

WRITING A PHD THESIS

This anonymous document was found by one of COER's students and has proved to be of value to a number of students. Apologies that some of the pictures are not showing.

DETAILS OF CHAPTERS AND THEIR SECTIONS

Turning from the general issues of style and structure above to more precise details of the structure of each section, each chapter of a PhD thesis and its parts are discussed next. Appendix VII has workshop details for initial planning of a thesis' chapters 1 and 2.

1 Introduction

1.1 Background to the research

Section 1.1 outlines the broad field of study and then leads into the focus of the research problem. This section is short and aims to orient the readers and grasp their attention. In journal articles, the introduction has the four stages outlined in appendix V (Swales 1984): establish the overall field, summarise previous research, indicate the research gap, and state the purpose of the article and outline it. However, in a PhD thesis, these stages are spread through the whole of chapter 1 and parts of chapter 2, rather than in section 1.1. Nevertheless, the first three stages could be borne in mind when structuring section 1.1, with the following section 1.2 providing the fourth stage. In graphical form, section 1.1 is the triangle shown in figure 2.

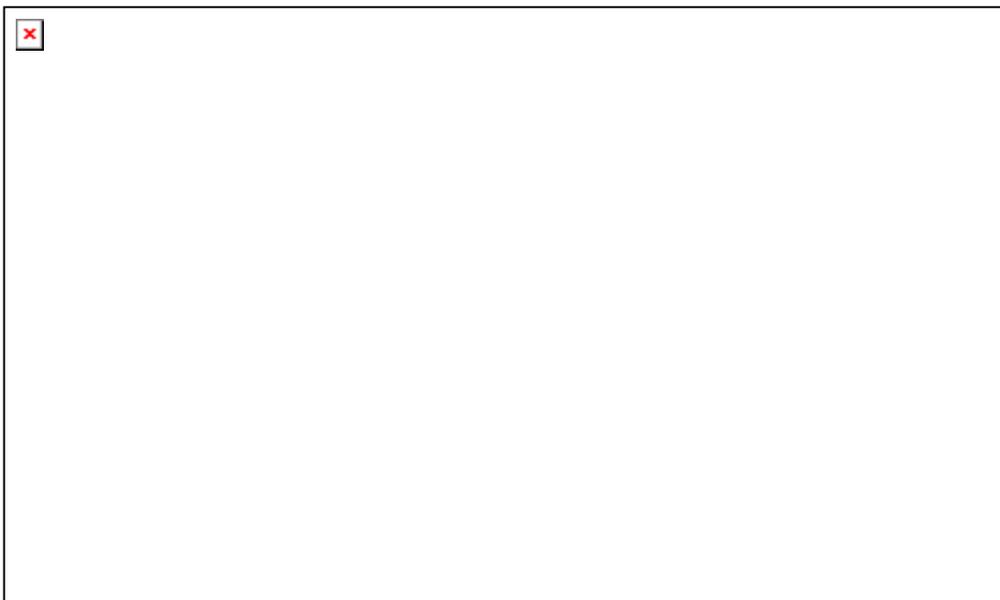


Figure 2 The triangle of section 1.1 of chapter 1

A PhD thesis should be able to reference at least four or five writers in the first one or two paragraphs, to demonstrate from the start of the thesis that care has been taken to acknowledge and chart the depth and breadth of the existing body of knowledge. Most of the material in section 1.1 is covered in more detail in later sections such as section 1.3, and so these sections will have to be referred to and section 1.1 is usually only about one or two pages maximum. This section is often *one of the last sections of chapters 1 and 2* to be written.

The section could use a 'field of study' approach or a 'historical review' approach. For example, using a field of study approach, section 1.1 of a thesis about a firm's licensing of technology would start with comments about international trade and development, Australia's GDP, the role of new product and process development in national economic growth, and then have an explanation of how technology licensing helps a firm's new product and new process development leading into a sentence about how little research has been done into it.

An alternative to the field of study example of the previous paragraph is to provide a brief historical review of ideas in the field, leading up to the present. If this alternative approach to structuring section 1.1 is adopted, it cannot replace the comprehensive review of the literature to be made in chapter 2, and so numerous references will have to be made to chapter 2. While the brief introductory history review may be appropriate for a journal article, section 1.1 of a thesis should usually take the field of study approach illustrated in the paragraph above, to prevent repetition of its points in chapter 2.

1.2 Research problem and hypotheses/research questions

Section 1.2 outlines the core or one big idea of the research, starting with the research problem printed in bold or italics on page 1 or 2 of the thesis. The research problem is one or two sentences that cannot be answered 'yes' or 'no'; it is the broad problem that the researcher will examine more precisely in the hypotheses and is the problem prompting and placing a boundary around the research without specifying what kind of research is to be done (Emory & Cooper 1991). As Leedy (1989, p. 61) notes in his thorough introduction to writing research problems, 'The statement of the research problem must imply that, for the resolution of the problem, *thinking on the part of the researcher* will be required'. Sometimes there may be sub-problems to the major research problem. Examples of research problems are:

- How do New South Wales and Queensland private sector managers successfully implement telemarketing into their organisations?
- How do Australian manufacturers select distribution channels for their exports to Japan?

The research problem in a PhD thesis is often more theoretical than the two examples above, for a PhD research problem should not be merely a 'problem-solving' one but should 'test out' the limits of previously proposed generalisations (Phillips & Pugh 1987, p. 45). That is, '[PhD] research, even when narrowly and tightly defined, should be guided by some explicit theoretical or conceptual framework' and without this, the thesis becomes a 'mindless ... theoretical wasteland' (Adams & White 1994, pp. 566, 574). That framework will be developed in chapter 2, but one or two of its constructs could be reflected in the research problem. Examples of appropriate research problems are:

- How culturally appropriate is TQM for 'reconceptualising' African management?
- How effective for strategic marketing in the Australian finance industry are Porter's models of competition and European models of networks?

Note that the constructs referred to in the research problem are high level ones and not the more specific constructs developed for hypotheses at the end of chapter 2 or their operational definitions developed in chapter 3.

When formulating the research problem, its boundaries or delimitations should be carefully considered. The research problem outlines the research area, setting boundaries for its generalisability of:

- one broad area of interest, for example, 'telecommunications marketing', (candidates might consider ensuring that this area of interest has its own academic discipline from which several examiners could be selected - a two-discipline thesis may produce conflicts among examiners from different disciplines),
- level of decision making, for example, directors, MDs, senior managers, customers, or public policy analysts,
- private or public sector organisation,
- industry, for example, transport industry,
- geographic limits, for example, Queensland or Australia, and
- time or business cycle limits, for example, in the late 1980s before the Australian economy entered a recession.

