

TTM THESIS DEVELOPMENT

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The objective of this document is to describe what a student registered in the M.Eng. in Telecommunications Technology Management (TTM) program needs to know to complete a high-quality thesis on time.

We are continuously searching for ways to improve TTM thesis production. If you have suggestions on how to improve this document or wish to learn more about the TTM program, please contact:

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TTM THESIS DEVELOPMENT

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1. INTRODUCTION

The objective of this document is to help TTM students prepare high-quality theses on time. Feedback on what is in this document is welcome. Feedback is used to continuously improve the production of TTM theses.

This document is updated at least twice a year. Please make sure that you are reading the most up-to-date version of this document.

Sections 3, 4, 14 and 15 of this document are edited versions of “How to Organize your Thesis” by Professor John Chinneck. The original document is available on-line at: <http://www.sce.carleton.ca/faculty/chinneck/thesis.html>. It has been customized for the particular case of TTM students.

Section 2 describes the Gate 0-1 Process, an informal process used to complete TTM theses. The process is voluntary and visible.

Section 3 defines TTM thesis expectations.

Section 4 provides a template for TTM theses. While professors prefer their students to organize theses in different ways, the essential elements in any thesis are the same.

Section 5 describes five research approaches used to prepare TTM theses.

Section 6 provides a list of the faculty who are able and willing to supervise TTM theses.

Section 7 organizes the research program into four sub-fields: i. Product and service development; ii. Sources of competitive advantage; iii. Technical entrepreneurship, innovation and commercialization; and iv. Engineering and technology. The first three sub-fields are part of the knowledge domain known as engineering management or engineering and technology management.

Section 8 identifies the TTM graduates and Section 9 the TTM thesis proposals defended at Gate Reviews. This list is referred to as the inventory of TTM theses in progress.

Section 10 provides a list of research questions relevant to the three engineering management sub-fields.

Section 11 provides a list of the journals most relevant to the engineering management and management aspects of the TTM program.

Sections 12 and 13 reproduce Carleton University’s *Policies for the Ethical Conduct of Research and Instructional Offences*.

Sections 14 and 15 provide answers to frequently asked questions and tips.

Section 16 includes the feedback forms used during the Gate 0 and Gate 1 reviews as well as Carleton University’s *Supervisor-Student Guidelines*.

2. GATE 0-1 PROCESS

OBJECTIVES

The objectives of the Gate 0-1 Process are to:

- help a TTM student complete a high-quality thesis on time
- prepare TTM students for the thesis defence
- reduce wasteful effort and time delays
- support a unique learning community anchored around TTM students' research efforts

RATIONALE

The Gate 0-1 Process provides a sense of structure and sequence to TTM thesis development. It reduces the ambiguity for TTM students regarding what to work on and when.

Gate Reviews:

- provide TTM students with a strong sense of responsibility and ownership
- motivate TTM students and allow them to assess their work activities and progress
- simplify identification of the requirements for a good thesis and allow earlier surfacing and resolution of potential problems
- promote communication among TTM students, faculty, TTM graduates, and key external stakeholders (e.g., company managers)
- aid TTM students and faculty in adopting a project attitude to thesis completion (e.g., milestones, clear deliverables, commitment to schedule, visible progress)
- facilitate creativity in problem solving, enhance learning, and increase attention to details
- strengthen the supervisor-TTM student relationship, one that grows with mutual respect and high levels of professional integrity

The Gate 0-1 Process is one of the factors that contribute to the success of the TTM program. Faculty and students take it quite seriously because they believe that it leads to successful thesis production and excellent learning and networking opportunities.

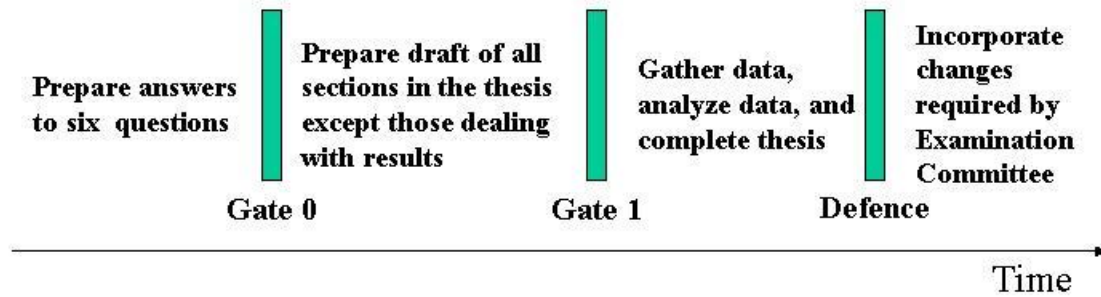
TTM students relate well to the Gate 0-1 Process because they follow similar processes when developing products in their companies.

GATE REVIEWS

Figure 1 shows the Gate 0-1 Process. Each TTM student goes through a Gate 0 Review and a Gate 1 Review before defending his/her thesis. To pass a Gate, your Supervisor must agree that you have satisfied the Gate requirements.

Figure 1

Gate 0-1 Process for TTM Thesis Development



The TTM student first selects a topic and then answers the six questions listed in the next section titled Gate 0.

