PART I

PREPARATION

1 INTRODUCTION AND TEXT USAGE GUIDE

1.1 Aims and Text Structure

In 1945, in his report to US President Harry Truman –*Science: The Endless Frontier (NSF.gov, 2015)* – Vannevar Bush, Director of the US Office of Scientific Research and Development, wrote the following words:

> *"The responsibility for the creation of new scientific knowledge - and for most of its application - rests on that small body of men and women who understand the fundamental laws of nature and are skilled in the techniques of scientific research. We shall have rapid or slow advance on any scientific frontier depending on the number of highly qualified and trained scientists exploring it."*

Decades later, we are still dependent upon the skills of highly qualified and trained scientists for our societal advancement. This book relates specifically to those who are involved in the training of researchers – not just scientists, but all those who practice research in diverse fields.

The objective of this book is to provide a framework guide to the key issues that arise during the conduct of postgraduate research student supervision. This book is aimed primarily at early career academics and researchers who may be tackling the supervisory process for the first time, either as a principal or associate supervisor in a postgraduate degree program.

The specific structure and assessment of postgraduate research degree programs varies from country to country and institution to institution. In some institutions, a Master's degree (by research) is a distinct research program in its own right – in other institutions it is a precursor to a

Doctoral program. For some institutions, a postgraduate research program is composed entirely of research into one specific area – in others, research is supplemented by coursework studies.

The complete picture is also remarkably variable at an international level. In the United States, there are often qualifying examinations for entry to higher level postgraduate programs such as Doctorates. Supervisors sometimes act as a leading entity in a thesis committee rather than unilaterally in their own right. In the British Commonwealth universities, supervision is generally left to an individual – or perhaps a principal supervisor and a co-supervisor.

Assessment methods also vary significantly, with some institutions requiring only the peer evaluation of a dissertation/thesis, and others expecting a dissertation supplemented with a formal defense of the work.

Even within a single institution, there can be marked variations to postgraduate research program formats – for example, some universities offer special forms of Doctorate, based upon a collection/portfolio of published work. Industry-based Doctorates add further variations, with the possibility of including commercial research and development into a program of assessment.

The possible postgraduate program variations are clearly significant and it is not practical to cover all of them in detail within a single book. Hence, herein, the entire suite of possible postgraduate research programs is condensed into the generic context of a single research program that is ultimately peer-assessed by means of dissertation and/or verbal defense. There is also an assumption that, for the bulk of the research program, there will be a professional relationship between a supervisor and student, in which that supervisor takes responsibility for oversight of the research conduct and preparation of research papers; thesis and defense.

This book is written in such a way that it can be read within a few sittings, in order to provide an overall insight into the basic aspects of research supervision – from initial contact with a research student, through to final thesis submission. Importantly, this book is not intended to be a research text in its own right – with large numbers of references and citations. The objective is to provide an easily digestible, linear pathway, covering the supervisory process, from beginning to end, in a straightforward manner – and written in the form of a guide.

Albert Einstein once observed that,

> *"Everything must be made as simple as possible. But not simpler."*

With this in mind, the context of this book is important for the reader to

understand. It begins with the premise that the process of research supervision is actually complex in its own right. Add to this the fact that each university has specific guidelines for postgraduate research conduct and examination. Add to this the fact that individual faculties, departments, research institutes, centers and research groups have their own research guidelines, under the umbrella of the university structure. Add to this the fact that some postgraduate research programs will involve external partners – including business/industry as well as external research organizations. Add to this the different capabilities of research students, and their varying requirements for support and interaction with their supervisors. Again, the permutations are enormous.

It would be neither helpful nor feasible to address all the permutations of research environments and programs, and then expect a reader to extract specifically relevant supervisory practices from such a text. Moreover, it would be unwieldy to assemble such a range of perspectives into a cohesive collection of methods that an individual supervisor could use practically. Instead, this book is written in such a way as to provide a sequential perspective on each of the key aspects of the supervisory process. These perspectives can then act as a point of reference – or a point of departure – for the reader.

It would also be presumptuous to suggest that what is presented herein is an optimal approach to supervision or tackling the issues intrinsic to that process. Ultimately, the best approach to supervision will arise from the supervisor's understanding and responses to:

- The surrounding research environment and resources
- The specific field of research, and peer expectations within that field
- The specific attributes – strengths and limitations – of the research candidate
- The developing professional relationship between the research candidate and the supervisor
- The surrounding peer groups available for consultation and support for both the supervisor and the student
- External factors influencing the research program, including collaborating partner organizations, etc.