Asking the familiar questions of 'who', 'what', 'where', 'how' and 'why' (Yin 1989, p. 17 may lead the candidate towards placing appropriate boundaries around the research problem. (Incidentally Yin is for distinguishing between various types of methodologies for different types of research problems).

All the boundaries of the research problem will be explicit in the research problem or in section 1.7, however, all the boundaries should be justified in section 1.7. In the example above, restricting the research problem to Queensland and New South Wales telemarketing could be based on those states being more advanced than the rest of Australia. That is, the boundaries cannot be arbitrary. Within those boundaries, the data and the conclusions of this PhD research should apply; outside those boundaries, it can be questioned whether the results will apply.

Identifying the research problem will take some time, and is an exercise in 'gradually reducing uncertainty' as it is narrowed and refined (Phillips and Pugh 1987, p. 37). Nevertheless, early identification of a preliminary research problem focuses research activity and literature searches, and so is an important early part of the PhD research project (Zuber-Skerritt & Knight 1986). The Introductory Notes on page 1 of these notes outlined some considerations in choosing a research problem. An example of the gradual narrowing of a research problem is a candidate's problem about the partners in small Australian architectural practice which initially referred to 'practice of strategic management', then to 'designing and implementing a strategy', then to 'implementing a strategy' and finally to 'the processes involved in implementing a strategy'.

After the research problem is presented, a short paragraph should say how the problem is solved in the thesis. This step is necessary because academic writing should not be a detective story with the solution kept a mystery until the end (Brown 1995). An example of this paragraph following a research problem statement is (based on Heide 1994, p. 71):

The problem addressed in this research is:

- How can relationships involved in interorganisational governance in marketing channels be managed?
- Essentially I argue that interorganisational governance is a heterogeneous phenomenon and that different relationship management strategies are appropriate under different conditions.

Another example of a research problem and its solution in section 1.2 is (based on Eisenhardt &

Zbaracki 1992, pp. 17-18):

- The problem addressed in this research is:
Which of the three major paradigms best explains strategic decision making?

I conclude that a strategic decision makers are boundedly rational, that power wins battles of choice and chance matters. I also propose a new agenda for future research which centres on a few, key research areas and opens up research to new paradigms.

This openness right at the beginning about the positions that will be developed in a thesis should also be shown in chapters, sections and even in paragraphs. That is, expectations are created about the intellectual positions which will be developed in the chapter, section and paragraph (in the topic sentence of a paragraph), then those expectations are fulfilled and finally a conclusion confirms that the expectations have been met.

After the research problem and a brief summary of how it will be solved is presented, section 1.2 presents the research questions or hypotheses. The research problem above usually refers to decisions; in contrast, the research questions and hypotheses usually require information for their solution. The research questions or hypotheses are the specific questions that the researcher will gather data about in order to satisfactorily solve the research problem (Emory & Cooper 1991).

The research questions or hypotheses listed after the research problem in section 1.2 are developed in chapter 2, so they are little more than merely listed in section 1.2. The section states that they are established in chapter 2 and notes the sections in which they appear in that chapter.

Note that early drafts of parts of chapters 1 and 2 are written *together* from the start of the candidature, although not necessarily in the order of their sections (Nightingale 1992). That is, the major ideas in chapters 1 and 2 should have crystallised in drafts before the research work described in chapter 3 starts, and the thesis is not left to be 'written up' after the research. It is especially important that chapter 2 is crystallised *before* the data collection actually starts, to prevent the data collection phase missing important data or wasting time on unimportant material. In other words, the research 'load' must be identified, sorted out and tied down before the 'wagon' of research methodology begins to roll. Despite this precaution, candidates will probably have to continue to rewrite some parts of chapters 1 and 2 towards the end of their candidature, as their understanding of the research area continues to develop.

1.3 Justification for the research

An examiner is concerned that the candidate has not addressed a trivial research area. So the research problem should be important on several theoretical and practical grounds; for example, a thesis about small businesses could justify its research problem through:

- importance of small business and/or the importance of the specific area of the small business discipline being investigated (this justification is usually accompanied by a mass of statistical data showing how huge the area of the research problem is in terms of constructs such as revenue, employment and assets, and often by authoritative discussions and quotations from government publications about committees of inquiry),
- relative neglect of the specific research problem by previous researchers (some of this justification would refer to chapter 2, for there is no need to repeat parts of chapter 2 here; however, chapter 2 deals with the nitty gritty of individual research questions while this section should emphasise the whole research problem and possibly conclude with some appropriate quotes from authorities about the research problem),

- relative neglect of the research's methodologies by previous researchers (with references to chapter 3 being required, with an acknowledgment that the methodology is justified there and is not simply used for the sake of novelty), and
- usefulness of potential applications of the research's findings (this justification is based on the researcher's initial assumptions, in contrast, section 5.4 is a statement of the completed research's usefulness).

These four justifications could also be used to justify a research problem in other areas.

1.4 Methodology

Section 1.4 is an introductory overview of the methodology, and is placed here in chapter 1 to satisfy the initial curiosity of the examiner. This section should refer to sections in chapter 2 and 3 where the methodology is justified and described.

So this section first describes the methodology in general terms (including a brief, one or two paragraph description of statistical processes, for example, of regression). Then the section could refer to sections in chapter 2 where methodology is discussed, and possibly justify the chosen methodology based upon the purpose of the research, and justify not using other techniques. For example, the choice of a mail survey rather than a telephone survey or case studies should be justified. Alternatively and preferably, these justifications for the methodology used could be left until the review of previous research in chapter 2 and the start of chapter 3. Details of the methodology such the sampling frame and the size of the sample are provided in chapter 3 and not in section 1.4.

In summary, this section merely helps to provide an overview of the thesis, and can be perfunctory - two pages would be a maximum length.

1.5 Outline of this report

Each chapter is briefly described in this section.(Incidentally, the candidate must use either `report' or `thesis' consistently.)

1.6 Definitions

Definitions adopted by researchers are often not uniform, so key and controversial terms are defined to establish positions taken in the PhD research. (The previous sentence could be used to begin this section). The term being defined should be in italics or in bold, and the format for presenting each of the definitions should be standard. Definitions should match the underlying assumptions of the research and candidates may need to justify some of their definitions. Thus candidates should try to use definitions of authorities wherever possible, so that the results of the PhD research can be fitted into the body of literature and so that the thesis can withstand attacks by examiners with trivial personal preferences; for example, Emory and Cooper (1991) could be used as a standard for research procedures and terms - their definitions of terms such as `construct', `research question', `hypothesis' and `operational definition' are assumed for this paper.