After his/her Gate 0 Review, a TTM student iterates various drafts of the thesis with his/her Supervisor. Typically, before the Gate 1 Review, the TTM student has:

- completed a draft of the thesis that includes all sections except those that discuss the results
- fixed the holes found by the Supervisor

Every year, all TTM students are scheduled to present evidence of thesis progress at Gate 0-1 reviews. Faculty, TTM students, TTM graduates and guests attend these reviews, ask questions, make suggestions, and provide written feedback to the presenters. The written feedback is provided to the TTM student on a confidential basis.

DATES FOR GATE REVIEWS

During the 2003-2004 academic year, Gate reviews will be held in 4359 ME on the following dates:

- Friday, October 24, 2003
- Friday, November 28, 2003
- Friday, January 30, 2004
- Friday, February 27, 2004
- Friday, March 26, 2004
- Friday, June 25, 2004

GATE 0

At a Gate 0 review, a TTM student provides evidence that:

- he/she understands what graduate level research is about
- he/she can deliver an effective presentation.

At a Gate 0 Review, a TTM student provides evidence that he/she understands what graduate level research is about by providing clear answers to the following seven questions:

- What is your research question or research problem?
- Why is your research question (or problem) an important one?
- What contribution will your thesis make?
- Which research method will be used?
- What variables will you measure and how will you measure them?
- What data will you collect, where will you get the data, how will you get the data?
- How will you analyze the data?

Each student has approximately 20 minutes to present and answer questions. The form the audience uses to provide feedback to a Gate 0 presenter is shown in Appendix 1.

Typically, all students who start the TTM program in September are scheduled to pass Gate 0 at the end of February of the subsequent year. If a student feels that he/she is not ready by then, he/she simply signs up for another date.

A TTM student does not need to select a Supervisor before his/her Gate 0 Review. However, most students have a Supervisor by the time they make their Gate 0 presentation.

GATE 1

At a Gate 1 Review, the TTM student:

- provides evidence that he/she is ready to collect and analyze data
- prepares for the final thesis defence
- improves presentation skills

At a Gate 1 Review, the TTM student provides evidence that he/she is ready to collect and analyze data by providing clear answers to the following questions:

- What is your research question or research problem?
- Why is your research question (or problem) an important one?
- What contribution will your thesis make?
- What variables will you measure and how will you measure them?
- What data will you collect, where will you get the data, how will you get the data?
- How will you analyze the data?
- What results will you obtain and the results will be interpreted?
- What conclusions can you make based on the results?
- What are the limitations of your research?

The form the audience uses to provide feedback to a Gate 1 presenter is shown in Appendix 2.

A major difference between Gate 0 and Gate 1 Reviews is that a Gate 0 Reviews can result in major changes to the student's thesis proposal, while a Gate 1 Reviews usually result in refinements and patches. Another difference is that the Gate 1 Review is more detailed and specific.

VOLUNTARY AND VISIBLE

The Gate 0-1 Process is both voluntary and visible.

We see no strong argument for formally enforcing the Gate 0-1 Process upon TTM students. The reasons for this are:

- Carleton University has excellent guidelines that define the responsibilities of supervisors and graduate students already (see Appendix 3)
- TTM students are too good, too motivated, and too experienced for faculty to waste their time adding more controls to those which exist already
- The Gate 0-1 Process is part of the TTM culture already

We argue that when good people share a strong culture of leadership and success, there is no need for additional formal controls.

A TTM student who has a more effective thesis development process is free to use it and ignore the Gate 0-1 Process altogether.

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The Gate 0-1 Process is visible. Information on expected thesis completion dates, and on who presents what, when is made public. Visibility creates the sense of community, pride for what we do, commitment to complete the thesis on time, and a taste of what you need to do to achieve excellence.

3. TTM THESIS EXPECTATIONS

WHAT IS THE TTM MASTER'S THESIS ABOUT

The TTM Master's thesis is a formal document whose sole purpose is to prove that you have made an original and useful contribution to knowledge. The contribution to knowledge of a Master's thesis can be in the nature of an incremental improvement in an area of knowledge or the application of known techniques to solve a problem in a new area.

Your thesis must show that:

- you have identified a worthwhile research question which has not been previously answered or a problem that has not been solved
- you have answered the research question or solved the problem

MUST HAVE REQUIREMENTS

Your Master's thesis must:

- provide a very clear statement of the research question or problem to be solved
- provide a thorough review of the existing literature on the subject and closely related subjects
- use the existing literature to demonstrate that your question (a) has not been previously answered and (b) is worth answering
- describe how you answered the research question or solved the problem
- clearly indicate what you did and distinguish it from what others did
- be a formal document (i.e., every item must be in the appropriate place, and repetition of material in different places should be eliminated)

WHAT EXAMINERS LOOK FOR

When examiners read a thesis they look to answer the following questions:

- what is this student's research question or problem?
- is it a good research question or problem? (has it been answered before? is it a useful question to work on?)
- did the student convince me that the research question was adequately answered? was the problem solved correctly?
- has the student made an adequate contribution to academic knowledge? to the practice of engineering management?

