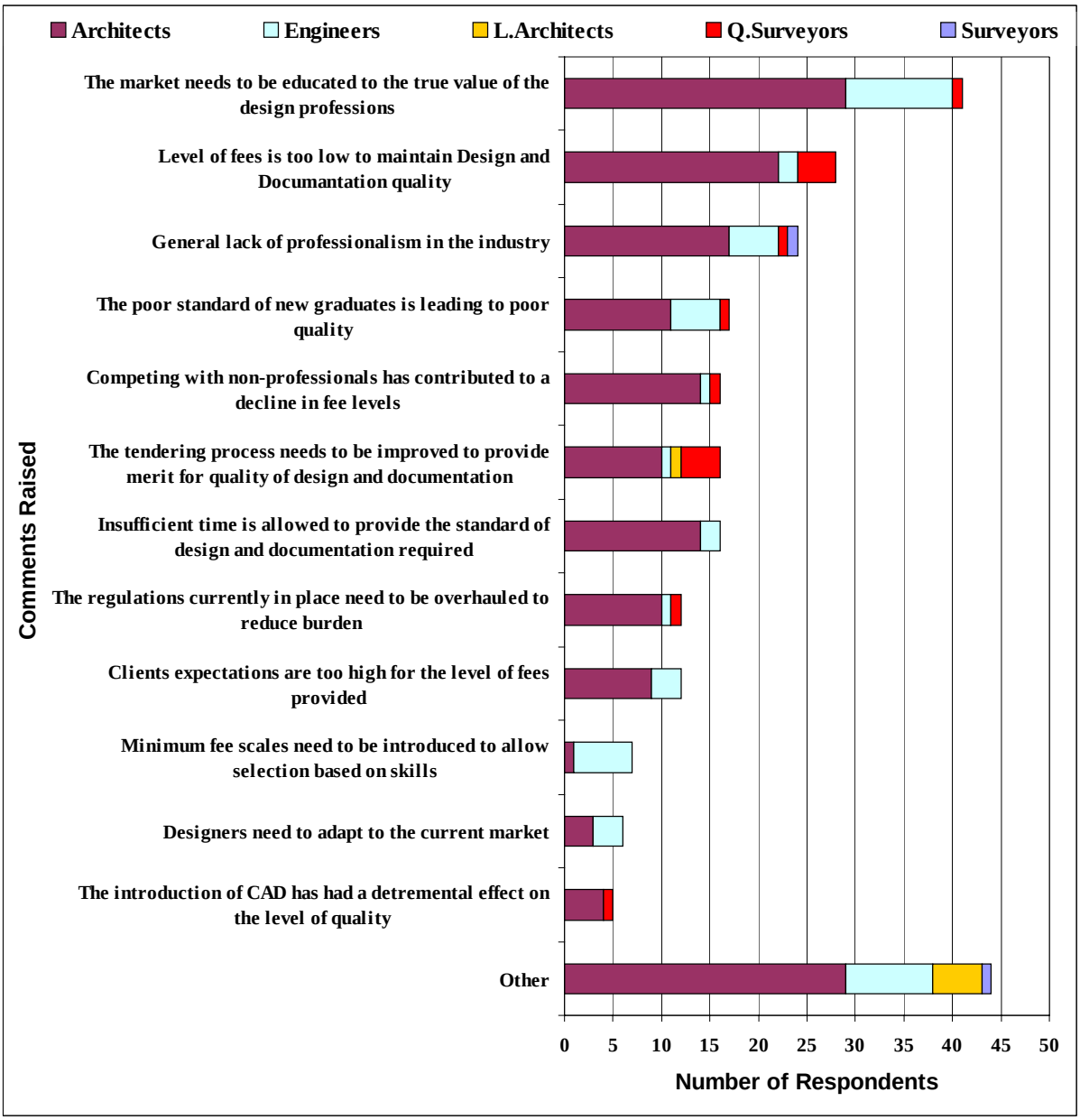

Figure 2.41 Breakdown of Comments Raised by Designers

To try to provide a feel for the types of comments given, extracts from some of the respondents' comments are listed below under the major topic areas. Overall, there were many interesting comments provided, either by way of a critique of various aspects of the industry, or as constructive insights into how we may improve the current situation.

