Synergizing Workplace Research and Postgraduate Degrees

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Abstract. Many mature age students are taking courses in postgraduate degree programs to acquire a degree needed for promotion. In these circumstances, the students may already have as much, if not more, knowledge about the subject as the instructor. A number of these degree candidates are also working in an environment whereby their work is of a research nature. Workplace research, however, is only one aspect of ongoing research. Important research is also being performed by working groups (WG) in professional organizations such as the INCOSE. In many instances such research can be incorporated into postgraduate degrees at the Masters and Doctoral levels. This paper discusses types of research that are appropriate, the benefits of applying workplace research for the employee and other stakeholders, and concludes with a step by step process for synergizing workplace research into a postgraduate degree.

INTRODUCTION

These days, a postgraduate degree[1] is becoming a minimum qualification for promotion to upper levels in organizations. More and more mature age students are studying for technical coursework postgraduate degrees in areas in which they are knowledgeable, have experience, but don't have the paper qualifications. For example, many students taking courses in the Master of Software Engineering (MSWE) and Master of Science in Computer Systems Management (CSMN) postgraduate degrees at University of Maryland University College (UMUC) have more experience in the subject than the instructor. These students are just sitting through the courses in the program in order to obtain the degree that will allow them to apply for promotion. Distance education is becoming a popular way to take these courses. International Data Corp. (IDC) reports that worldwide revenue derived from corporate distance-mode learning will reach more than $23 billion by 2004 (Entrepreneur 2001). At the same time, it seems that much of the research that is being undertaken in industrial and government laboratories, as well as in business areas, professional and semi-professional societies is as good as, if not better than the research being performed for many postgraduate theses. Yet, while the research practitioners may benefit from a postgraduate degree, they have not considered applying their research towards qualifying for such an Award and saving themselves from the tedium of a postgraduate award by coursework. This may be because in the USA, postgraduate degrees by research (without any coursework) are not available. These types of postgraduate degrees, however, are available in Australia, the United Kingdom, and much of Europe; and with today's technology in distance education are available to students worldwide.

RESEARCH DEGREES

Research degrees are not mail-order degrees. Students have to research a topic and produce a substantial written thesis. Typically, in Australia, there is no oral defense of the thesis; a candidate is judged solely on merits of the written manuscript by three or more examiners, who are usually international experts in the field, who may reside in any country, and who are not from the candidate's university. The examiners recommend that theses be passed, passed pending modifications, or in some cases, failed. With good research supervisors, theses do not fail, because the supervisor and the degree administrator make sure that all the bases are covered in the written work prior to the assessment by the examiners.

There are three types of research degrees: - Masters, Doctor of Philosophy and Professional Doctorates.

[1] At the Masters or Ph.D. level.

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The Masters degree is awarded for an original contribution to knowledge that is achieved in one to two years of full-time candidature or the equivalent in part-time work. The focus of the degree is on research, but depending on the institution and the candidate's knowledge and experience, a limited amount of coursework may be included in the program.

The Doctor of Philosophy (Ph.D.) is a degree by research and thesis, with an emphasis on a significant original contribution to knowledge and/or the application of knowledge within a specific field of study. Doctoral degrees are awarded for a substantial original contribution to knowledge achieved in two to four years of full-time candidature or the equivalent part-time.

The Professional Doctorate may combine coursework and structured research tasks that are specifically related to professional practice, and are often carried out in the workplace. The standard is equivalent to that of a Ph.D., but the orientation is towards the development of professional practice rather than primarily as a contribution to academic knowledge.

EXAMPLES OF SUITABLE RESEARCH

Typical examples of research that is, or could be made suitable are:

- Much of the work done in the working groups (WG) of the INCOSE and other professional organizations.
- Research into process improvement, capability maturity models.
- Research into the new paradigm of industrial and academic cooperation.
- Research into distance education.
- Some of the work done in industrial laboratories such as COMSAT, Mitre and Lucent Technologies.
- Some of the work done in Government Laboratories, such as NASA, DSTO, and Telecommunications Research Laboratories.
- Business research which is defined as the systematic and objective process of gathering, recording and analyzing data for aid in making business decisions (Zikmund 1994).
- Amateur Radio research. Radio Amateurs discovered or pioneered many communications techniques that are now taken for granted. They are continuing that tradition today into areas of research such as aspects of communications links, satellites and propagation. For example, the radio amateur satellite program has built and launched more than 40 spacecraft, since 1961, and has conceptualized at least two missions to the planet Mars. Some of this research is at the professional level. In addition, the American Radio Relay League, The Radio Amateur Satellite Corporation (AMSAT) and AMSAT-UK hold annual technical conferences and symposia to present the findings from this research and each publish refereed proceedings.