WHAT IS EXPECTED OF A TTM STUDENT IN THE THESIS OPTION

It is expected that at the end of his/her thesis, a student becomes a trusted specialist in a narrow domain and can point novices to the proper sources of knowledge. For this purpose, we expect TTM students to:

- know where to find the relevant information about a knowledge domain
- know how to look for relevant information about a knowledge domain
- read and understand what is published in the leading journals and books that specialize on what is known about the knowledge domain

4. THESIS TEMPLATE

No two theses are organized in exactly the same way. The following is a template that can be used for any thesis. While professors prefer their students to organize theses in different ways, the essential elements in any thesis are the same.

1. INTRODUCTION

This is a general introduction to what the thesis is all about -- it is not just a description of the contents of each section. Briefly summarize the research question or the problem, some of the reasons why it is a worthwhile research question, and give an overview of your main results.

2. BACKGROUND INFORMATION (OPTIONAL)

A brief section giving background information may be necessary, especially if your work spans two or more traditional fields. That means that your readers may not have any experience with some of the material needed to follow your thesis, so you need to give it to them. A different title than that given above is usually better; e.g., "A Brief Review of Equipment Vendor's Brand Differentiation."

3. LITERATURE REVIEW

Here you review the state of the art relevant to your thesis. Again, a different title is probably appropriate; e.g., "Literature Review on Brand Differentiation." The idea is to present the major ideas in the state of the art right up to, but not including, your own ideas.

You organize this section by idea, and not by author or by publication. For example if there have been three important main approaches to Brand Differentiation to date, you might organize subsections around these three approaches, if necessary:

- 3.1 Business-to-Business brand differentiation
- 3.2 Image brand differentiation
- 3.3 Experiential brand differentiation

4. RESEARCH QUESTION OR PROBLEM STATEMENT

You can refer to a "research question" to be answered or a "problem" to be solved. In either case, this section has at least three main parts:

- a concise statement of the research question or the problem that your thesis addresses
- justification, by direct reference to the literature, that your question is previously unanswered
- discussion of why it is worthwhile to answer this question.

5. DESCRIPTION OF HOW YOU SOLVED THE PROBLEM OR ANSWERED THE QUESTION

This part of the thesis is much more free-form. It may have one or several sections and subsections. But it all has only one purpose: to convince the examiners that you answered the research question or solved the problem that you set for yourself. You show what you did that is relevant to answering the question or solving the problem.

If there were blind alleys and dead ends, do not include these, unless specifically relevant to the demonstration that you answered the thesis question.

6. CONCLUSIONS

You generally cover four things in the Conclusions section, and each of these usually merits a separate subsection:

- Conclusions
- Contributions to Academic Knowledge
- Contributions to Engineering Management Practitioners
- Future Research

Conclusions are short, concise statements of the inferences that you have made because of your work. It helps to organize these as short numbered paragraphs, ordered from most to least important. All conclusions should be directly related to the research question or problem you address.

The Summary of Contributions to Academic Knowledge and Contributions to Engineering Management Practitioners will be carefully read by the examiners. Here you list the contributions of new knowledge that your thesis makes. Organize from most to least important.

The Future Research subsection is included so that researchers picking up this work in future have the benefit of the ideas that you generated while you were working on the project. Again, concise numbered paragraphs are usually best.

7. REFERENCES

The list of references is closely tied to the literature review. Most examiners scan your list of references looking for the important works in the field, so make sure they are listed and referred to in the body of your thesis. Truth be known, most examiners also look for their own publications if they are in the topic area of the thesis, so list these too. Besides, reading your examiner's papers usually gives you a clue as to the type of questions they are likely to ask.

All references given must be referred to in the main body of the thesis. Note the difference from a Bibliography, which may include works that are not directly referenced in the thesis. Organize the list of references either alphabetically by author surname (preferred), or by order of citation in the thesis.

8. APPENDICES

Appendices include material that is important to justify the results of a thesis. Generally it is material that is of too nitty-gritty a level of detail for inclusion in the main body of the thesis, but which should be available for perusal by the examiners to convince them sufficiently. Examples include program listings, immense tables of data, lengthy mathematical proofs or derivations, etc.

5. RESEARCH APPROACHES

By the very nature of being the result of a research effort, a TTM thesis is a unique endeavour. The research approach in the thesis follows the nature of the research question or problem the thesis addresses.

To guide students in their understanding of the type of effort required, the quality of the results required, and examples of good research we provide a classification of research approaches we deem useful. It permits faculty and graduate students to better explain what they are doing (e.g., we are working on approach X, we are working on a combination of approaches X and Y). The intent is to provide mature graduate students with a research approach classification that is helpful, not “cookie cutter” recipes for theses.

Five research approaches are described in this section:

- Constructive
- Positive
- Grounded
- Simulation
- Theoretical

CONSTRUCTIVE

A TTM student uses the constructive approach to design, build a test a working system or prototype.

Students pursuing this approach must be very comfortable with the tools that they will use to build their systems (e.g., programming languages, network protocol stacks, operating system kernels, Web tools).

Advantage

The main advantage of this approach is that the student ends up with a real system/prototype.

