

5

Planning a Postgraduate Research Program

Read this chapter if you would like to have the following questions addressed:

- *Why is it necessary to plan a postgraduate research program?*
- *Which program elements and timing issues need to be considered in planning?*
- *What can go wrong if a program is unplanned or poorly planned?*

5.1 Overview

If one had to encapsulate, from personal supervision experience, the single, largest problem in postgraduate research planning then it would be that students simply do not believe in the plans that they put forward. All the other planning failures, during the course of a postgraduate research program, tend to stem from this fundamental flaw.

A postgraduate research project, like any other project, needs some degree of planning if it is to be conducted in a systematic manner. An experienced researcher may be able to formulate and retain a preliminary plan in his/her own mind but then the postgraduate research student is generally not an experienced researcher. Hence, the formal planning of a research program needs to be undertaken by research students prior to the commencement of their research work. The common problem, however, is that many research students do not perceive (or genuinely believe in) the need for a project plan and, often, the plan becomes little more than a document prepared to satisfy a supervisor or university research committee. What then eventuates can be little more than a half-hearted attempt to follow a half-hearted project plan.

The purpose of a project plan is to include, sequence, and time-estimate a number of elements that are important to the systematic conduct of an investigation. Every postgraduate research program, regardless of discipline, and regardless of whether it is conducted at Master's (minor thesis) level or Doctoral (major thesis) level, has some common elements. These may include:

- (i) Acquiring a detailed understanding of the problem to be investigated
- (ii) Conducting a detailed review of literature in the field
- (iii) Ascertaining, from the review, the seminal authors in the field; other cited and non-cited authors in the field, and the key journals and conferences in the field

- (iv) Determining a course of action for the research program, based upon findings from the review, and based upon interaction with peers and supervisors
- (v) Developing, in detail, a strategy or methodology which is to be presented as the core of the research
- (vi) Devising a systematic and detailed study, or series of experiments, which will test the boundaries of the proposed methodology or strategy and compare it with other work in the field
- (vii) Conducting the experimentation or study
- (viii) Analysing the results of the study and comparing those results with other researchers in the field
- (ix) Presenting the findings of the research program to peers in the field, at an international level, for review
- (x) Analysing the peer reviews and, possibly, modifying the methodology, studies and experimentation to satisfy peer requirements
- (xi) Documenting the research program through a dissertation.

A number of the above elements may need to be performed in parallel and some, such as the literature review and dissertation preparation, may be ongoing throughout the research program. The reality, unfortunately, is that many research students, in their enthusiasm to move into the core of the program, commence their research with item (v), hastily move on to item (vii), and then spend the remainder of the program time endeavouring to patch and amend the resulting work.

The key factor here is that the external reviewers for the program may have far more interest in the research methodology than in the core of the research or the findings themselves. If, however, the

research student places undue emphasis on the core rather than the method, then it may well be that the basis of the core research is fundamentally flawed, or the testing procedures are fundamentally flawed, or even that the entire research program is, coincidentally, little more than a copy of studies that have been previously performed by other research groups.

In practice, many research students are under pressure to produce the core research portion of the postgraduate program and to give the other aspects secondary treatment. This often occurs in collaborative research programs where industry partners are (quite justifiably, from their perspective) more concerned with the commercialisation of an end-product than they are in the outcomes of a student's research program. The same problem can occur when supervisors are under pressure to publish research findings within a limited time-frame.

Accepting that, in the practical environment, a research student may be required make an immediate launch into developmental work, the key point here is that the student must also have a good understanding of the other elements of the program that need to be considered in order to achieve a good research outcome. In some cases, the pressures of collaborative research may mean that a student will need to spend considerably more time on a project than a pure researcher unencumbered by commercial issues. However, regardless of the environment, the research student must learn to plan and to adapt plans according to changing needs if he/she is to be successful.