Design fees and the time available to carry out the work

Time constraints and tight fees together make the design & doc. process unpleasant & risky.

Basically the problem is that projects are cost driven & the risk of litigation or other legal consequent is always increasing. More information & more detail is required by clients yet there are less fees available & less time to produce the design/documentation (due to external money markets). This is more pronounced in the public sector where political careers are more important.

Economical & financial issues are greatly affecting the construction industry with the majority of clients expecting high level of performance, but not prepared to pay for it.

The requirements for designers are more intensive & onerous than previously. The fees are always on the low side, yet clients always demand more without wanting to pay. Overall, the standard of design in the industry is below par. Cut price fees are the norm…

In rough terms, our fees are 60-70% of ten years ago. While some of the difference has come from better technology, most has come from forgoing profits, reducing wages of senior staff & directors & cutting out training both of existing staff and apprentices. We are so busy that just keeping our overdraft within limits that we have no time for any "extraneous"(professional development) matters. I am witnessing, at first hand, the death of my profession.

Public and Private sectors will both negotiate fees even after you may have won the project. They all know the work is too valuable to give up.

I liquidated my last practice rather than undertake work for unrealistic fees to unreasonable time programs. I don't think much has changed - we are our own worst enemy

Quality of design staff, design education and training

Poor or very poor education of our young architects in "commercial" practices and particularly in their university training is lowering skill levels of the profession.

Less fees results in less salary and slower implementation of technological aids. The result being employment of less experienced staff.

Reduced fees have meant that adequate staff training is impossible. Adequate staff are not being trained as site time cannot be permitted.

A major problem for architectural firms today is the lack of basic training in the various institutions in the areas of building construction documentation, building regulations & drafting skills. Many graduates have very poor manual drafting skills, freehand drawing skills, are not familiar with basic building construction & do not understand or know how to use BCA.

Education standard at universities and those accepted by the institution are becoming less, leading to poorer quality staff.

Decline in quality of new engineering graduates is a serious issue. Only a small percentage of graduates are capable of the demands of a modern consulting practice. This is probably due to reduced standard of intakes into engineering degree courses.

Architectural education is generally failing to provide design professionals who are literate both in a design sense and literally. There is no time or money for a genuine apprenticeship, once graduates enter the workforce.

Graduates now have more understanding of design & the "archi" jargon. But in the real world they are unable to deal with building issues. They know little about building details and less about how to deal with builders. Tertiary training does not prepare you for the real world, and offices can't afford to do this - you no longer learn the ropes for 5yrs, it is expected to start on day 1.

Issues relating to Quality Assurance (QA)

Despite being fully QA accredited we are unable to obtain/tender state gov't works because as we had not done any for 2 yrs we were now "not experienced". Up till QA became a necessity we always had a PWD job in the office. It seems a catch 22 situation. Hold off whilst obtaining QA - then you're no longer experienced due to the time when getting QA.

QA has not improved the standard of work on building sites. Reinforcement is never checked by builders prior to consultant check, although QA staff and forms float around. Formal QA is unnecessary and a burden (cost) on small practices.

I have not started and will not start QA proceedings as it's a scam and has a massive detrimental effect. You should have asked 'Is QA viewed as a marketing tool or a means to better quality.

Issues relating to clients

Professional clients in government are generally appalling. Private enterprise project managers may pay more but put extraordinary time constraints on the delivery of services.

The client communication interface adopted by many project managers has severely restricted the interaction between clients and design professionals to the detriment of both parties and to the detriment of the overall built result.

Clients should be better educated about the architects project input and should select a person appropriately qualified and experienced

All clients should be made aware of 'Life Cycle Costing'! The contribution of all consultants, including the architect, is essential to proper long-term performance of the building. The cost of this contribution is a very small proportion of this 'Life Cycle Costing' and yet people argue of small percentages of consultant's fees. Crazy!

The extent of work required to design and document adequately is not understood by clients.

Public sector at least 2-3 times more likely to engage in fee bidding than private sector. Much greater drop in quality of design & construction in public sector.

It is extremely difficult to obtain quality briefs from clients or their representatives and a general unwillingness to make the hard decision to reconcile brief requirements with budgets.