Disadvantage

The main disadvantage is the time spent overcoming implementation issues that have little to do with the core of the thesis. For example, a student may be delayed weeks because of the need to change his/her code because the system administrator updated an old version of a required system to a newer one (e.g. time spent upgrading code that is required when version 7.3 of RedHat Linux is upgraded to version 8.0).

Examples of TTM theses

- Chen, Fung (2002) *Policies as Design and Implementation Artifacts for Non Functional Requirements.*
- Pellerin, Karine (2003) *Multimode Verification System Using Fingerprint and Speech Information.*

POSITIVE

A TTM student uses the positive approach to develop a theory with testable hypotheses and then to test these hypotheses. Hypotheses should be:

- clearly stated
- testable
- interesting
- likely true

The positive approach is applicable when a useful theory can be developed at the start of the research effort using available data and previous research results.

Advantage

The main advantages of this approach are two. First, the requirement for creativity and insight comes early in the research process. This means that thesis success can be ascertained before thesis completion.

The second advantage is that the student ends up with interesting data and clear insights on the elements of the theory and their relationships.

Disadvantage

The main disadvantages of this approach are two. First, the student needs to make a significant commitment to learn applied statistics. Second, the student needs to overcome the uncertainties and delays associated with collecting data.

Examples of TTM theses

- Izsak, Trevor (2001) *Product News Releases for Time to Market Competitive Intelligence..*
- Ochoa, Edgar (2002) *Coordinating Hardware and Software Development: Evidence of Success Factors.*

References

- Foddy, William (1994) *Constructing Questions for Interviews and Questionnaires: Theory and Practice in Social Research*, Paperback Reprint Edition, Cambridge University Press; ISBN: 0521467330.
- Norusis, Marija J. (2002) *SPSS 11.0 Guide to Data Analysis*, Prentice Hall ; ISBN: 0130348309.
- Stevens, James (2001) *Applied Multivariate Statistics for the Social Sciences*, 4th edition, Lawrence Erlbaum Associates; ISBN: 0805837779.
- Callahan, John R. and Brian Moreton (2001) "Reducing Software Product Development Time", *International Journal of Project Management*, 19(1), January.
- Eisenhardt, Kathleen M. and Behnam N. Tabrizi (1995) "Accelerating Adaptive Processes: Product innovation in the global computer industry", *Administrative Science Quarterly*, 40(1), March, 84-110.

GROUNDED

A TTM student uses the grounded approach to build a theory by closely observing real data.

The approach is used when rich, multi-aspect data is needed to investigate a management problem. The grounded approach is applicable when a useful theory cannot be developed at the start of the research effort using available data and previous research results. The grounded approach is exploratory.

Advantage

The main two advantages of this approach are that the student can use a wide variety of data types and sources and that the research strategy and tactics can be adjusted as the research proceeds

Disadvantage

The main disadvantages of this approach are two. First, the student needs maturity and communications skills to gather data.

The second disadvantage is that the requirement for creativity and insight comes at the end of the research process. Thus, there is uncertainty until the end as to whether or not the student has done or found something significant.

Examples of TTM theses

- Muegge, Steve (in progress) *Independent Start-ups and Corporate Spin-outs in the Ottawa High-Tech Community.*

- Miller, Scott (in progress) *Changes that Occur to Software Architecture following Organizational Change*.

References

- Carlile, Paul, David Sundahl and Clayton Christensen (2002) "The Process of Theory-Building", working paper #02-016 (<http://www.innosight.com/index.php?mcat=ilib&scat=work>)
- Dyer, Jr., W. Gibb and Alan L. Wilkins (1991) "Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt", *Academy of Management Review*, 16(3), 613-619.
- Eisenhardt, K.M. (1989) "Better stories and better constructs: The case for rigor and comparative logic", *Academy of Management Review*, 16(3), 620-627.
- Eisenhardt, K.M. (1989) "Building theories from case study research", *Academy of Management Review*, 14, 532-550.
- Leonard-Barton, Dorothy (1990) "A Dual Methodology for Case Studies: Synergistic use of a longitudinal single site with replicated multiple sites", *Organization Science*, 1(3), August, 248-266.
- Miles, Matthew B. and A. Michael Huberman (1994) *Qualitative Data Analysis: An Expanded Sourcebook*, Sage Publications; ISBN: 0803955405.
- Yin, Robert K. and Donald T. Campbell (2003) *Case Study Research: Design and Methods*, 3rd Edition, Sage Publications, Inc.; ISBN: 0761925538.
- Cusumano, Michael A., Yiorgos Mylonadis, and Richard S. Rosenbloom (1992) "Strategic Maneuvering and Mass Market Dynamics: The triumph of VHS over beta", *Business History Review*, 66, Spring, 51-94.
- Eisenhardt, K.M. (1989) "Making Fast Strategic Decisions in High-Velocity Environments", *Academy of Management Journal*, 32(3), Sep, 543-576.
- Lewis, Michael A. (2001) "Success, Failure and Organisational Competence: A case study of the new product development process", *Journal of Engineering and Technology Management*, 18(2), June, 185-206.
- Rosenbloom, Richard S. and Michael A. Cusumano (1987) "Technological Pioneering and Competitive Advantage: The birth of the VCR industry", *California Management Review*, 29(4), Summer, 51-76.
- von Corswanta, Fredrik and Claes Tunälvb (2002) "Coordinating Customers and Proactive Suppliers: A case study of supplier collaboration in product development", *Journal of Engineering and Technology Management*, 19(3-4), September, 249-261.