A research supervision undertaken in one of the world's highly-resourced and highly-ranked universities may be markedly different to one undertaken in a resource-poor regional university in a developing nation. This doesn't have to mean that the quality of the outcomes will be different, but it does mean that supervisors need to adapt and supervise according to

their surroundings.

There are as many approaches to research supervision as there are research supervisors. It would therefore be condescending to supervisors to become too prescriptive in the approaches that such individuals should take. Herein, the objective is to provide a basic, common approach to tackling each key supervisory issue, and to work on the assumption that the readers will then calibrate their specific approach accordingly, based upon their own professional judgment.

The basic elements of postgraduate research supervision that need to be addressed include the following:

(i)   Identifying/selecting/evaluating appropriate candidates for research, and initiating discussions with them.

(ii)   During early discussions, identifying potential career pathways for the candidate at the completion of the research program, and determining how the program can be structured to maximize opportunities for the candidate to achieve his/her goals.

(iii)   Defining the specific terms of the research candidature and project for the benefit of the researcher, supervisor and institution.

(iv)   Establishing the boundaries for a professional relationship between the supervisor and research candidate, and articulating how that relationship will manifest itself over the research period.

(v)   Identifying potential problems that may arise during the course of research candidature – understanding potential personal problems that a candidate may have; potential health and safety issues with the research to be performed; resource requirements, and then attempting to identify the unique requirements of the candidate.

(vi)   Planning the research program and developing a mutually agreed project management plan and timeline with the candidate.

(vii)   Establishing regular, formal and informal, meetings during the course of the research program in order to provide constructive, ongoing feedback in relation to the research

program and its directions.

(viii) Determining internal and external peer review mechanisms throughout the course of the research to ensure integrity – including discussions with local peers, learned colleagues; publication of findings, etc.

(ix) Formally supervising – and providing oversight to – the research/experimental work of the candidate to ensure that the candidate is performing according to agreed requirements.

(x) Ensuring that the research candidate is behaving morally, ethically, and adhering to the rules of the institution.

(xi) Ensuring that the research candidate acts in a safe manner that does not imperil himself/herself or others working in the environment.

(xii) Ensuring that the candidate behaves in a manner which is respectful and courteous to colleagues and supporting staff.

(xiii) Providing ongoing advice to the candidate about achievements and what areas the candidate needs to improve in order to achieve his/her goals beyond the program.

(xiv) Identifying problems that the candidate is unable to resolve in his/her own right, and determining what additional support measures and resources may need to be introduced in order to complete the research program

(xv) Resolving ongoing problems as they arise – whether they be personal; research-specific; resource-based or professional conflicts with other students/staff.

(xvi) Providing ongoing support and feedback in relation to the preparation of research papers and the thesis/dissertation.

(xvii) Preparing the candidate for examination by thesis and/or other defense.

(xviii) Discussing future plans and career prospects with the candidate.

(xix) Establishing an ongoing professional relationship with the

candidate beyond the research candidature.

This list is not exhaustive, but it does serve to demonstrate that research supervision is far more complex and multidimensional than the basic oversight of a set of research activities.

Novice research supervisors can sometimes naively believe that if they are exemplary mentors and loyal friends to their research students, then all else is peripheral, and any other problems will resolve themselves. The simple fact of the matter is that they will not. While research supervisors may indeed be exemplary friends and mentors to their students, they have a professional responsibility to their university to manage their researchers in a systematic, methodical and impartial manner – and according to university procedures. This duty of care needs to remain intact whether or not a supervisor and student are friends, and even if a student does not perceive the supervisor to be one of his/her mentors.

At the most fundamental level, each research supervisor needs to understand that he/she is assuming an important level of responsibility for a human being – specifically, one that will need to interact with other human beings, and potentially operate in an environment that may contain various hazards. Additionally, the candidate may be required to perform tasks which are potentially deleterious to other humans or animals used in experimentation. These are not minor, sundry issues – they are issues that have profound moral and legal consequences in most modern, developed countries.

Over and above these core responsibilities for the supervisor, there needs to be an ingrained awareness that the postgraduate research program is creating a highly specialized individual – and one for whom career opportunities will, by definition, be accordingly limited. This makes the responsibilities of the supervisor all the more complicated.

At a global level, each year, the number of individuals completing postgraduate research qualifications is significantly higher than the number of available tenured academic positions within the *research-intensive* university sector. Moreover, the deficit between graduates and tenured academic positions is annually cumulative. It would therefore be reasonable to suggest that many of those who complete a postgraduate research qualification will *not* be working within the university system as an academic in the long-term. Some will work in commercial research; some will work in normal professional roles in commercial or government entities; some will move directly into management roles, and some will create their own start-up companies.