1.7 Delimitations of scope and key assumptions

This section `builds a fence' around the research findings that are additional to the limitations and key assumptions established in the previous section about definitions. For example, the explicit boundaries of the research problem described in section 1.2 above should be noted again in this section and other, implicit boundaries should be clearly expressed. Other delimitations could be

the industries chosen, the locations chosen, environmental factors, and variables that could not be controlled. In effect, the `population' about which findings are to be made, is outlined here. In most theses, other limitations caused specifically by the methodological methods chosen are placed in chapter 3 rather than in this section.

In this section, the researcher is trying to forestall examiners' criticisms, so justifications for these delimitations must be provided in the section. It would be wise not to emphasise that `time' and/or `resources' were major influences on these delimitations of the research - an examiner may think that the candidate should have chosen a research project that was more appropriate for these obvious limitations of any research. For example, if the population is restricted to one state rather than a nation, perhaps differences between states may be said to have caused just one state to be selected. No claims for significance beyond these delimitations will be made.

Incidentally, `delimitations' are sometimes called `limitations' in PhD theses. Strictly speaking, limitations are beyond the researcher's control while delimitations are within his or her control. The first term is common in US theses and is suggested here as referring to the planned, justified scope of the study beyond which generalisation of the results was not intended.

Some candidates might like to describe the unit of analysis here, for example, firm or manager. Whether it is here or in chapter 3 is not important, just as long as it is identified and justified in the thesis.

1.8 Conclusion

The final paragraph of each chapter usually summarises the key achievements of the chapter. So the conclusion of chapter 1 should read something like:

- This chapter laid the foundations for the report. It introduced the research problem and research questions and hypotheses. Then the research was justified, definitions were presented, the methodology was briefly described and justified, the report was outlined, and the limitations were given. On these foundations, the report can proceed with a detailed description of the research.

2 Literature review

The second chapter aims to build a *theoretical foundation* upon which the research is based by reviewing the relevant literature to identify research issues which are worth researching because they are controversial and have not been answered by previous researchers. That is, the literature review is *not an end in itself*, but is a *means to the end* of identifying the worthy research issues which will be listed in the chapter's conclusion and were briefly introduced to the examiner in section 1.2. Thus some candidates may commendably prefer to call this chapter `Research issues' rather than `Literature review'. This chapter is about the extant literature, so the candidates' own ideas or opinions have no place in this chapter, except where they are used to structure the treatment of the literature and clearly supported by authorities, evidence or logic.

The survey of the literature in a PhD thesis should not concentrate only on the area of the research problem described in section 1.2, but also show links between the research problem and the wider body of knowledge. That is, the literature review should include the immediate discipline/field of the research problem (for example, employee motivation or customer service) and also demonstrate a familiarity with its parent discipline/field (for example, employee psychology or services marketing). Phillips and Pugh (1987) descriptively name these disciplines as the background and focus theories, respectively.

As noted earlier, the immediate discipline/field of the research problem should preferably relate to one academic discipline from which examiners will be selected, but there may be more than one parent discipline/field; for example, a thesis examining the immediate discipline/field of marketing orientation might discuss two parent disciplines/fields of marketing theory and strategic management. In other words, the literature review of a PhD thesis tends to extend further beyond the boundaries of the research problem than it does in most other types of research. Nevertheless, the literature review should be focussed and should not contain disciplines that are not directly relevant to the immediate discipline/field - these indirectly associated disciplines should be relegated to section 5.4 of the thesis as areas for which the research has implications. In other words, only parent disciplines/fields are involved, not uncles, aunts, or other relatives.

The relationship between the immediate discipline/field and the parent discipline/field is shown in figure 3.

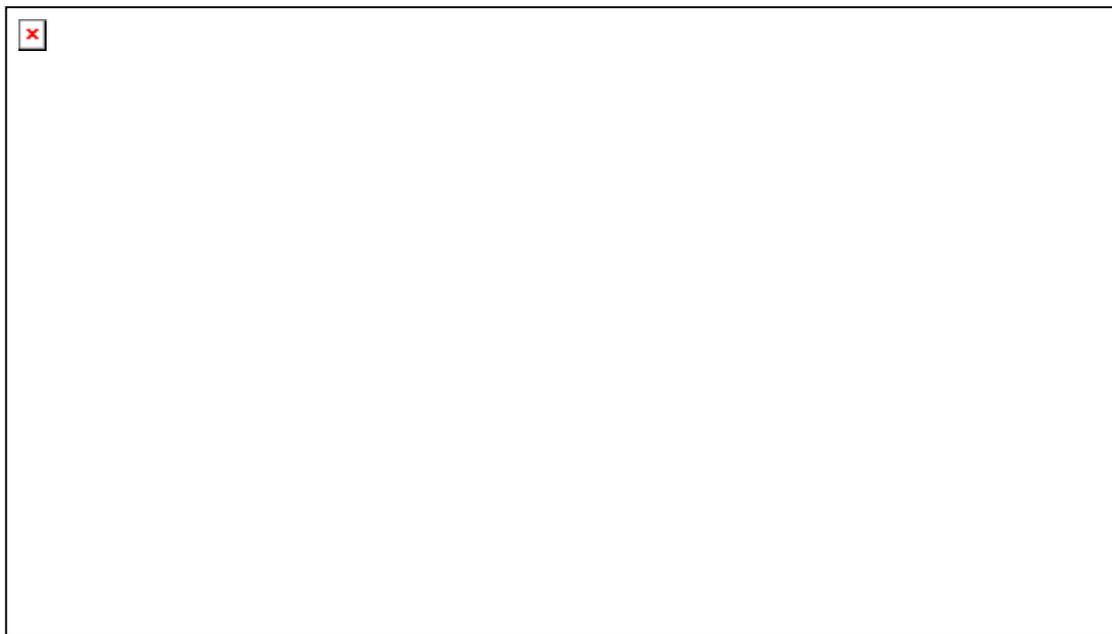


Figure 3 Relationship between the research problem and research questions or hypotheses

In figure 3, note that some boundaries of the research problem are made explicit in section 1.2 and others are made explicit in section 1.7; this difference is shown by some but not all of the line around the boundaries of the research problem in the figure being the same as the line around the research problem area. All boundaries of the research problem should have been justified in section 1.7.