SIMULATION

A TTM student uses the simulation approach to build a simulation model of a real system, and then uses results from the simulation to make recommendations about the real system.

The biggest challenge of the simulation approach is validation, (i.e., how to ensure that the simulation results are an accurate reflection of reality) and experimental designs (i.e., which of the millions of experiments should be run to arrive at interesting results).

Advantage

The main advantage of the simulation approach is that the simulation allows the greatest range of experiments in a controlled manner.

Disadvantage

The main disadvantage is that the student needs to learn statistical techniques.

Examples of TTM theses

- Alexiu, Gabriela (in progress) *Scalability of Virtual Private Networks*.

THEORETICAL

A TTM student uses the theoretical approach to solve a well-known problem mathematically.

The student needs excellent mathematical and formal methods skills.

Advantage

The main advantages of the theoretical approach are completeness (the student can arrive at a definite answer) and significance (why the problem is relevant and what the importance of the student's results are, can be clearly shown).

Disadvantage

The main disadvantage is the uncertainty associated with intellectual capability (i.e., the student may not quite get the proof done even though he/she devoted significant time to it).

Examples of TTM theses

No TTM thesis has been prepared using this approach. Examples include:

- proof that an e-commerce security protocol is indeed secure (within certain parameters)
- demonstrate that "X" is impossible

6. TTM THESIS SUPERVISORS AND CO-SUPERVISORS

This section provides a list of faculty who are able and willing to supervise or co-supervise TTM theses.

SAMUEL AJILA

Research Areas	Suggested Background	Contact
<ul style="list-style-type: none"> • Software Process Evolution • Product Line Evolution • Software Maintenance • Knowledge Management Engineering (with particular reference to Software Product Development) • Performance issues in embedded database systems 	<ol style="list-style-type: none"> 1. SYSC 5704 - Elements of Computer Systems <i>for students with backgrounds other than Computer Science/Engineering</i> <p>Take one of 2 or 3</p> <ol style="list-style-type: none"> 2. TTMG 5006-Management of Software Engineering Projects 3. SYSC 5105 - Software Quality Engineering and Management. <p>And</p> <ol style="list-style-type: none"> 4. Students interested in embedded database systems must take SYSC 5703 - Integrated Database Systems. 	Systems and Computer Engineering Samuel.Ajila@sce.carleton.ca 520-2600 ext 2673 www.sce.carleton.ca/faculty/ajila.html

TONY BAILETTI

Research Areas	Suggested Background	Contact
Product development, new product introduction and technology adoption	Two of: <ul style="list-style-type: none"> • TTMG 5101 Integrated Product Development • TTMG 5005 Management of System Designs • TTMG 5004 Management of Design Systems 	Systems and Computer Engineering and Eric Sprott School of Business bailletti@sce.carleton.ca 520-2600 ext. 8398 www.sce.carleton.ca/faculty/bailletti.html

LIONEL BRIAND

Research Areas	Suggested Background	Contact
Verification and validation of software systems, object-oriented analysis and design and software quality assurance and control	<ul style="list-style-type: none"> • SYSC 5708 Development of Real-Time and Distributed Software with Reusable Components • SYSC 5105 Software Quality Engineering and Management • SYSC 5800 Network Computing • SYSC 5103 Software Agents • COMP 5403 Real-Time System Development • COMP 5404 Computer-Aided Program Verification 	Systems and Computer Engineering Lionel.Briand@sce.carleton.ca 520-2600 ext. 2471 www.sce.carleton.ca/faculty/briand.html

JOHN CALLAHAN

Research Areas	Suggested Background	Contact
Product development, technology strategy and organizational structure	Two of: <ul style="list-style-type: none"> • TTMG 5101 Integrated Product Development • TTMG 5005 Management of System Designs • TTMG 5004 Management of Design Systems 	Systems and Computer Engineering and Eric Sprott School of Business john_callahan@carleton.ca 520-2600 ext. 2372 www.carleton.ca/~callahan

JOHN CHINNECK

Research Areas	Suggested Background	Contact
Optimization, including new algorithms, applications, algorithms and software to assist in the automated formulation and "debugging" of mathematical programs, and data classification.	<ul style="list-style-type: none"> • SYSC 5004 Mathematical Programming for Engineering Applications 	Systems and Computer Engineering John.Chinneck@sce.carleton.ca 520-5733 www.sce.carleton.ca/faculty/chinneck.html

DAVID COLL

Research Areas	Suggested Background	Contact
Telecommunications, high level distributed application development technology, the management of knowledge-based industries and institutions	<ul style="list-style-type: none"> • TTMG 5002 Telecommunications Technology • SYSC 5800 Network Computing 	Systems and Computer Engineering coll@sce.carleton.ca 520-5720 www.sce.carleton.ca/faculty/coll.html