The biggest problem by far in managing programmes and meeting deadlines is a severe lack of discipline and commitment to client decision making.

Our major concern is the lack of understanding by our clients (both private & public) of the importance of quality design and documentation in providing not only the best possible product but at the best possible construction cost. They cannot conceive that the additional cost involved in the provision of thorough design & documentation will in fact provide much greater savings than the additional architectural fees would ever be. Few clients understand how much time is involved in design and documentation and

assume that every architect, regardless of their fee, will produce comparible work. Until the public ie: private and public sector are better educated in this regard, quality of design and documentation will continue to decline.

I believe design and documentation quality is simply a measure of the strength of the relationship between owner/client and consultant. Consultants need to be able to establish relationships and convince clients of the value of their services, not complain about low fees.

In a nutshell, I would say that only the rare client truely realises that they get what they pay for. I think they think that higher fees is more profit not more output. I would also say that only the rare client would know good design if they saw it. Adequate, workable, affordable they know, Exceptional, timeless, worthwhile - who needs it? I'd like to run a boutique, but the shoppers are all at Silly Sollies.

CAD and other IT issues

CAD can be a very useful tool if used by the right people for the right jobs. However, I believe there are CAD operators who are not architects and do not know how to put a building together. They can draw fast but this is not the only issue.

CAD has very limited applications on small jobs and staff is expensive. Greater time is required to produce adequate documents and many operators have inadequate building & design experience.

Computers & IT have streamlined processes in offices, which means more profitable practices.

Although CAD is a very useful tool in an architect's office the operators & architectural staff must understand & be able to translate their knowledge of construction, regulations & drafting skills on CAD. At present this ability is rare & much time is spent cross checking documentation & training staff.

Computer aided drafting is not seen as a saving grace since skillful operations familiar with building and construction techniques are not proliferating. IT is providing means for the swift transfer of information, but the process of design has not changed for the wishing to maintain the same standards of output and client service.

The advent of the use of CAD in architectural practice has grown & developed over the last10-15yrs. This falls withihn the period being investigated and has caused significantly increased costs, for limited increased productivity or design flaws. Hopefully, as this technology in the levels out, this deficiency will decrease and an economic balance will be reached to the business of architecture. Our sphere of upper / small practice finds client expectations of CAD usage to be beyond what they are prepared to pay fees for.

CAD operators have different methods of operating and are usually incompatible when combined - ie working on the same project. Architects with some CAD skills are put on the same 'level' as draftsmen with CAD skills, and as a result "drafties" perceive that they can do an architects work. Some firms allow this to happen, because its cheaper to engage a "drafty". Older generation architects, not so familiar with CAD, rely on juniors, and invariably don't check work - "It was done on the computer so it must be right". Work is no longer able to be supervised 'over shoulder! You cannot see the full

size sheet unless you print out, and the coloured layers can be confusing and incorrect if not done properly - inexperience.

Over the last 10 years we have heavily invested in CAD systems and QA and this has enhanced the quality and accuracy of our deliverables. These CAD systems, particularly 3D CAD, have other advantages in client review, operator training and material control. The company is accredited to ISO9001 and we are convinced that our system helps us to improve quality.

Changes to design professional's role and image within the industry

The level of respect and therefore relevance afforded to design consultants has reduced as their role in documentation and on site contract administration has reduced. The tendency for a number of architectural practices to have extremely limited roles in the overall management process & the construction site itself limits self corrective feed back and erodes the profession's competence and therefore its profile.

Engineers have not addressed their status and are willing to work for wages without adequate levels of profit. Engineers do not understand what the word profit means almost to admit that it is a sin to make one.

Overall, the perception of engineers is they are a necessary evil, & demanding excessive fees.

It seems to me that an orchestrated attack on the profession, initiated by the state & federal governments, has downgraded us to "businessmen/&/women". For example, I now spend over 50% of my time on tendering, management and paperwork. During the 1980's this was less than10% and I was able to use my training (which had been paid by the public purse) in providing society with a better built environment.

Architecture is a dying profession due to the cost imposed to practice that profession, the general public belief that anyone that can draw plans are "architects' and that cheap is always best.