Planning is not only critical to ensuring the systematic conduct of a research program but it is also critical to ensuring that resources can be input to the program at the appropriate times. Many university departments cannot simply purchase or lease apparatus on a research student's whim. Sometimes, costly studies or experiments need to be planned months in advance. Sometimes, studies or experiments are rejected by a department on grounds of cost, ethical issues, etc. In these instances, the research program needs to be modified, and the amended plans developed and assessed in terms of their impact upon the research. In essence, these issues are no

different to those faced by any professionals working on long-term projects in construction, engineering, etc. The objective in research, as in these other areas, is to minimise delays arising from unplanned requests; to avoid surprises, and to avoid the collapse of a research program in the event that studies or experiments cannot be conducted in a particular way because of external issues. In this chapter, some of these basic issues of research planning are considered.

5.2 Preliminary Program Plan

Many research programs, particularly those with a medical, scientific or engineering basis, regardless of their specific details, have a number of common elements that need to be included in order to demonstrate a systematic approach to the process of discovery. The key factor here is derived from emphasis on the term "systematic" - professional research is a *discipline* not just a means of self-fulfilment. It is therefore important to remember that postgraduate research is not about curiosity- or interest-driven meanderings but, rather, the methodical approach by which accurate portrayals of reality can be derived, free from personal bias or opinion. This requires a number of basic procedural steps and, in order to ensure that these are methodically undertaken, a plan is required.

The basic elements, typical to many research programs, were listed in Section 5.1. If one accepts these as being the major elements for a given research program, then the next step is to develop a preliminary plan based upon such elements. The first step is to consider how much time is available to undertake the research program and the thesis development. Normally, the preliminary research plan is developed using the month as the basic unit, because it is often difficult to resolve the initial ideas more accurately. The preliminary program plan needs to consider the outcomes of the program in its entirety and, although elements within the plan may change, in terms of timing, the overall plan should remain intact. As an example, consider a preliminary program plan for a Doctoral research program to be undertaken over three years. This is shown in Figure 5.1.

The basic program plan in the example includes thesis milestones, on the assumption that thesis preparation is an ongoing and integral part of the program, rather than a retrospective essay on the conducted work. The example also shows a thesis divided into seven basic chapters and shows how the development of these chapters, at draft level, integrates with the conduct of the research program.

Once the program plan has been established, it is imperative that a research student works towards ensuring that the broad plan and milestones are achieved. This means that there may be periods when the student's workload has to increase dramatically in order to meet the self-set deadlines, even though, in their preliminary form, they may only have been estimates.