AYSEHUL CUHADAR

Research Areas	Suggested Background	Contact
Signal/image processing, high performance computing, and multimedia applications.	<ul style="list-style-type: none"> Graduate course in signal processing. 	Systems and Computer Engineering cuhadar@sce.carleton.ca 520-2600 x 1938 www.sce.carleton.ca/faculty/cuhadar.html

BABAK ESFANDIARI

Research Areas	Suggested Background	Contact
Agent-based systems, network management and supervision, object-oriented design and languages, network computing, telephony applications, symbolic machine learning, and algorithms and heuristics	<ul style="list-style-type: none"> SYSC 5103 Software Agents SYSC 5800 Network Computing 	Systems and Computer Engineering Babak.Esfandiari@sce.carleton.ca 520-2600 ext: 2479 www.sce.carleton.ca/faculty/esfandiari.html

ROSHDY HAFEZ

Research Areas	Suggested Background	Contact
Wireless access technologies, fixed and personal communications using cellular, PCS, wireless LAN's and Ad-Hoc networking, RF design and integrated Fiber/Wireless local loops	<ul style="list-style-type: none"> SYSC 5608 Wireless Communications Systems Engineering 	Systems and Computer Engineering Roshdy.Hafez@sce.carleton.ca 520-5731 www.sce.carleton.ca/faculty/hafez.html

THOMAS KUNZ

Research Areas	Suggested Background	Contact
Mobile computing systems, mobile Internet or adaptive mobile applications related topics	<ul style="list-style-type: none"> SYSC 5306 Mobile Computing Systems 	Systems and Computer Engineering tkunz@sce.carleton.ca 520-3573 www.sce.carleton.ca/faculty/kunz.html

YVAN LABICHE

Research Areas	Suggested Background	Contact
Verification and validation of software systems, object-oriented analysis and design and software quality assurance and control	<ul style="list-style-type: none"> • SYSC 5708 Development of Real-Time and Distributed Software with Reusable Components • SYSC 5105 Software Quality Engineering and Management • SYSC 5800 Network Computing • SYSC 5103 Software Agents • COMP 5403 Real-Time System Development • COMP 5404 Computer-Aided Program Verification 	Systems and Computer Engineering yvan.labiche@sce.carleton.ca 520-2600 Ext. 5583 www.sce.carleton.ca/faculty/labiche.html

GITTE LINDGAARD

Research Areas	Suggested Background	Contact
Human computer interaction, universal design, cost/benefit analyses, decision making in the design process, user, task and work context analysis, computer supported cooperative work, and links between aesthetics, perceive/actual usability and user satisfaction.	Passion about users and the link between usability and the business bottom line, understanding system and product life cycles, highly motivated to learn and act.	Human Oriented Technology Lab (HOTLab), Department of Psychology Gitte_Lindgaard@carleton.ca 520-2600 x 2255 www.carleton.ca/hotlab www.carleton.ca/psychology/directory/lindgaard_g.html

SAMY MAHMOUD

Research Areas	Suggested Background	Contact
Integrated wireless and Optical networks; resource allocations and management strategies in broadband wireless data networks; radio frequency spectrum management techniques; ultra wide band wireless communication systems.	<ul style="list-style-type: none"> • SYSC 5201 Computer Communications • SYSC 5608 Wireless Communications Systems Engineering. 	Systems and Computer Engineering (Office of the Dean of Engineering) Mahmoud@sce.carleton.ca 520-5743 www.sce.carleton.ca/faculty/mahmoud.html

TREVOR PEARCE

Research Areas	Suggested Background	Contact
<ul style="list-style-type: none"> • Design, specification and modeling of embedded systems. • Simulation and modeling of computer systems. • Core computing at the hardware/software 	<ul style="list-style-type: none"> • SYSC 5701 Operating Systems Methods for Real-Time Applications • SYSC 5807 Methodological Aspects of Modelling and Simulation • SYSC 5708 Development of Real-Time and Distributed 	Systems and Computer Engineering Trevor.Pearce@sce.carleton.ca 520-2600 ext 4054 http://www.sce.carleton.ca/faculty/pearce.html

interface. <ul style="list-style-type: none"> Real-Time operating systems. 	Software with Reusable Components <ul style="list-style-type: none"> ELG 7187 Hardware-Software Codesign for Embedded Systems 	
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DORINA PETRIU

Research Areas	Suggested Background	Contact
Software performance engineering, performance models, object-oriented software development, UML modeling, and scalability of virtual private networks	<ul style="list-style-type: none"> Competent in object oriented software development, UML modeling, performance measurements and analysis, and high-level network communication protocols. 	Systems and Computer Engineering Dorina.Petriu@sce.carleton.ca 520-5652 www.sce.carleton.ca/faculty/petriu.html

LARISA SHAVININA

Research Areas	Suggested Background	Contact
Innovation and creativity	Two of: <ul style="list-style-type: none"> TTMG 5101 Integrated Product Development TTMG 5005 Management of System Designs TTMG 5004 Management of Design Systems 	Université du Québec en Outaouais (UQO) in Hull larisa.shavinina@uqo.ca