Models. Some judgement may be required to balance the need to focus on the research problem and its immediate discipline/field and the need for a PhD thesis to show familiarity with the literature of the parent discipline/field. One way of balancing these two needs is to develop 'mind maps' such as a new classification model of the body of knowledge showing how concepts can be grouped or clustered together according to schools of thought or themes, without necessarily considering relationships between groups (figure 3 is an example). These concepts could be the section headings in the outline of the chapter which should precede the writing of the chapter (Zuber-Skerritt & Knight 1986). The new classification model will begin to show that the candidate's literature survey is constructively analytical rather than merely descriptive, for the rigour in a thesis should be predominantly at the upper levels of Bloom and Krathowl's

(1956) six-level hierarchy of educational objectives. Levels 1, 2 and 3 are mere knowledge, comprehension and application which every undergraduate should display. Levels 4, 5 and 6 are analysis, synthesis and evaluation - the higher-order skills which academic examiners consider a postgraduate research student should develop (Easterby-Smith et al. 1991). Presenting this analytical classification model in a figure near the beginning of chapter 2 will help the examiners follow the sequence of the chapter. Referring briefly to the figure as each new group of concepts is begun to be discussed, will help the examiner follow the intellectual journey of the chapter. In other words, the literature review is not a string of pointless, isolated summaries of the writings of others along the lines of Jones said...Smith said..Green said. The links between each writer and others must be brought out, and the links between each writer and the research problem should be clear. What the candidate says about a writer is more important than a description of what a writer says (Leedy 1993), and this emphasis is helped by using a bracketed reference like '(Leedy 1993)' in the first part of this sentence, rather than leading with the writer by saying 'Leedy (1993) says...'

After the classification model of the parent discipline/field is developed, the immediate discipline/field of the research problem can be explored to unearth the research questions or hypotheses; these should appear to 'grow' out of the discussion as gaps in the body of knowledge are discovered. A second, more analytical model of core constructs and their relationships based on this analysis of the immediate discipline/field, is also highly desirable. This analytical model will usually explicitly consider relationships between concepts, and so there will be arrows between the groups of concepts (figure 1 is an example). Sekaran (1992, chapter 3) discusses this model building procedure for quantitative research. These analytical models are a very important part of chapter 2, for they are the theoretical framework from which the propositions or research questions flow at the end of the chapter. Showing appropriate section and subsection numbers on these models (like 2.1, 2.2 and so on) will help referencing of them in the body of the report.

Incidentally, having numbers in the headings of each section and subsections of the thesis, as shown in table 1, will also help to make the large thesis appear organised and facilitate cross-referencing between sections and subsections. However, some supervisors may prefer a candidate to use headings without numbers, because articles in journals do not have headings with numbers. But articles are far shorter than theses, and so I prefer to include an explicit skeleton in the form of numbered sections and subsections to carry the extra weight of a thesis.

In brief, chapter 2 reviews the parent and immediate disciplines/fields of the research problem, with the aims of charting the body of knowledge with a summary model or two, showing where the research problem fits into that body of knowledge and then identifying research questions or hypotheses. These will focus the discussion of later chapters on directions where further research is required to answer the research problem, that is, having sections in chapter 3 and 4 explicitly related to the hypotheses or research questions facilitates the 'seamless' characteristic of an effective thesis.

Of course, each candidate will write chapter 2 differently because it involves so much personal creativity and understanding and so the chapter's structure may end up being different from that suggested in these notes. Nevertheless, two examples of chapter 2 based on the structure might be useful for beginning PhD candidates. Note how skilfully the candidates have linked their reviews of the parent and immediate disciplines/fields.

The first example of how to structure chapter 2 is provided in a PhD thesis which had a research problem about inward technology licensing. Chapter 2 began by developing a definition of inward technology licensing, and then reviewed the parent discipline/field of new product development. In a chronological discussion of major researchers, the review showed a familiarity with major conceptual issues in the parent discipline/field of new product development such as:

approaches to new product development which are alternatives to inward technology licensing, the importance of new product development, its riskiness, and its stages with their influencing factors. The review acknowledged disagreements between authorities without developing hypotheses, and established that inward technology licensing was an interesting part of the parent discipline/field to research, summarised in a table which compared inward technology licensing with some other methods of new product development on three criteria, using a high-medium-low scale. After fifteen pages of reviewing the parent discipline/field, the chapter addressed the immediate discipline/field of inwards technology licensing by reviewing literature in four groups of influencing factors, summarised in a classification model. As sections of the chapter considered each of these groups, researchers were compared with each other and some hypotheses were developed where controversy or methodological weaknesses existed or research 'gaps' in possibly interesting areas were identified. Particular concepts and the hypothesised directions of relationships between them were summarised in a detailed analytical model which grew out of the earlier classification model used to structure the literature review.

The second example of chapter 2's structure is from a thesis with a research problem about the marketing of superannuation services. Chapter 2 first demonstrated a familiarity with the parent discipline/field by tracing the historical development of the term 'service' so as to develop a definition of the term, but this survey became too big for chapter 2, and so it was placed in an appendix and the main points summarised in section 2.2 of chapter 2 in words and a classification model with three major groups, each having four sub-groups. The research problem's immediate discipline/field was then identified as falling into one of the sub-groups of the parent discipline/field, its importance confirmed, and hypotheses worthy of further research unearthed as the chapter progressed through the immediate discipline/field's own classification model and developed an analytical model. (Incidentally, some examiners may think too many appendices indicate the candidate cannot handle data and information efficiently, so do not expect examiners to read appendices to pass the thesis. They should be used only to prove that procedures or secondary analyses have been carried out.)

Details of chapter 2. Having established the overall processes of chapter 2, this discussion can now turn to more detailed considerations. Each piece of literature should be discussed *succinctly* within the chapter in terms of:

- topics covered, including the year, the industry, the country and/or region, and the subjects in the research (for example, MDs or middle managers),
- survey and statistical methodologies used,
- findings,
- limitations and problems of the research, for example, was the data collection or its analysis appropriate? and
- contribution to the body of knowledge, that is, how it compares and contrast with the positions developed by other researchers.

Providing a concise description of the research topics and methodologies underlying findings reached by writers will provide a basis for the candidate's view of the value of their findings to the body of knowledge, will remind the examiner of the research involved, and will help the candidate to carefully chart the boundaries of the body of knowledge. (Incidentally, it is courteous to reference as many publications as possible of likely examiners.)

Useful guides to how contributions to a body of knowledge can be assessed and clustered into

groups for classification and analytical models are many articles in each issue of *The Academy of Management Review*, the literature review parts of articles in the initial overview section of major articles in *The Academy of Management Journal* and other prestigious academic journals, and the chairperson's summing up of various papers presented at a conference. Heide (1994) provides an example of a very analytical treatment of two parent disciplines/fields and one immediate discipline/field, and Leedy (1993, pp. 88-95) provides a thorough guide to collecting sources and writing a literature review. Finally, Cooper (1989) discusses sources of literature and suggests that keywords and databases be identified in the thesis to improve the validity and reliability of a literature review.