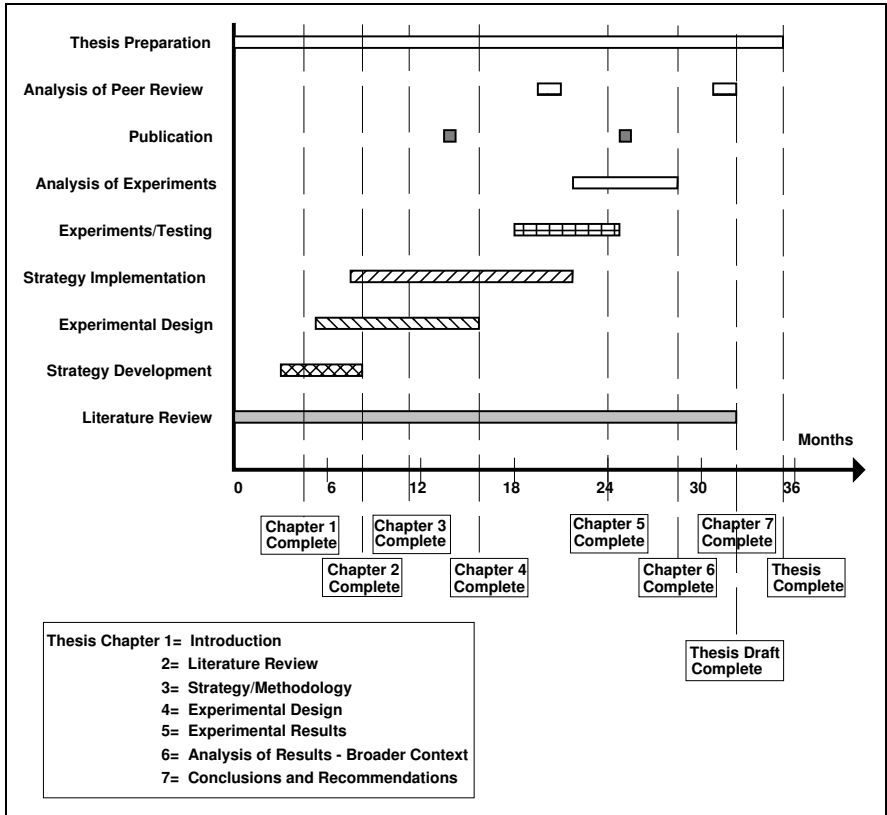


Figure 5.1 - Example Preliminary Program Plan for Three-Year Doctoral Program

Project management experience tends to suggest that if people endeavour to treat original plans as immovable, and work towards achieving the deadlines set therein, then, on average, the likelihood of the overall plan being realised on time is greater than if plans are constantly revised. Some research students have a tendency not to work towards self-imposed deadlines - however, this is one of the basic self-disciplinary principles that has to be mastered during the course of the postgraduate research program and it is critical to ensuring that time is not unnecessarily wasted.

The other side of the project planning equation pertains to the quality of the conducted research - is it more important to fulfil an arbitrary schedule (originally derived in the absence of a detailed understanding of the required work) or to have an open-ended commitment to continue until an acceptable level of quality is achieved?

The simplistic answer to this question is naturally that, when work is conducted in an academic environment, and the primary objective is a pursuit of excellence, then quality is of paramount importance. However, it is important to understand that quality must not become a convenient excuse for avoiding heavy workloads or for unnecessarily drawing out the length of a program. All too often, research students confuse a pursuit of quality and knowledge with poor project planning or bad work ethics.

Consider that, in many large-scale civil and industrial projects, in which project management techniques are applied, the number of unknown event times and unknown paths, at the commencement of a project, is far larger than that in any individual research program. And, yet, large projects can generally be completed to within a reasonably small timing margin of the original estimates in the preliminary program plans. Why? Because disciplined project managers are generally reluctant to relax scheduled event times just because difficulties arise - the solution is often to place increased pressure on those involved in the activities, or to add resources (e.g., labour) until each event is completed on time. Project quality does not necessarily need to suffer from the requirement to meet deadlines.

From a research student's perspective, hard deadlines are difficult to accept - why? Again, a fundamental problem tends to stem from the fact that research students often do not believe in their own project plans. Secondly, many students favour a curiosity-driven or interest-driven approach rather than the self-disciplined approach of project management. The problem with this is that curiosity- and interest-driven research, when conducted without research experience, tends to be performed at the expense of the more tedious elements of the research program - that is, literature reviews, experimental design, and so on. The end result can be a drawn-out program of research which, rather than being a "quality" product, has fundamental weaknesses in process. Hence, the value of the preliminary plan, and a firm commitment (on the part of the student) to that plan are immensely important to the successful outcome of a research program.

5.3 Planning for Literature Review

An impartial review and assessment of the work performed by peers is important in creating an impetus for the research work that is conducted by the research student. In general, research students need to

- Justify their course of action
- Compare their results
- Differentiate their research

via the published findings of other researchers in their field. Given that literature is continuously updated, it should not be surprising to note that the literature review is an ongoing activity in a postgraduate research program that only terminates when the final thesis is ready for assessment.

More specifically, there are a number of objectives in conducting a literature review. These are to:

- (i) Determine the principal (landmark) researchers and research organisations in the particular field
- (ii) Determine the seminal (highly cited) authors in the field of study
- (iii) Determine the key forums in which principal researchers present their work in a particular field - that is, the preferred refereed journals, conference transactions, etc.
- (iv) Study the works of other research groups and compare and contrast positive and negative attributes
- (v) Consider the recommendations of other researchers as the basis of the methodologies put forward in a postgraduate research program

- (vi) Compare and contrast the findings in the current postgraduate research program with that of other researchers in the field.

The literature review is generally one of the most significant aspects of any postgraduate research program and it is also one of the more tedious aspects. With these points in mind, it is important to incorporate the review into the research plan in order to ensure that:

- A comprehensive review is achieved
- The tediousness of the review process does not become an intractable problem that leads to demoralisation.