BRIAN TANSLEY

Research Areas	Suggested Background	Contact
Human factors, ergonomics, and engineering psychology	<ul style="list-style-type: none"> Competent students 	Psychology Department and Systems and Computer Engineering brian_tansley@carleton.ca 520-2600 ext. 2707 http://www.carleton.ca/~btansley/

GABRIEL WAINER

Research Areas	Suggested Background	Contact
Modelling of real-time systems and complex systems using hierarchical and modular descriptions. The research is intended to provide practical results through model execution, but it is based on sound theoretical grounds.	Basic knowledge about object-oriented programming (in C++ and/or Java).	Systems and Computer Engineering Gabriel.Wainer@sce.carleton.ca 520-2600 x 1957 http://www.sce.carleton.ca/faculty/wainer.html

MICHAEL WEISS

Research Areas	Suggested Background	Contact
Electronic commerce, software agents, and agent patterns	<ul style="list-style-type: none"> COMP 5401 Electronic Commerce 	School of Computer Science weiss@scs.carleton.ca

		520-2600 ext 1642 www.scs.carleton.ca/~weiss
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GEORGE YEE

Research Areas	Suggested Background	Contact
Security and privacy for electronic services, security enhancement using software agents, confidential networking, design of reliable and secure software	Competent in mathematics, computer networking, computer organization, software design, software agents, algorithms and heuristics, communication protocols; basic familiarity with electronic security concepts	Institute for Information Technology, National Research Council of Canada George.Yee@nrc-cnrc.gc.ca 613-990-4284 http://www.sce.carleton.ca/faculty/yee.html

7. RESEARCH PROGRAM

The TTM theses that students produce define the research program. To date, the TTM research program has been anchored around four sub-fields:

1. Product and service development
2. Sustainable growth and sources of competitive advantage
3. Technical entrepreneurship and commercialization
4. Engineering and technology

The first three sub-fields listed above are part of the knowledge domain referred to as engineering management or technology and engineering management.

For each of the four sub-fields, topic examples are provided below. The topic examples include TTM theses completed and TTM theses that have passed Gate 0 as of June 20, 2003.

PRODUCT AND SERVICE DEVELOPMENT

Examines the tools, processes, skills, and culture required to incorporate customer requirements into new products and services, integrate work in product development organizations, and manage development projects

Examples

- Determinants of successful hardware-software coordination
- Politics of setting product development schedules
- Market repositioning and product line management
- Supplier involvement in product development
- Changes in architecture and changes in the development organization
- Developers' psychological health and project outcomes
- Success-failure determinants in service development
- Intelligent collaborative support for project management

SUSTAINABLE GROWTH AND SOURCES OF COMPETITIVE ADVANTAGE

Examines technical and non-technical means companies use to grow year after year, gain advantages over their rivals, and transform technology, engineering and management into customer value.

Examples

- Product news releases for time to market competitive intelligence
- Performance of telecommunications equipment suppliers during industry meltdowns
- Attracting and retaining talent
- Model for making investment decisions
- Success measures for standard management
- Best practices for acquiring technology companies
- Competitive intelligence in small and medium sized companies

TECHNICAL ENTREPRENEURSHIP, INNOVATION AND COMMERCIALIZATION

Examines the start and growth of technology companies, technical innovation and the means to exploit technology, product and services for financial gain.

Examples

- Independent start-ups and corporate spin-offs

- Venture capital and new venture success
- Early sales of new products developed by small and large companies
- Adoption of Linux-based technological infrastructures
- Adoption of wireless LANs
- Formation, structure and performance of strategic alliances

ENGINEERING AND TECHNOLOGY

Examines technical innovations, approaches and issues as well as technical solutions to known problems.

Examples

- Computer network security risk analysis
- Scalability of virtual private networks
- Multimode verification systems
- Ontologies of Electronic Devices for Product Design Services in the Semantic Web
- A CORBA-based approach to signaling for IP-based telephony services
- Interoperable Secure E-Mail Over the Internet
- Policies as design and implementation artifacts for non functional requirements
- Use of analysis contracts to improve the testability of object oriented code

8. TTM GRADUATES

The table below provides information on our TTM graduates. Please note that the Department no longer supports the project option. To graduate, a TTM needs to complete a suitable thesis.