If a quotation from a writer is being placed in the thesis, the quotation should be preceded by a brief description of what the candidate perceives the writer is saying. For example, the indirect description preceding a quotation might be: 'Zuber-Skerritt and Knight (1986, p. 93) list three benefits of having a research problem to guide research activities:' Such indirect descriptions preceding quotations demonstrate that the candidate understands the importance of the quotation and that his or her own ideas are in control of the shape of the review of the literature. Moreover, quotations should not be too long, unless they are especially valuable; the candidate is expected to precis long slabs of material in the literature, rather than quote them - after all, the candidate is supposed to be writing the thesis.

References in chapter 2 should include some old, relevant references to show that the candidate is aware of the development of the research area, but the chapter must also include recent writings - having only old references generally indicates a worn-out research problem. Old references that have made suggestions which have not been subsequently researched might be worth detailed discussion, but why have the suggestions not been researched in the past?

Exploratory research and research questions. If the PhD research is exploratory and uses a qualitative research procedure such as case studies or action research, then the literature review in chapter 2 will unearth *research questions* that will be answered in the research of later chapters. (Essentially, exploratory research is qualitative and asks 'what are the variables involved?'; in contrast, explanatory research is quantitative and asks 'what are the precise relationships between variables?' Easterby-Smith et al. (1991) distinguish between qualitative and quantitative methodologies in management research, in detail.) Research questions ask about 'what', 'who' and 'where', for example, and so are not answered with a 'yes' or a 'no', but with a description or discussion. For example, a research question might be stated as:

- How are conflicts between owners and managers which are resolved in the board of directors of a big business, resolved in a small professional practice without a board of directors?

'Pure' exploratory research or induction which does not use research questions developed in chapter 2 is not appropriate for PhD research (Phillips & Pugh 1987; Perry & Coote 1994). Nevertheless, exploratory research questions should supplement and not displace the subjects' own meanings and interpretations during the *qualitative research* methodologies often used in exploratory research. That is, they provide an indication of areas of interest but should not be the only areas discussed during an interview. For example, an interview should begin with trying to discover the interviewee's own meanings and subjective understandings, and the research questions should only be raised as probes towards the end of the interview if their topics have not been discussed in the earlier unstructured discussion (Perry & Coote 1994; Patton 1992). As noted earlier, the first person may be used in chapter 3 of exploratory research theses when describing what the researcher actually did, similarly, many quotations from interviewees should be used in chapter 4 to illustrate findings.

Explanatory research and hypotheses. On the other hand, if the research is *explanatory* and so refers to queries about 'how' or 'why' and uses some quantitative research methodology often used in explanatory research such as regression analysis of survey data, then chapter 2 unearths testable hypotheses that can be answered with a 'yes' or 'no', or with a precise answer to questions about 'how many' or 'what proportion' (Emory & Cooper 1991). That is, research questions are open and require words as data to answer, and hypotheses are closed and require numbers as data to solve. For example, a hypothesis might be presented as a question that can be answered 'yes' or 'no' through statistical testing of measured constructs such as:

- Does the number of successful telemarketing calls correlate with the level of specialisation of telemarketing representatives?

Each construct in the hypothesis (for example, 'specialisation of telemarketing representatives') must be capable of being measured; precisely how the instruments were designed to measure the constructs is described later in chapter 3. That is, operational definitions of the constructs developed for hypotheses are not divulged until chapter 3, that is, the statistical form of a hypothesis involving null and alternative hypotheses about means, distributions or correlation coefficients, for example, is not presented until chapters 3 and 4. Indeed, this distinction between hypotheses about constructs in chapter 2 and hypotheses about population statistics in chapter 3 can be confusing and several candidates prefer to refer to chapter 2's hypotheses as propositions and restrict the term hypothesis to the associated and similarly numbered statistical forms developed in chapter 3 after operational definitions have been developed, of constructs identified in chapter 2.

In some PhD research, there may be a mix of qualitative research questions and quantitative hypotheses, and a case study methodology can combine both in either exploratory and explanatory research (Yin 1989). Generally speaking, the total number of research questions and/or hypotheses should not exceed about four or five; if there are more, sufficient analysis may not be done on each within the space constraints of a PhD thesis. Whether research questions or hypotheses are used, they should be presented in the way that informed judges accept as being most likely. For example, the hypothesis that 'smoking causes cancer' is preferred to 'smoking does not cause cancer'. The transformation of the hypothesis into statistical null and alternate hypotheses is left until chapter 3.

The research questions or hypotheses developed during chapter 2 should be presented throughout the chapter as the literature survey unearths areas which require researching, that is, they should appear to 'grow out' of the review, even though the candidate may have decided on them long before while writing very early drafts of the chapter. When first presented at intervals through chapter 2, the research questions or hypotheses should be numbered and indented in bold or italics. The concluding section of chapter 2 should have a summary list of the research questions or hypotheses developed earlier in the chapter.

In brief, chapter 2 identifies and reviews the conceptual/theoretical dimension and the methodological dimension of the literature and discovers research questions or hypotheses that are worth researching in later chapters.

3 Methodology

Chapter 3 describes the major methodology used to collect the data which will be used to answer the hypotheses. In many theses, several methods may be used for 'increasingly authors and researchers who work in organisations and with managers argue that one should attempt to mix methods to some extent, because it provides more perspectives on the phenomena being studied' (Easterby-Smith 1991, p. 31) and the same position is recommended in PhD theses by Gable

(1994). But within the time and other resource constraints of a PhD thesis, I consider that there will usually be only one major methodology which suits the research problem and associated research gaps uncovered in chapter 2. Other methodologies would be used in a secondary role to help formulate research issues (for example, some interviews to help design a survey's questionnaire could be described in chapter 2 if they help in formulating hypotheses or in chapter 3 if they help in developing the operational definitions of constructs) or to slightly extend or generalise the findings of the main method (for example, some interviews to confirm an unexpected result which could be described in chapter 4 or 5). So chapter 3 usually centres on the major methodology of the PhD research, although the same considerations might be briefly mentioned when discussing any secondary methodologies.

Chapter 3 about data collection must be written so that another researcher can replicate the research, and is required whether a qualitative or quantitative research methodology is used (Yin 1989). Indeed, a qualitative PhD may contain even more details than quantitative one, for a qualitative researcher may influence subjects more - for example, how subjects were chosen, how they answered, and how notes and/or recordings were used. Moreover, the candidate should use 'I' when describing what he or she actually did in the field, to reflect an awareness that the researcher cannot be independent of the field data. Incidentally, I think that as rough rules of thumb, PhD research requires at least 350 respondents in a quantitative survey or at least 45 qualitative case studies.