In order to achieve such outcomes, the key factors are:

- An aggressive attack on the literature review process in the early months of the research program (while enthusiasm is high and development / experimental work is relatively low)
- A progressive scaling down (but not cessation) of the review after the principal researchers, seminal authors and key publication forums have been identified in the field of interest
- A steady-state, background monitoring of ongoing developments in the field by reviewing new issues of journals or new conference transactions.

A literature review can be time-consuming for beginners in the research field. The mechanics of finding papers of interest from a vast field of journals, conference proceedings and trade publications can often be quite complex and, without a substantial (full-time) effort in the early stages of the program, enthusiasm for literature reviews tends to wane rapidly. Hence, an aggressive (full-time) attack on the review is essential if advances are to be made within a reasonable time-frame. Despite the advent of computer-based journal storage

and retrieval, the initial stages of a literature review process can still involve physical relocation to a range of libraries so that obscure journals can be studied or traced. This level of information sifting requires a significant amount of time. It is also important to note that many libraries do not catalogue or store older publications on computer-based media and, hence, the more traditional forms of manual search may still be important.

In planning a research program, a good rule-of-thumb is to allow at least one day to visit each local (i.e., within the same city or state) university library which holds papers in the broad field of interest (e.g., medicine, engineering, etc.). It is particularly important for student to browse through a range of journal holdings in each library, rather than to artificially confine their reading to computer-based abstracts. Sometimes, even research papers that are only peripherally relevant, can have references which turn out to be significant to the current research program. It also needs to be remembered that some postgraduate research programs require that developmental/experimental work is conducted for the benefit of a university department or collaborating partner organisation. It is therefore unrealistic to expect that supervisors will allow a full-time commitment to a literature review to continue for more than one or two months. In planning the research program, it is therefore important to consider how and when the review process will metamorphose from a foreground activity to a background activity without losing momentum.

Once the core literature review has been completed, an ongoing monitoring task needs to be put into place to ensure that the research student is kept up to date with the latest developments in the field of interest. Generally, this can be achieved as a background task because the scope of the review should have been narrowed down to specific publications during the initial high-intensity review process in the opening weeks of the research program. The common mistake, however, is to allow the review to lapse and to lose touch with ongoing developments in the field. This can lead to a dissertation which presents outdated methods or information to an assessor and negates the benefits of the researcher's work.

5.4 Planning for Experimentation and Testing

In many postgraduate research programs, the research student needs to demonstrate, to peer reviewers, an ability to impartially determine the limitations or relative advantages and disadvantages of a theory, methodology, model or idea. This generally necessitates the conduct of experiments, tests or studies that can provide relevant data for the study.

It may appear to be a statement of the obvious to suggest that the experimentation portion of a research thesis is of particular importance but, ironically, it is an area of considerable weakness in many research dissertations. In particular, it would be reasonable to suggest that it is not the actual experiments or studies that are the core problem but, rather, the design of the experiments and studies.

There are a number of reasons why experimental/study designs tend to be weak in many research programs. Fundamentally, these tend to stem from the fact that research students tend to view the "project" as the focus of their research, over and above the attainment of an understanding of research procedures. Often, the development and experimentation portions of a research program are seen to provide greater personal satisfaction than the fundamental design of the experiments or studies that are used for verification or testing purposes. However, it must be remembered that it is the design of the studies and experiments which will be of paramount importance to an external assessor that seeks to judge the merits of a research student's abilities as a researcher. Moreover, the principal objective of the experimental/study design is to ensure that the undertaken developments and experiments match with the stated objectives of the research program. In many instances it becomes apparent that they do not. Why? Because experiments or studies have been conducted as an afterthought to some development rather than as a precursor to the development.

There are a number of reasons why it is critically important to formally plan for the conduct of experiments and studies in a research program. These include:

- A fundamental need to ensure that all studies and experiments are directly relevant to the stated objectives of the research and are an appropriate vehicle for evaluating the boundaries of any proposed theories or methods
- A need to demonstrate to a peer reviewer that the research student was not predisposed (i.e., biased) toward achieving particular outcomes for research and, hence, that the research was conducted with an open-mind
- A requirement to demonstrate to a peer reviewer that the research student had a comprehensive plan for impartial self-assessment, in which he/she was cognisant of the possibility that the presented "ideas" could be proven flawed.