Whichever pathway a postgraduate researcher ultimately chooses, there needs to be recompense for opportunity costs and forgone professional income as a result of participation in a postgraduate program that takes several years to complete. It needs to be recognized that this period of postgraduate research is 5-10% of a professional working life, and so the compensation needs to be significant. This compensation may be monetary but it could also come in the form of more interesting work; a business opportunity; better overall career prospects, or just some form of personal satisfaction as a result of achieving a particular research outcome.

For these reasons, the actual research which students undertake and complete during their time as a postgraduate cannot be *the* outcome – it can only be one part of the broader set of outcomes that need to be achieved if the university and supervisor are carrying out their roles diligently. In the modern world, a good piece of research and an unemployable graduate is as inadequate an outcome as a poor piece of research and an employed graduate.

A supervisor therefore has an important role in achieving both a good research outcome and a postgraduate with meaningful future professional directions. Without this, what does any university really achieve in the long-term – if its graduates are not deemed to be employable in positions befitting their highly qualified status?

Unfortunately, sometimes universities and academics view postgraduate research students as little more than low-cost research labor, in order to achieve their own ends. However, this is a very shortsighted and dated view – particularly if the end result is a collection of disenfranchised, disgruntled individuals with limited career prospects. Taking the longer term view, and understanding that successful, grateful graduates will inevitably give back immeasurably to the university and its research is a far more productive approach for the modern world.

For these reasons, creating a *complete postgraduate* should be the ultimate goal of the modern supervisor, and it is a difficult one. In order to achieve this, research students will need to be pushed outside their comfort zones. However, this means that research supervisors will also need to step outside their own comfort zones and look at the broader development of the complete high caliber postgraduate as part of their core responsibility. This may seem unjust, given that supervisors can view themselves solely as purveyors of knowledge in a specific field, but it is the reality of modern supervision.

In many universities, the guidelines for supervisors talk of *mentoring* research students. The most basic part of that mentoring role is setting a good example in the context of research conduct and, more particularly, in

terms of research ethics. Another obvious part of the mentoring role is trying to get research students to understand their own strengths and limitations. In the modern world, however, a new and critical aspect of supervision is getting research students to understand the varied and complex environments into which they will ultimately transition at the conclusion of their postgraduate degree. This is not something which can be achieved within a few weeks at the conclusion of the program – it is something which needs to start early in the research candidature.

Completing a significant research task is one part of modern postgraduate candidature, and understanding how that research task, and the broader research training, fit into the world is the other.

On reaching the end of this text, and given the range of supporting supervisory activities which become apparent herein, novice supervisors may be forgiven for thinking that all these supporting activities will detract from the actual journey of knowledge discovery. This is not the case in practice. As a supervisor develops increasing experience in the oversight of postgraduate research, the supporting activities will become second nature, background thought processes, and the primary focus will always remain on the discovery of knowledge.

1.2 Text Overview

This book is composed of three main parts:

I. Preparation
II. The Supervisory Process
III. Relevant Supervisory Issues.

The first part of the text deals with issues that relate to preparing for and initiating the supervisory process. The second part deals with issues directly relating to the research supervision and examination itself. The third part deals with a range of supporting issues that are not core to the supervisory process itself but can have critical ramifications for the conduct of the research supervision and the future career of the candidate.

The three parts of the book are divided into a total of 15 chapters, 14 of which follow on from this one. In summary, the purpose of each of the subsequent chapters is as follows:

PART I - Preparation:

- *Chapter 2 - Understanding the Fundamentals of Research Supervision* – A chapter looking at the critical outcomes that need to be delivered for both the student and the supervisor

- *Chapter 3 - Basic Responsibilities of Research Supervision* – A chapter outlining important basic requirements for supervisors, including maintaining safety and ensuring wellbeing (physical and emotional) for students – including avoidance of discriminatory practices, etc.

- *Chapter 4 - The Relationship between the Supervisor and Student* – A chapter examining the types of supervisory relationships that can exist and the relative benefits/limitations.

- *Chapter 5 - Understanding the Research Environment* – A chapter explaining the different types of research environments – generic governance structures in universities, research institutes, etc.

PART II - The Supervisory Process:

- *Chapter 6 - Preliminary Tasks in Research Supervision* – Student recruitment; definition of research projects; scholarship funding; submission of candidature forms, etc.

- *Chapter 7 - Initiating the Formal Supervisory Process* – Establishment of formal and informal meeting mechanisms; project requirements, and so on.