The chapter should have separate sections to cover:

- justification for the methodology in terms of the research problem and the literature review, for example, a qualitative methodology requires a research problem involving people's constructions of meanings which have not previously been explored (Hassard 1990) - Yin (1989, p. 17) has a table which might help in writing about this; incidentally, recent theses are showing an awareness of the strengths and weaknesses of the positivist and phenomenological paradigms as a basis for discussing choice of methodology (Phillips & Pugh 1987, p. 55; Orlikowski & Baroudi 1991; Easterby-Smith et al. 1991, pp. 22-32; Patton 1992, pp. 1-63; Newman 1994, chapter 4; Perry & Coote 1994; Guba & Lincoln 1994); table 2 summarises these considerations;
- the *unit of analysis* and subjects or sources of data, for example, explicit reference to steps such as deciding the population, the sampling frame and the sample, and the sample size; for case study research, these are discussed in Perry & Coote (1994);
- instruments or procedures used to collect data, including how the dependent variable was measured, details of pilot studies and explicit concern about specific procedures used to handle internal and external validity (as in Yin 1989, p. 41; Parkhe 1993, p. 260-261 and - for qualitative research - Lincoln & Guba 1985, pp. 290-294); note that the boundaries of external validity were implicitly addressed in sections 1.2, 1.6 and 1.7;
- administration of instruments or procedures (for example, when, where and who, non-response bias (which is a very important issue and is discussed in Armstrong & Overton (1977)), response rates, dates and protocols of interviews (Yin 1989)), so that the research is reliable, that is, it could be repeated;
- *limitations* of the methodology if they were not explicitly discussed in section 1.7, for example, practical limitations on the sampling frame or size of questionnaire in survey research might be clarified and justified (for example, some types of respondents might have been missed because of their religious beliefs), and Parkhe (1993, p. 255) discusses some possible limitations of the case study methodology which should have been

addressed in a thesis;

- any special or unusual treatments of data before it was analysed (for example, special scoring of answers to a survey question);
- computer programs used to analyse the data, with justifications for their use (for example, why chisquare was used instead of a Wilcoxon test) - this may require a brief description of the type of data and some appropriate references where similar procedures had been used in similar circumstances; and
- ethical issues.

Table 2 Aspects of a unified thesis

Qualitative research	Quantitative research
Research problem: how? why?	Research problem: who (how many)? what (how much)?
Literature review: exploratory - what are the variables involved? constructs are messy research questions are developed	Literature review: explanatory - what are the relationships between the variables which have been previously identified and measured? hypotheses are developed
Paradigm: phenomological/interpretive	Paradigm: positivist
Methodology: for example, case study research or action research	Methodology: for example, survey or experiment

Chapter 3 describes the methodology adopted (for example, a mail survey and a particular need for achievement instrument), in a far more detailed way than in the introductory description of section 1.5. The operational definitions of constructs used in questionnaires or interviews to measure an hypothesised relationship will be described and justified, for example, how an interval scale was devised for the questionnaire. Note that some authorities consider that PhD research should rarely use a previously developed instrument in a new application without extensive justification - they would argue that an old instrument in a new application is merely Master's-level work and is not appropriate for PhD work. However, often parts of the PhD instrument could have been developed by authorities (for example, a need for achievement instrument), but those parts must still be justified through previous studies of reliability and validity and/or be piloted to the PhD candidate's requirements in order to assess their reliability and validity, and alternatives must be carefully considered and rejected. Any revisions to the authority's instrument must be identified and justified. Alternatively, multi-item measures could be developed for constructs that have been previously measured with a single item, to increase reliability and validity. It can be argued that an old instrument in a new application will be an original investigation, and so a new or partly-new instrument is not an absolute necessity for PhD research (Phillips, E. 1992, pers. comm.). Nevertheless, I recommend some qualitative pilot

studies before an old instrument is used - they will confirm its appropriateness and may suggest additional questions that help develop new ideas for the thesis, thus reducing the risk that an examiner will disapprove of the thesis.

In addition to the above, chapter 3 should show that other variables that might influence results were controlled in the research design (and so held at one or two set levels) or properly measured for later inclusion in statistical analyses (for example, as a variable in regression analysis). This point is a very important consideration for examiners.

The examiners can be assumed to know essentials of the methodology adopted, so very detailed descriptions are not required. However, candidates will have to provide enough detail to show the examiner that the candidate knows the body of knowledge about the methodology and its procedures. That is, examiners need to be assured that all critical procedures and processes have been followed. For example, a thesis using regression as the prime methodology should include details of the pilot study, handling of response bias and tests for assumptions of regression. A thesis using factor analysis would cover preliminary tests such as Bartlett's and scree tests and discuss core issues such as the sample size and method of rotation. A thesis using a survey would discuss the usual core steps of population, sampling frame, sample design, sample size and so on in order (Davis & Cosenza 1993, p. 221). To fully demonstrate competence in research procedures, the statistical forms of hypotheses could be explicitly developed and justified in a PhD thesis, even though such precision is often not required in far shorter journal articles describing similar research. Sekaran (1992, pp. 79-84) provides an introduction to how this hypothesis development is done. Note that a null and its alternative hypothesis could be either directional or not; an example of each type of null hypothesis is:

- The level of specialisation of telemarketing representatives will not increase the probability of successful telemarketing.
- The level of specialisation of telemarketing representatives will not influence the success of marketing.

A directional hypothesis will require different forms of statistical tests of significance than a non-directional hypothesis, for example, the use of a directional hypothesis allows a one-tailed test of significance.

In addition, candidates must show familiarity with controversies and positions taken by authorities. That is, candidates must show familiarity with the body of knowledge about the methodology, just as they did with the bodies of knowledge in chapter 2. Indeed, Phillips and Pugh (1987) equate the body of knowledge about the methodology with the body of knowledge about the background and focal theories of chapter 2, calling it the 'data theory'. An example of this familiarity for candidates using a qualitative methodology would be an awareness of how validity and reliability are viewed in qualitative research, in a discussion of how the ideas in Easterby-Smith et al. (1991, pp. 40-41) and Lincoln and Guba (1985, chapter 11) were used in the research. Familiarity with this body of knowledge can often be demonstrated as the methodology is justified and as research procedures are described and justified, rather than in a big section about the body of knowledge on its own. For example, providing details of a telephone survey is inadequate, for the advantages and disadvantages of other types of surveys must be discussed and the choice of a telephone survey justified (Davis & Cosenza 1993, p. 287). Another example would be to show awareness of the controversy about whether a likert scale is interval or merely ordinal (Newman 1994, pp. 153, 167) and justify adoption of interval scales by reference to authorities like a candidate who said:

A number of reasons account for this use of likert scales. First, these scales have been found to

communicate interval properties to the respondent, and therefore produce data that can be assumed to be intervally scaled (Madsen 1989; Schertzer & Kernan 1985). Second, in the marketing literature likert scales are almost always treated as interval scales (for example, Kohli 1989).