In order to achieve these objectives, the experimental/study plan should logistically be analogous to a flow-chart, where the proposed research idea or methodology is subjected to a series of tests. For each test, the plan must contain a course of action to be pursued in the event that the test does not produce a result which the research student considers to be positive. For example, if the research investigates the relationship between some drug stimulus and a human neural response, a project plan would have to consider that there may be no correlation whatsoever between the two. What is the next step in the research process given that there is no correlation found?

Many research dissertations are artificially (or, more appropriately, conveniently or expediently) efficient in terms of their presentation of experimental results. In other words, the experiments always appear to support and verify some proposed methodology or idea. In the examiner's mind, however, the question that needs to be addressed is not whether the research student "*produced the correct answer*" but, rather, whether the research student was mature enough to contemplate the flow of a research program through all the permutations associated with possible experimental outcomes. This

requires careful planning of experimentation prior to the commencement of those experimental procedures.

The other key factor that emerges from a lack of planning is poor project management practice. Without well-planned experimentation, that is designed around the basic objectives of the research program, and which takes into consideration the spectrum of possible experimental outcomes, important experiments are often neglected. Sometimes, experimental apparatus has to be reassembled; study groups have to be reconvened, and so on. This can lead to lengthy project delays or, in some cases, as a result of the impracticalities of reproducing experimental conditions, incomplete experimental results.

In some areas of research, experiments and studies can only be performed after ethics clearances have been obtained from appropriate bodies within the university, or from government regulatory bodies. Often, these require experimental designs to be submitted in advance and approval may be complex and take weeks or months. In some cases, clearances can be denied and research programs need to be revised.

The overall project planning process must therefore consider the delays associated with clearances or acquisition and assembly of equipment and ensure that productive work can continue while such deliberations are under way. In general, this means that the design of experiments and studies needs to take place in a formal (i.e., documented) manner as soon as a basic methodology or idea materialises in a detailed form. This planning should also serve to avoid unnecessary experiments or studies that do not relate to the basic research objectives, and to ensure that important aspects are not excluded.

The planning of experiments sometimes requires complex experimental design techniques or statistical design techniques to be employed. These, in turn, tend to be outside the general knowledge base of many research students and are often a science in their own right. The mastery of experimental or statistical design techniques

may take weeks or months of additional study and literature review, on the part of the student, and this too needs to be factored into the overall project plan for the research. Importantly, a lack of understanding in such areas can lead to the presentation of weak or meaningless data that negates the entire purpose of the experimentation or study.

5.5 Planning for Publication and Peer Review

An independent peer review of a research student's work, through publication in refereed international journals or other recognised conferences and transactions, can provide vital feedback to the student prior to submission of a dissertation for assessment. Moreover, if a research student makes specific mention of his/her published work, within the dissertation, then there is a clear indication, to an assessor, that the student has followed a systematic investigative procedure, by seeking independent peer review at the highest international levels.

It is also possible that an external peer review of a research student's work will be highly critical of procedures or results, or even the basic impetus for, and significance of, the work itself. In any event, the feedback provided by independent referee panels is vital because it enables a student to correct errors in the investigation or to strengthen the defence of the work, where it is evident that the fundamentals are correct but the supporting arguments or data are inadequate.

Publication, and the associated peer review process, require planning in terms of a postgraduate research program. In particular, the preliminary research plan needs to consider the time taken to achieve a peer review. This, in turn, requires that a student:

- Determines the elements of his/her research program that will need to be subjected to review (through the publication process) and, subsequently, into how many publications this can be ethically translated
- Determines the highest levels at which peer review can be undertaken in a particular field (i.e., the most respected journals or conferences associated with a field of study)

- Familiarises himself/herself with the publication and editorial standards of the key journals or conferences in the field of interest
- Determines the editorial policies of the journals, in terms of the time taken to review a paper; the times and locations at which conferences are held, and so on.

Once these factors have been determined, the student can plan for the development and writing of a paper, and the submission and review process, within the constraints of the postgraduate research program.