The questionnaire does not deal with a "waste" time component, which is becoming a larger issue year by year. In the mid 1980's we lamented only being able to spend 80% of a project time on issues directly related to the project ie: design, doc., construction attendance/contract admin. The remaining 20% was spent on addressing the 'politics' of the project, its PR, extraneous paperwork particular to the client and his project demands (eg: internal government budget attendances etc...). In 1998 that direct project time percentage has dropped to 60% with the extraneous requirements now requiring 40% of the time. This is largely a consequence of also now attending to others QA requirements, apart from an increase in the political and internal client support services required.

Competition from non-design professionals

The standard of design & documentation has been detrimentally effected by the increase of so called "building designers" that provide architectural services at fee scales that qualified architects find it had to compete with. They are unable to do this because:
(1) The standard of design & documentation they produce is diminished because of lack of proper training particularly in design skills;
(2) They provide only minimal service, which is lacking in detail and functionality.

Legislation needs to be put in place to control these practices and only then will the standard of design and documentation be elevated to a higher level. I find it strange that a building structure can only be designed by a qualified structural engineer but anyone is able to design a building have it approved and erected without any formal or proper education in that field.

It is definitely getting harder to make a buck! Clients expect more and pay less. They expect that architects should compete in fees with plan services & draftsmen, even though those people are under-skilled & unregulated. The architect's liability however is increasing. Good design is being devalued.

Drafting firms are still widely accepted as being architects. This is very detrimental to the uniformed client who is then usually disappointed with the results then blames the architectural profession.

Solutions to the problems

This self-defeating cycle has to stop.

First: *Collective action - stop fee bargaining;*

Second: *Invest in your staff - greatest resource yet undervalued;*

Third: *Raise expectations over time and time with realistic outcomes. Most firms fail to deliver, but do not deliver a failure.*

Fourth: *Integrate with other team members, - fellow consultants get them on side.*

Fifth: *Educate the client on design quality & value for money.*

Sixth: *Thereby raise the standard of architecture & the profession will be elevated in the eyes of their peers.*

Perhaps minimum design & documentation standards need to be created and enforced under the BCA. This may not be so easy, but it would force a minimum level of standard in the marketplace. Additional to this would need to be educating the market place on the VALUE of design and documentation.

Fees must rise!! The institute is failing the profession. Doctors & lawyers maintain their fees to the betterment of those professions. Our institute & some architects are failing to see that reduced fees will eventually destroy the profession.

Architects should form more of a cohesive group instead of undercutting each other's fees to the point that they cannot service to contract & destroy the profession in the process.

3 Conclusions and Recommendations

An investigation by means of a survey questionnaire, specifically designed to obtain from the design professions their perceptions of the changes in design and documentation being produced in the Australian construction industry, has indicated a direct relationship between the level of fees being paid to designers and both the quality of design and documentation and the level of service provided by the consultants.

Although architects and engineers provided the bulk of the responses, there is general agreement among all disciplines in relation to the issues surveyed. The respondents were also classified into groups based on various other factors such as level of quality assurance, size of firm, number of years the firm has been in operation and in which state they are operating to see if there were any significant differences in responses based on these factors. As is the case for the various disciplines, the responses indicated general agreement for those surveyed. Overall, the level of response to the survey was acceptable, with most disciplines and all states well represented. The number of responses received has ensured that the results determined are statistically significant and generally representative of the opinions of the design sector of the industry.

The issues which designers believe are important to ensure quality in design and documentation stem from the designer's belief that the design should effectively serve both the purpose intended and the project requirements. This requires a thorough examination of the design proposals to ensure that the proposals are functional and relevant in the first instance. Once the design stage is affected the completed documents need to be legible, easily read and interpreted, free of errors and inconsistencies and be properly checked prior to release to the contractor. Designers believe there should be a competent manager in charge of the design process to ensure design and document quality. The decreasing level of fees available to designers has had a detrimental effect on their ability to carry out what they consider to be critical functions within the design and documentation process.