Yet another example would be to show awareness of the controversy about the number of points in a likert scale by referring to authorities' discussions of the issue, like Armstrong (1985, p. 105) and Newman (1994, p. 153)

The candidate must not only show that he or she knows the appropriate knowledge body of knowledge about procedures, but must also provide evidence that the procedures have been followed. For example, dates of interviews or survey mailings should be provided. Appendices to the thesis should contain copies of instruments used and instruments referred to, and some examples of computer printouts; however, well constructed tables of results in chapter 4 should be adequate for the reader to determine correctness of analysis, and so all computer printouts do not need to be in the appendices (although they should be kept by the candidate just in case the examiner asks for them). Note that appendices should contain all information to which an intensely interested reader needs to refer; a careful examiner should not be expected to go to a library or write to the candidate's university to check points.

The penultimate section of chapter 3 should cover ethical considerations of the research. Emory and Cooper (1991), Easterby-Smith et al. (1991), Patton (1992), Lincoln and Guba (1986) and Newman (1994, chapter 18) describe some issues which the candidate may consider addressing. A candidate may like to include in appendices the completed forms required for Australian Research Council (ARC) grant applications and reports - his or her university's Research Office will have copies of these.

In summary, writing chapter 3 is analogous to an accountant laying an 'audit trail' - the candidate should treat the examiner like an accountant treats an auditor, showing he or she knows and can justify the correct procedures and providing evidence that they have been followed.

4 Analysis of data

Chapter 4 presents patterns of results and analyses them for their relevance to the research questions or hypotheses. Frequent summary tables and figures of results are essential, so that readers can easily see patterns in the mass of data presented in this chapter. Tables of statistical data are presented in quantitative research and matrices are used in qualitative research (Miles & Huberman 1985).

This chapter should be clearly organised. The introduction has the normal link to the previous chapter, chapter objective and outline, but often also has basic, justified assumptions like significance levels used and whether one or two tailed tests were used; for example:

- Significance of test results is reported in the three ways suggested by Coolican (1990, p. 174), based on p the probability level:
 - 'significant': $0.05 > p < 0.01$;
 - 'highly significant': $0.01 > p < 0.001$; and
 - 'very highly significant': $0.001 > p$.

All probabilities reported are based on two-tailed tests as each comparison had two possible directions.

Note that some statisticians prefer to not accept the null hypothesis just because it is not rejected (because the type II error involved in acceptance is not known, although the Type I error involved in rejection is), hence the practical implications of a statistical test involving no significant difference between test statistics must be made explicit, and not confused with the statistical result - an example is shown below.

The introduction of chapter 4 may be different from introductions of other chapters because it refers to the following chapter - chapter 5 will discuss the findings of chapter 4 within the context of the literature. Without this warning, an examiner may wonder why some of the implications of the results are not drawn out in chapter 4. In my experience, chapter 4 should be restricted to presentation and analysis of the collected data, without drawing general conclusions or comparing results to those of other researchers which were discussed in chapter 2. That is, although chapter 4 contains references to the literature about methodologies, it should not contain references to other literature. If the chapter also includes references to other research, the more complete discussion of chapter 5 will be undesirably repetitive and confused.

After the introduction, descriptive data about the subjects is usually provided, for example, their gender or industry in survey research, or a brief description of case study organisations in case study research. This description helps to assure the examiner that the candidate has a 'good feel' for the data.

Then the data for each research question or hypothesis is usually presented, in the same order as they were presented in chapters 2 and 3 and will be in sections 5.2 and 5.3. Sensitivity analyses of findings to possible errors in data (for example, ordinal rather than assumed interval scales) should be included. If qualitative research is being done, an additional section should be provided for data which was collected that does not fit into the research question categories developed in the literature review of chapter 2.

Note that the chapter 4 structure suggested in the two paragraphs above does not include tests for response bias or tests of the assumptions of regression or similar statistical procedures. Some candidates may like to include them in chapter 4, but they could discuss them in chapter 3 for they refer primarily to the methodology rather than to the data analysis which will be directly used to test research questions or hypotheses.

In chapter 4, the data should not be merely presented and the examiner expected to analyse it. One way of ensuring adequate analysis is done by the candidate is to have numbers placed in brackets after some words have presented the analysis. For the same reason, test statistics, degrees of freedom or sample size (to allow the examiner to check figures in tables, if he or she wishes) and p values should be placed in brackets after their meaning has been explained in words that show the candidate knows what they mean. For example:

- Question 9 explored attitudes to product quality and respondent's answers are summarised in table 4.6. Most respondents (59.2 percent) agreed that the product quality was important, but a sizeable minority (27.8 percent) had no view about product quality - a somewhat surprising finding which will also be discussed within the context of the literature in section 5.4.3... A t-test was used to discern the relationship between attitudes to product quality and price (section 4.9), because both were measured with an interval scale. No significant difference between the means of attitudes to the two variables was found ($t = 1.56$, $dof = 23, 25$; $p = 0.35$). A practical implication of this finding is that the shoppers considered product quality and price separately.

All patterns of results in chapter 4 must be supported by the evidence unearthed by the procedures described in chapter 3. That is, a reader should be able to check findings by looking

at tables or figures. So each table or figure should be referred to in the body of the chapter, with the reason for its presence. As the example in the previous paragraph showed, a topic should be introduced in words and the main findings presented; then the table or figure referred to and evidence from it should be introduced in one or two sentences; and then the highlights of the table or figure should be discussed more fully, together with a brief description of what the reader will look for in the table or figure when he or she turns to it. In other words, for a reader should not be expected to develop the links between the words in chapter 4 and a table or figure by himself or herself. Indeed, the reader should be able to grasp the meaning by reading either the words or the figures without reference to the other.

When figures are used, the table of data used to construct the figure should be in an appendix. All tables and figures should have a number and title at the top and their source at the bottom, for example, 'Source: analysis of survey data'. If there no source is listed, the examiner will assume the researcher's mind is the source, but a listing such as 'Source: developed for this research from chapter 2' might reinforce the originality of the candidate's work.