Many students are not aware of the difficulties and time delays associated with the review and publication process in international journals. An eminent journal may hold a paper for up to a year during the course of a review. In many cases, referees request that changes be made to the paper and that the paper be resubmitted. The re-evaluation process may take several more months. Even after the refereeing process has been concluded, there are delays associated with publication. Journals are generally only published on a monthly or quarterly basis, with only a limited number of papers per journal. Hence, a paper needs to be scheduled for publication (according to current queues) before it is sent to a publishing house, the staff of which may subsequently choose to make editorial changes to the work, in consultation with the author. Overall, it may take as long as two years, from the time a paper is submitted to the time that it appears in a journal.

Fortunately, for the research student, the key factor in publication is the peer review component and the fact that a paper is "in press" (i.e., delayed by queuing in the publishing house) is of less relevance to the student or those assessors examining the final dissertation produced in the research. Nevertheless, the journal review component alone can be a significant delay in the overall postgraduate research program and needs to be planned.

Another factor, associated with peer review and publication, that may need to be planned, is the cost of publication. While it is self-

evident that publication through conferences and transactions will impose a cost burden, many students are surprised to learn that some international journals impose a fee (per page) for publishing a research paper. In some cases, this fee can be quite substantial, and funds therefore often need to be sought from a university department to fund a publication or conference attendance. Again, this requires planning on the part of the student to ensure that publication or conference fees can be met or, if not, that alternative forms of peer review can be sought.

5.6 Planning for Thesis Preparation

A dissertation (or thesis) is generally the principal mechanism by which the actions of a researcher are judged. A thesis is a portfolio of a research student's plans, methods and experimental results. By nature, it is prepared as a historical document which reflects a series of events and actions that led to a series of conclusions and recommendations. However, in the context of a research program, it is a living document that should evolve as the research program evolves.

Many students (and supervisors) view a thesis as a document that is written after the research program has been completed. Although such a practice can lead to positive outcomes, it is a poor means of tackling postgraduate research for a number of reasons. Firstly, when a thesis is the only means by which research is assessed, then the pragmatic (and systematic) approach is to begin with a clear insight into the final goals - that is, to generate a document which will be assessed by a peer reviewer. Without a clear understanding of the final outcomes, the research program can often lose direction - that is, it can become research for the sake of research.

Secondly, postgraduate research is oriented towards specialists - it is not a generalist pursuit. In other words, the final outcome of a research program (i.e., the thesis) is directed towards a very specific type of reader. In many cases a research program can be multidimensional in nature and can explore issues in a range of different fields. It must be understood, however, that the natural tendency of a specialist reader will be to place the greatest emphasis on the aspects with which he/she is most adept. Hence, the final outcome of a research program (the thesis), and the research itself, must be oriented towards a very specific type of individual. This does not mean that one needs to know the actual name of an assessor but, rather, the typical profile of the person who will be the assessor.

The third reason for making the thesis a living document (which is developed in conjunction with the research program) is that the thesis is the detailed plan of attack for the research. It is the most

comprehensive description of the research to be undertaken, the ideas and arguments to be presented, and the experiments and studies that will be employed to test the boundaries of (and defend) presented ideas. It is therefore logical that this document should become the recipe for the research. In doing so, the scope of the research is narrowed down; the possibility of missing important experiments is reduced, and development and testing are minimised.

Fourthly, it is interesting to note that, despite the diversity of research programs, and disciplines in which postgraduate research is conducted, theses tend to be remarkably similar in structure if not detail. The bulk of a thesis can be written once:

- An extensive literature review has been completed
- A methodology or idea, arising from the review has been formulated
- A series of experiments have been systematically planned to test the boundaries of the idea.

Many research students are surprised to find that, if a thesis is well structured and developed, then the document is largely insensitive to the specific outcomes of experiments or studies. Why? Because a well-written thesis begins as an open-minded exploration of an idea, with no predisposed outcomes. The literature review provides an insight into peer researcher thoughts on the subject of interest and possible extensions to existing knowledge. The methodology, developed following the literature review, is a detailed formulation of the idea. The experimental procedures provide an unbiased means of assessing the boundaries of the methodology, defending its merits and determining its negative attributes. In fact, all that remains to be derived for the thesis are the results of the experiments and the conclusions and recommendations to be drawn from them.