SYNERGIZING WORKPLACE RESEARCH IS WIN-WIN

Synergizing workplace research towards a postgraduate degree provides a win-win scenario all around. Consider the advantages of several scenarios.

Individual research – joining forces with academia would introduce objectivity and rigor into the research. The individual would learn the benefits of applying scholarly research methods, learn to write research reports, theses, position papers, etc. The individual would also be exposed to research techniques including literature reviews and interpretation of data.

INCOSE Working Groups - researching aspects of systems engineering. However, the groups are made up of volunteers and the effort is a spare time activity. While enthusiasm is high when an INCOSE member hears about the work of the WG at the symposium and decides to join, the high level of enthusiasm is generally not maintained for any number of reasons. In addition, people rotate through the WGs so the work tends to be reexamined causing delays in completion.

This situation poses a twofold problem. There are two sectors that have needs, which are different, and each sector needs to be satisfied for the whole to work.

- **INCOSE needs** - something that not only motivates members to join the WGs but also motivates them to stay with the WG, complete the project, and produce a product of value to the system engineering community.
- **WG Member needs** - WG members need a reason to stay with the WG, namely to be rewarded for their efforts. In addition, it would be a bonus if the reward helps to advance their career. One way to provide this kind of reward is a postgraduate degree, which would open the door to promotion. In addition, since they would be working towards a degree, they may be able to fund their participation in the WG via their employer's tuition reimbursement program.

Professional research can lead to a postgraduate degree in addition to producing new knowledge. This may even motivate an employee to stay with the organization until the degree is awarded: particularly if the tuition reimbursement program is conditional on some future period of employment. The employee benefits by receiving the award, the employer benefits by raising the number of employees with postgraduate

degrees. The employer may also be able to negotiate a reduced fee scale or quantity discount with a particular institution. In a coursework degree program, workplace research may also be used to fulfill the requirements for a minor thesis or to offset the number of courses that need to be taken in the program. In the MSWE (by coursework) degree at UMUC the following courses were set up for this situation

- **MSWE 697 Independent Research** (3 credits). This course is based on a proposal submitted by the student to perform research in, or other study of, a systems and software engineering topic. The student reports the results of the effort in written and oral form. The research is conducted under the guidance of an advisor.
- **MSWE 699 Advanced Topics in Software Engineering** (3 credits). This course covers advanced topics selected by the faculty from the literature of Software Engineering to suit the interest and background of students. It may be taken for repeated credit up to a maximum of six credits.

In addition, ways currently exist for classified (military) research or research for hire that is specific to the organization to be the subject of a postgraduate thesis.

Business research – the scope is limited by the definition of "business". It covers production, finance, marketing, or management areas of for-profit organizations, as well as not-for-profit organizations. It may be applied but can also be pure research in areas like developing capital asset pricing theories to help in the understanding of finance; performance satisfaction theories to help managers understand job performance factors; and consumer behavior theories to help marketers understand buyer behavior (Davis and Cosenza 1988).

Amateur Radio and other hobby research – These provide a vast range of topics. Research has one prime goal: *discovery* (Leedy 1993). The hobby world is full of journals, each containing papers documenting the discoveries in some aspect of the hobby. Many of these articles are the result of serious research. There is no reason why this research cannot be applied to a postgraduate award.

INCOSE WG research – The research supervisor can ensure that the researchers take note of more material being published in the field than they might otherwise be aware of. For example, INCOSE has a WG researching Requirements Engineering. The supervisor would be able to advise the WG that pertinent papers are being published in other conferences as well as the INCOSE Annual Symposium (e.g. conferences sponsored by the IEEE). INCOSE and similar professional societies may need to reengineer the way research is done in their working groups. The society research organizer would have to work with the academic institutions to shape the direction of the research. This could be done in several ways either with one institution in the way of an industrial-university relationship, or by allowing the individual member to select an institution of choice. Mechanisms to achieve this include

- Awarding scholarships or matching scholarships for research in areas of interest to the society when applied to a research degree at the member's university of choice, or from a list of approved universities; thus not paying volunteers directly.
- Endowing academic positions at universities in areas of specific interest: for example, an INCOSE chair of systems engineering at Hypothetical University.
- Sponsoring awards for research papers published at the annual symposium.
- Assigning a "sponsored research" track at the annual symposium.