- *Chapter 8 - Planning the Postgraduate Research Program* – Regardless of discipline or research topic, all research programs have basic elements, including literature review; development of methodology; experimental design or hypothesis testing; analysis of results; peer-review by publication; preparation and presentation of a thesis – and possibly a verbal defense. These need to be assembled into a cohesive plan.

- *Chapter 9 - Conflict Resolution in Postgraduate Research* – There are numerous sources of conflict that arise in postgraduate research – including those between the supervisor and student; the student and colleagues; resource providers; external parties to the research, and so on. A supervisor needs to be able to identify the sources of these conflicts and put in place mechanisms for their resolution.

- *Chapter 10 - Research Supervision in Industry/Partnered Collaborative Projects* – When research is conducted in collaboration with third parties (either commercial or other universities and research institutes) additional considerations need to be factored into supervisory practices. In particular, these can include contractual disputes; conflicts of interest; conflicting objectives; intellectual property disputes; publication disputes, etc.

- *Chapter 11 - Peer Review by Publication* – In most postgraduate research programs, a preliminary part of the research assessment occurs by having the student submit research papers on key elements of the work. This chapter deals with issues that arise as a result of the publication process.

- *Chapter 12 - Preparation of a Thesis* – Postgraduate research programs are structured investigations, and subsequently theses also have to be carefully structured in order to document those investigations.

This chapter looks at the generic elements that need to be included, and the various options for thesis structuring.

PART III - Relevant Supervisory Issues:

- *Chapter 13 - Research Misfeasance Issues* – In an ideal world, research malfeasance should not arise but it unfortunately does during the course of an academic career. This chapter looks at generic issues relating to plagiarism or other academic misconduct on the part of student, supervisor or surrounding academic colleagues.

- *Chapter 14 - The Long Term Researcher/Supervisor Relationship* – In order to help build a vibrant university, supervisors need to ensure that the end of the postgraduate research program is not the end of the relationship between the student and supervisor. In the short term, supervisors may need to become involved in supporting the career choices of their students. In the long term, there is a need to ensure an ongoing positive relationship.

- *Chapter 15 – Questions Supervisors Should Ask Themselves* – Having read the preceding 14 chapters, and before actually taking on a research student, potential supervisors need to ask themselves some basic questions about their motivations and how these will impact upon a candidate.

1.3 Overview of the Research Supervisory Process

In order to progress discussions on the various aspects of research supervision, some assumptions need to be made about the sequence of events associated with research supervision. Needless to say, the specific elements in the process, and their sequencing, are unique to each particular university and each field of research. However, in order to make the discussions herein tractable, a generic sequence of supervisory elements is presented in Table 1.1, as the basis for discussions herein.

Step	*Details*
1	Identification/selection of postgraduate research candidate
2	Preliminary/informal discussions with potential candidate to establish possible research areas/projects, and long-term career aspirations
3	Detailed discussions with potential candidate to establish research program specifics and funding/scholarship/tuition arrangements
4	Formal application and university processing of research candidature application and scholarship/tuition funding arrangements
5	Initial meeting/s with candidate to formally commence research program and set off a series of regular supervisor meetings. Formal/informal discussion of supervisory arrangements and general expectations on the part of the supervisor and candidate
6	Formal establishment of basic resources for research candidature – including office and laboratory space; technical; library and information technology (IT) support, etc.
7	Identification and evaluation of potential hazards; safety requirements, and ethics requirements for the research program
8	Initial research candidature project meeting – outline of project requirements and project plan; timelines; critical pathways; thesis preparation process; interim and final milestones/deliverables; etc.
9	Regular formal/informal meetings to discuss and evaluate research progress; results problems and resolution mechanisms
10	Meetings to discuss formal and informal internal/external peer review processes for the research candidate – including in-house presentations of interim work; reviewed publication of results, etc.
11	Meetings to discuss future professional pathways for candidate at the completion of the postgraduate research program, and possible

		mechanisms for achieving these
12		Meetings to discuss thesis preparation/progress and final examination of research where verbal defense is required
13		Problem resolution meetings to address personal and professional research student issues; conflicts; health or safety concerns
14		Editing, feedback and iterative development of research dissertation/thesis
15		Preparation of candidate for final thesis submission and/or examination
16		Meetings to discuss future career directions and employment possibilities for candidate – support for research candidate's transition out of the program
17		Establishment of a future, ongoing professional relationship with the candidate to enable the professional researcher to remain an active contributor to the university environment.

*Sequence steps shown in black are repetitive, ongoing elements of the process

Table 1.1 – Generic Sequence of Steps in the Postgraduate Research Supervisory Process