In summary, the thesis needs to be planned for as a living part of the research program and, in many instances, the thesis should be

written before developments and studies take place. In particular, experimental methods need to be established well before developments occur and experiments take place. This enables a researcher to ensure that the final document (i.e., the final defence of a research student's work) is clear in its objectives and that the literature review and experimental procedures are absolutely aligned with those objectives. All too often, the reverse is true and time is wasted when students realise that conducted experiments are inadequate to support espoused theories or ideas - experimental rigs have to be rebuilt, studies have to be repeated, and so on. The risks of such occurrences can be avoided if the fundamental method of defence is clearly documented from the outset.

Many research students believe that they have a clear picture of the research program and the manner in which experiments will be conducted to verify their stated ideas. However, when pressed to document the ideas, it becomes evident that the ideas are often not clear and that initial perceptions of an experimental defence are either inappropriate, inadequate or inconsistent with the presented ideas.

Another common fault amongst research students is that even when they do undertake thesis development, during the course of the program, they often consider it to be "work in progress" or "draft" form. This is a serious error in judgement because it implies that any poorly developed ideas or experimental procedures can suffice until some later stage ("*...it's only at draft stage...*") and be subsequently corrected. This approach exudes a lack of self-discipline and is seriously flawed. Drawing upon an analogy, in the construction industry, one does not erect "draft" buildings. There is only one building to be constructed and the objective is to take every reasonable step to ensure that it is as good as it can possibly be on the first attempt. In developing a thesis, every sentence, every idea and every reference that is put forward should be put forward as though it was the final product. To do less than this is akin to erecting a draft building in some naive expectation that it can be corrected at a later stage. In a thesis, just like a building, if the foundations are flawed then no amount of correction will practically remedy the final product.

Needless to say, regardless of how well a thesis is written, there is always some likelihood that it will need to be amended as the research progresses - however, the objective is to always strive to write the thesis in one attempt. This creates a much higher degree of discipline for the research and the researcher.

There are a number of key factors involved in planning for the thesis. These include:

- (i) Establishing a general concept of the research program
- (ii) Undertaking a detailed literature review to obtain a clearer picture of the landmark researchers and seminal authors in the field
- (iii) Establishing a detailed profile of the type of final examiner to which the research thesis will ultimately be submitted - the specific field of interest; the typical preferences and biases that are held; the key contributions and research outcomes that would be of interest, and so on
- (iv) Developing a detailed introductory chapter for the thesis that simply and clearly states:
 - The specific objectives of the research
 - The background of the research
 - The basic premise, idea or methodology put forward for contention
 - The relative contributions that the research has made to its discipline
 - The means by which the basic contentions of the research will be evaluated and defended

- (v) Developing a literature review chapter that specifically addresses each of the individual items in (iv)
- (vi) Developing a series of experimental procedures that specifically address the individual items in (iv)
- (vii) After completing development and experimental work or studies, documenting the outcomes of the experiments or studies and drawing conclusions from them.

In addition to the above planning steps, one also needs to consider the time it will take to have a thesis reviewed by others before submitting it to an examiner. It is good practice to have the thesis read by:

- An expert in the field - in order to determine the quality of the specific research and the correctness of the approach
- An expert in an altogether different field - in order to ensure that the thesis is correctly structured and that arguments can be readily followed (without being prejudiced by the actual technical aspects of the work)
- A reader endowed with good writing skills and a high level of ability in the final language of the work - in order to ensure that the thesis is grammatically correct and well written as an interesting document.

All these phases of thesis review take time and rarely can they all be completed by a research supervisor - typically, several different people are required. In planning a research program, one therefore needs to consider the time it will take others to read the dissertation that will be finally submitted for review.

A thesis is generally not a document that can be read and scrutinised over a short period (like a novel). Normally, readers can only review one or two chapters at a time and, even then, it may take

several days or even weeks or months to digest and analyse the presented information. It is particularly important for a research student to consider these sorts of delays from the outset and, in planning for the research program, to consider the distribution of the thesis to other readers as an ongoing aspect of the program. This often enables other work to go on in parallel with review of various thesis chapters. In particular, those students who experience language difficulties often need to work in collaboration with an experienced writer to ensure that the thesis develops, both technically and grammatically, as an integrated whole. This should involve seeking assistance in the early stages of the research program, rather than presenting a large, poorly-written document for complete and hasty amendment in the final days of the program.