Professional organizations such as INCOSE will need to develop an operations concept for how the cooperative research will ensue. Two such Use Cases for the concept of operations are

- **Dual reports** - Each WG member may be expected to produce two reports, an academic thesis and a document for the professional group. This second document may take the form of a book, web page(s) or conference/journal paper(s).
- **Conflict resolution** – Several potential sources of conflict are apparent. For example, WG members, after spending years on the research, may not wish to write two reports, and only produce the academic thesis. As another example, WGs change leadership from time to time. New leaders may want to change the focus of the research away from the degree research. Practitioners will tend to resist these changes. The organization will have to address these issues before supporting applying WG research towards a postgraduate academic qualification.

The University perspective – students would be attracted to universities that study topics they are interested in and propose the topic to the prospective supervisor. It is thus incumbent on the potential student to research the appropriate university and the research interests of its faculty. Modern technology no longer limits the candidate to local universities (Kasser 2000), so the list of suitable candidate institutions stretches around the globe. Each institution has an Internet presence, so finding the optimal institution is not a difficult research project in itself.

With students in different locations doing research into different but similar projects, the information flow will benefit the research since the academic research supervisor will be able to pollinate ideas between students researching similar topics in different areas. For example, the problems in designing equipment for long-duration (interstellar) space missions are similar to those of the design of systems for exploring the ocean bed at great depths. Similarly, the problems faced by designers of waste recycling units aboard space stations have much on common with the problems facing designers of environmentally friendly terrestrial urban waste management facilities.

The university sector can potentially gain faculty with postgraduate degrees. The Graduate School of Management and Technology at UMUC, in general, only employs full- and part-time teaching staff with Doctoral degrees. This makes it hard to find suitable instructors for courses in software engineering. The program directors are continuously recruiting and the possession of the degree counts more than teaching ability, at least the first time around. The achievement of research degrees by industry practitioners will provide a larger pool of qualified instructors and will then tend to raise academic standards. Thus, for anyone thinking about retiring from industry, and entering academia, achieving a research degree is a major milestone towards that future.

THE NATURE OF RESEARCH

The research problem. Leedy (1993) states that at the very heart of every research project is the problem. The situation is quite simple: no problem, no research. There are several kinds of research, each with subsets.

Pure research attempts to expand the limits of knowledge. Thus it does not solve immediate problems. As such it is conducted to verify a theory or to find out more about certain phenomena.

Applied Research takes place to answer questions about what solutions exist to specific problems. When applied research is not suitable for the traditional postgraduate degrees, it may well be suitable for all or part of the work leading to the award of a Professional Degree.

Academic research – In the academic world of the postgraduate degree candidate, research in science and engineering follows the scientific method. Observations are made and analyzed, literature is examined to assist in the analysis and a hypothesis explaining the observations is stated. Further research is proposed to support the hypothesis. This research is then performed, and if the hypothesis is supported all is well. If not, further analysis takes place, and the cycle recommences with the proposal of a new hypothesis. The research methodology must suit the specific problem.

CRITERIA FOR A RESEARCH PROJECT

Leedy (1993) provides the following criteria (requirements) for a research project

- **Universality** – the research project shall be such that any competent person may carry it out.
- **Replication** – The research shall be repeatable when performed by a competent researcher under the same conditions.
- **Control** – the research shall be conducted within a specified context.
- **Measurement** – the data shall be susceptible to measurement.

THE PUBLICATIONS PERSPECTIVE

Much if not all research will be the same if performed for academic credit or for non-academic reasons. However, the format of the business or other non-academic report will be different to the format of the thesis or scholarly publication. Thus

- The many books published today that extend the limits of knowledge could be reformatted as postgraduate theses.
- Research performed for sponsors in government or university centers may be written up in two ways, once as a report to the sponsor, and once as a scholarly paper (with the sponsor's permission). While one publication does not a degree make, it can build a track record of publications. A record of publication shows that the person is capable of original research.