Throughout the different levels of size and complexity of projects, the level of fees being *submitted* by consultants to try to obtain the work, has decreased by up to 30% over the past 15 years. One of the causes for this may be the competition from the proliferation of 'backyard' designers prepared to work for minimum fees. The lower level of fees available emphasises their view that designers are selected based mainly on the level of fees submitted. Other factors in the selection process such as the design firm's reputation, capabilities, experience and qualifications and quality assurance accreditation is perceived to be of secondary consideration. When comparing public and private sector clients, designers believe both offer a lower level of fees now than was the case 15 years ago. Designers have also indicated that the level of fees available from the public sector is on average approximately 6% lower than those available from the private sector.

According to the designers, the lower fees available from both sectors have impacted on the adequacy of time available to provide quality design and documentation. This, they believe is due to there being insufficient time available for each key phase of the design process to ensure high quality. This is highlighted by the lack of time to properly compare and discuss project details with other design disciplines or to investigate innovative approaches to better meet the specific project requirements. Although the time available has declined, the level of service requested by clients has remained relatively constant which appears to underline the designers opinion that the design function has been downgraded from a clients perspective.

Designers also indicated a decline in the accuracy and completeness of documentation over the past 15 years, which again appears to be a reflection of the decline in the level of fees and time available.

From the designer's responses it would appear that lower fees have an impact on just about every area of design and documentation quality. With less time available to preserve the quality of the design and provide the level of service needed, designers are unable to incorporate to the degree they did 15 years ago, many of the attributes of design and documentation quality. Issues like coordinating design details from various other consultants and providing practical design detailing and construction methods. Without sufficient time to review the design and documentation there is more risk in the process. There is also a likelihood of higher project costs due to increased variations, delays and rework. In addition, reduced design efficiency over the past 15 years, is highlighted by an increase in the number of drawing revisions, as well as the number of RFIs requesting design clarification. All these problems have also led to an increase in the potential for legal action.

Other areas affected by lack of time, are innovation and staff training. Time is needed to explore innovative approaches to meet project requirements and investigate alternative designs and comparative cost analysis. New ways of approaching design problems need time to be considered. Without the necessary time to develop new solutions the advancement of design, construction methods and material efficiency is stifled. Innovative designs are likely to lead to lower overall project costs. Lower fees also impact on the profitability of a firm. With less profit there is insufficient money to provide on the job training for junior staff. Future design depends on the training provided to the junior staff. Without sufficient training the designers of the future will have limited ability to provide adequate designs for projects. Over the past 15 years there has been a decrease in 'in-house' training. There has also been a decrease in the availability of experienced personnel.

The effect of the lack of time available has been somewhat reduced however, due to improvements in technology. The use of CAD, IT and computer software has helped speed up the design process allowing better use of the limited time available and may account for the increased use of standardisation and conformity in documentation. Lack of time may have also increased the use of standard specifications.

When comparing the situation between the different procurement methodologies, there is a belief that there is more time available using the traditional method of procurement. This may be one of the reasons why the preferred method of procurement is the traditional method, with approximately 62% of projects acquired using this method. However, in spite of this, there has been a significant increase in the use of Design and Construct method and an even greater increase in the use of the Management method of procurement over the past 15 years.

This survey has collected the thoughts of the designers and determined that there is a perception that current design and documentation quality in the Australian construction industry is of a lower standard, than was the case 15 years ago. The primary cause of these changes – in the opinion of the designers – is the reduced fee levels and the lack of time available to provide the necessary service to ensure quality design and documentation. The changes identified by the survey are significant and need to be arrested. Designers believe clients need to have an increased understanding of fees, service and timing and that the selection of designers should be based on more than just the level of design fees submitted for the project. Due to the problems which are occurring due to a lack of sufficient design fees and time, it is the designers' belief that more reasonable fee levels – paid in the first instance for the design function – would ultimately reduce overall project costs, by increasing the time available to ensure quality design and documentation – thereby decreasing risk. It would also

offer more time to explore more innovative and cost effective designs. There is the prospect of creating methods that allow for better designs and more economical uses of materials and ultimately a higher quality of place created. More reasonable fee levels now would also ensure that designers would have the required level of skill to undertake future projects through the reintroduction of adequate training.

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5 Appendix

Attached is a copy of the Designer's Questionnaire – for reference purposes.