5 Conclusions and implications

5.1 Introduction

Chapter 5 is the most important chapter of the thesis, for after ensuring the methodology and research processes are sound, the examiners will spend much time studying chapter 5. But the chapter is often marked by fatigue and Phillips and Pugh (1987, p. 56) note that 'in our experience its inadequacy is the single most common reason for requiring students to resubmit their theses after first presentation'. So the PhD candidate must discover springs of interest and creativity to make his or her chapter 5 worthy of the rest of the thesis, and make it clearly show that the PhD research does make a distinct contribution to the body of knowledge. Thus the research's contributions to knowledge should be the explicit theme of sections 5.2 to 5.4.

Actually, identifying what is a distinct contribution to knowledge can bewilder some candidates, as Phillips (1992, p. 128) found in a survey of Australian academics and candidates. Nevertheless, making a distinct contribution to knowledge 'would not go beyond the goal of stretching the body of knowledge slightly' by using a relatively new methodology in a field, using a methodology in a country where it has not been used before, or making a synthesis or interpretation that has not been made before. So this task should not be too difficult if the research and the preceding chapters have been carefully designed and executed as explained in these notes.

Do remember that the introduction to section 5.1 is longer than the introduction of other chapters, as the section above titled 'Links between chapters' noted.

5.2 Conclusions about research questions or hypotheses

Findings for each research question or hypothesis are summarised from chapter 4 and explained *within the context of this and prior research examined in chapter 2*; for example, with which of the researchers discussed in chapter 2 does this research agree or disagree, and why? For each research question/hypothesis, the agreement or disagreement of the results of a numbered section in chapter 4 with the literature should be made clear and the reason for disagreement thought through. For example, the disagreement might be because some previous research was done in Asia and this research was done in Australia. Disagreement suggests the PhD research is making a contribution to knowledge and this contribution of the research should be clearly developed. Each research question or hypothesis would have its own subsection, that is, 5.2.1, 5.2.2 and so on, and each section will have a reference to the appropriate section of chapter 4 so that the

examiner can clearly see that the conclusions come from the findings in chapter 4; of course, each section will also have many references to the writers discussed in chapter 2.

A brief example of one of these discussions is:

- The final set of factors in the initial conceptual framework of this research illustrated in figure 2.10 was the strategic objectives of the firm. The interaction between entry mode choice and strategic objectives has attracted considerable attention in the literature (Jones 1991; Anderson & Gatignon 1986; Hwang 1988; Hill et al, 1990). For example, Minor, Wu and Choi (1991) argue that entry mode choice is based on strategic objectives when considered in tandem with ...

This research had varied results about these factors. Section 4.3.5's findings were that innovation learning and whether firms consider a global strategy, are unimportant. These findings are inconsistent with the literature. The reasons for this inconsistency appear to be the small size of the firms in this survey and their industry. Jones (1991) surveyed firms with turnovers above \$1 million in the pharmaceutical industry, and Hwang (1988) surveyed... In contrast, Australian small jewellers are... Presumably, they are more entrepreneurial and have less at stake than larger firms and ...

5.3 Conclusions about the research problem

Based on section 5.2, implications of the research for furthering understanding of the research problem are explored. The section goes beyond the mere number-crunching of chapter 4 and *incorporates qualitative findings about the research problem developed during the research*, including those insights discovered during interviews in qualitative research which had never even been considered in the literature reviewed in chapter 2. Again the contribution of the research to the body of knowledge should be clearly developed.

You are warned that examiners are careful that conclusions are based on findings alone, and will dispute conclusions not clearly based on the research results. That is, there is a difference between the conclusions of the research findings in sections 5.2 and 5.3 and implications drawn from them later in sections 5.4 and 5.5. For example, if a qualitative methodology is used with limited claims for generalisability, the conclusions must refer specifically to the people interviewed in the past - 'the Hong Kong managers placed small value on advertising' rather than 'Hong Kong managers place small value on price'.

This section may sometimes be quite small if the hypotheses or research questions dealt with in the previous sections comprehensively cover the area of the research problem. Nevertheless, the section is usually worth including for it provides a conclusion to the whole research effort. Moreover, I suggest that this section conclude with a summary listing of the contributions of the research together with justifications for calling them 'contributions'. As noted earlier, the examiner is looking for these and it makes his or her task easier if the candidate explicitly lists them after introducing them in earlier parts of this chapter.

In a report of non-PhD research such as a journal article or a high-level consulting report, this section would be the 'conclusion' of the report, but a PhD thesis must also discuss parent and other disciplines (Nightingale 1984), as outlined in the next section.

5.4 Implications for theory

The full picture of the research's findings within the body of knowledge is provided in section 5.4, that is, it provides the theoretical implications of the research. This section aims to convince examiners that the PhD research has not only made a significant contribution to knowledge in its

immediate discipline/field as outlined in sections 5.2 and 5.3, but also has implications for the wider body of knowledge, including the parent disciplines/fields but also among other related disciplines that were not even mentioned among the few parent disciplines/fields of chapter 2; the broad range of disciplines mentioned in section 1.1 might suggest some of these related disciplines. For example, in a PhD thesis with a research problem involving customer service, section 5.4 might refer not only to the parent disciplines/fields of services marketing but also to consumer behaviour, personality characteristics and psychological motivations.

If one or more of the models developed in chapter 2 have to be modified because of the research findings, then the modified model should be developed in section 5.3 or 5.4, with the modifications clearly marked in bold on the figure. Indeed, development of a modified model of the classification or analytical models developed in chapter 2 is an excellent summary of how the research has added to the body of knowledge, and is strongly recommended.

In brief, sections 5.3 and 5.4 are the 'conclusion' to the whole PhD (Phillips and Pugh 1987) and are the PhD candidate's complete answer to the research problem.

5.5 Implications for policy and practice

Practical implications for private sector managers are covered in section 5.5.1 and implications for public sector analysts and managers are covered in section 5.5.2. Need for training or new government policies are often raised here. Examiners may be impressed if this section develops a checklist of procedures for managers which incorporates the research findings, and this may help to fulfil justification iv of section 1.3.

5.6 Limitations

Section 1.7 has previously outlined major limitations of the research that were a deliberate part of the research (for example, industry boundaries to the research problem). This section discusses other limitations that became apparent during the progress of the research, for example, questionnaire results may indicate that age of respondents is a limitation. Often, this section is unnecessary.

5.7 Implications for further research

This final section is written to help PhD and other researchers in selection and design of future research. Further research could refer to both topics and to methodologies or to both. A case study methodology thesis should mention the need for positivist research to generalise the findings. Removing some limitations mentioned in section 1.7 usually provides opportunities for further research, for example, different regions or countries, different industries and different levels of management.

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