INITIATING THE PROCESS

Anyone wishing to apply his or her workplace research towards a postgraduate award has a process to follow. The process contains the following steps, but is not necessarily sequential.

1. If you are not sure of the nature of research, check it out by reading suitable publications such as Davis and Cosenza (1988); Fraenkel and Wallen (1993) Leedy (1993) Zikmund (1994).
2. Identify the topic for the workplace research formally. Leedy (1993) recommends inspecting any volume of *Dissertation Abstracts International* under the general heading of the topic of interest to become aware of how intimately the everyday world and the world of research have become intertwined. The reference may be obtained from local libraries.
3. Find a mentor in your organization to help you with your workplace research topic.

4. If you comfortable with the concept, discuss your workplace research with your employer (supervisor) and determine the mutual advantages of instituting academic rigor into it. Note, in addition, your research supervisor can probably be leveraged as a consultant at no extra cost.
5. Formulate the problem in a statement that is carefully phrased and represents the single goal of the total research effort (Leedy (1993).
6. Determine the nature of a thesis for the desired postgraduate award (Easterbrook 2000). Note that the requirements will be different at specific institutions.
7. Identify a prospective university with the expertise in the subject or one willing to take you on as a part-time student. Elements of the evaluation criteria may include reputation, interested faculty, subject matter expertise, and employer-tuition program policy constraints.
8. Outline the proposal that has to convince a particular overworked person in the university to take the candidate on as a student. The proposal has two sections, technical and risk-management.
9. Write the draft of the research or technical proposal. This is the document that describes the hypothesis, the proposed research and the applicant's expertise in the field. A track record of publications helps to prove expertise but is by no means essential.
10. Write the risk management proposal. This is the document that analyses and discusses the probability of the applicant completing the research. The candidate is likely to be a mature person with family and employment responsibilities. The research will thus tend to be part-time and will take several years to complete.
11. Initiate the contact with the university and follow the applicable institutional process to complete the enrolment procedure. Before final enrolment, complete the research proposal and document exactly what is expected from both the candidate and research supervisor. The proposal then takes on aspects of a contract in case the research supervisor should not be available for the duration and the replacement provided by the university tries to redirect the research.

RESOURCES FOR RESEARCH INFORMATION

Performing a literature search is not too difficult in the early 21st century. Local collegiate and urban libraries contain written material in the form of books, journals and CD-ROMs, as well as on-line access to databases and electronic media. The Internet provides information on a wide variety of topics. Employers may provide access to subscribed databases.

INDIVIDUAL AND COLLABORATIVE RESEARCH

The research may be individual or collaborative. In the Professional WG environment the WG team leader manages the research, the academic supervisor's role is to monitor, and mentor, providing pointers to suitable resources, and ensuring that the standards are met, and the research is expanding the limits of knowledge. The WG research may be partitioned so that each member of the team focuses on a specific area and writes a thesis on that topic. For a minor thesis, this is the same scenario as the team project in many postgraduate courses. The techniques for collaborative learning and working in the academic face-to-face classroom as well as in the online distance mode classroom apply to the WG.

COSTS

The discussion of a postgraduate award would not be complete without some mention of the tuition costs. Costs will of course vary since each institution has its own rates, and there will be fluctuations in the value of overseas currencies with respect to the US dollar. However, as an example, tuition at the author's institution, at the current rate of exchange would be less than US$4,000.00 per annum for non-resident, part-time overseas students.

CONCLUSIONS

Synergizing workplace research and postgraduate degrees provides many benefits and is a true win-win situation.

This paper is a proposal containing a freely formatted preliminary concept of operations for synergizing workplace research and postgraduate degrees.

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BIOGRAPHY

Joseph Kasser has been a practising systems engineer for 30 years. He is the author of "*Applying Total Quality Management to Systems Engineering*" published by Artech House. Dr. Kasser is a DSTO Associate Research Professor at the University of South Australia (UniSA). He is a recipient of NASA's Manned Space Flight Awareness Award for quality and technical excellence (Silver Snoopy), for performing and directing systems engineering.

Dr Kasser has taken up his own suggestion and enrolled in a Ph.D. program in Education at the University of South Australia. His interest is in researching factors contrbuting to optimal delivery formats for post-graduate education in the corporate environment.