	NAME	GRAD DATE	E-MAIL	ORGANIZATION	SUPERVISOR
1	Abaciouglu, Turgut	2003 Winter	running_prince@hotmail.com	Ankara, Turkey	Bailetti
Project: <i>B2B Business Models on the Internet</i>					
2	Ahmed, Syed	2003 Spring	imtiazahmed@rogers.com	Signal Stream Ottawa, Ontario	Bailetti/Weiss
Thesis: <i>Ontologies of Electronic Devices in DAML+OIL for Product Design Services in the Semantic Web</i>					
3	Barnett, Michael	2001 Fall	Barnett.MS@forces.gc.ca	Canadian Forces	Bailetti
Project: <i>Knowledge Generation: The Competitive Advantage</i>					
4	Bassem, Ali	2000 Fall	Bassem.Ali@alcatel.com	Alcatel Ottawa, Ontario	Bailetti
Project: <i>Comparing Telco-owned with non-Telco owned Internet Service Providers</i>					
5	Chafe, Kevin	2000 Spring	Chafe.KB@forces.gc.ca	Canadian Forces	Devetsikiotis
Thesis: <i>A Practical Solution to Interoperable Secure E-Mail Over The Internet</i>					
6	Chen, Feng	2002 Fall	feng_y_chen@yahoo.com	Innovance Networks Ottawa, Ontario	Esfandiari
Thesis: <i>Policies as Design and Implementation Artifacts for Non Functional Requirements</i>					
7	Fallah-Khair Melody	2002 Fall	melody@digitalfairway.com	Digital Fairway Ottawa, Ontario	Hafez
Project: <i>A Framework for UMS QoS</i>					
8	Izsak, Trevor	2001 Spring	trevor.izsak@seawaynetworks.com	Seaway Networks Ottawa, Ontario	Bailetti
Thesis: <i>Product News Releases For Time To Market Competitive Intelligence</i>					
9	Khan, Obaid	2003 Winter	obaidk@nortelnetworks.com	Nortel Networks Ottawa, Ontario	Bailetti

	Project: <i>An Inventory of Location Based Services</i>				
10	Lakhani, Faizel	2002 Summer	faizel@caspiannetworks.com	Caspian Networks San Jose, California	Bailetti
	Project: <i>The Race to 40; but when will it be needed?</i>				
11	Liu, Jingdong	2002 Fall	ningfeng@sympatico.ca	Ottawa, Canada	Bailetti
	Project: <i>Team Creativity in Software Development</i>				
12	Lopez, Daniel	2002 Fall	danlop_mailbox@yahoo.ca	Bradson Technology Professionals Ottawa, Ontario	Callahan
	Project: <i>Improving Software Consultant Retention</i>				
13	Loudiadis, Josee	Sep 2003	jloudiadis@yahoo.com	Ottawa, Canada	Bailetti
	Thesis: <i>Comparing early sales of industrial products closed by start-ups and large suppliers</i>				
14	Lu, Tian	2001 Spring			Pagurek
	Thesis: <i>A CORBA-based Interface-centric Approach to Signaling for IP-based Telephony Services</i>				
15	Maheshwari, Arti	2001 Winter	arti.maheshwari@alcatel.com	Alcatel Ottawa, Ontario	Bailetti
	Project: <i>An Investigation of Business Responses to Technological Discontinuities</i>				
16	Martel, Sophie	2002 Fall	sophiemartel@videotron.ca	Canadian Forces	Briand
	Thesis: <i>A New Model for Computer Network Security Risk Analysis</i>				
17	Ochoa, Jorge	2003 Winter	jorosete@chat.carleton.ca	Mexico D.F.	Callahan
	Thesis: <i>Coordination of Hardware and Software Development: Evidence of Success Factors</i>				
18	Pellerin, Karine	June 2003	karinepellerin@videotron.ca	Canadian Forces Ottawa, Canada	Bailetti
	Thesis: <i>Multimode Verification System using Fingerprint and Speech Information</i>				

19	Rasteh, Farzin	2002 Fall	farast@yahoo.com		Hafez
	Project: <i>Studying the Behaviour of AMC in 3G Systems</i>				
20	Salimi, Babak	1997 Winter	babak.salimi@sygate.com	Sygate Technologies Fremont, California	Gerwin
	Project: <i>New Product Development Process and Product Planning for Small to Mid-Size High Technology Firms</i>				
21	Sun, Hong	2002 Spring	a13965sun@yahoo.com	Alternate Solutions Hamilton, Ontario	Briand
	Thesis: <i>Investigating the Use of Analysis Contracts to Improve the Testability of Object Oriented Code</i>				
22	Tao, Jingjun	2003 Spring	jjtao2001@yahoo.com	Nortel Networks Ottawa, Ontario	Huang
	Project: <i>Broadband Wireless Access and Simulation</i>				
23	Usman, Arshad	1999 Spring	ausman@nortelnetworks.com	Nortel Networks Ottawa, Ontario	Bailetti
	Thesis: <i>The Effect of Product Price and Product Category on Online Payment Methods and on the Decision to Own a Secure Server</i>				
24	Xie, Chong	1998 Winter	chong.xie@riverstone.net	Riverstone Beijing, China	Bailetti
	Project: <i>New Product Development: Managing North American Based R&D and China Based Marketing</i>				
25	Xu, Bing	2002 Winter	brooksxu@yahoo.com	Perkinelmer Hong Kong, China	Callahan
	Project: <i>Canadian Layered Telecom</i>				
26	Wong, Louis	2003 Winter	louisw@alumni.uwo.ca	Nortel Networks Ottawa, Ontario	Bailetti
	Project: <i>Knowledge Management for Global Organizations</i>				
27	Wood, Walter	2001 Fall	c_w_wood@sympatico.ca Wood.WA@forces.gc.ca	Canadian Forces	Callahan
	Project: <i>The Impact of Enterprise Communications and Knowledge Management System Personalization on Team Effectiveness</i>				

9. THESES IN PROGRESS

The table below provides an inventory of the thesis proposals presented at the Gate Reviews of January 31; February 28; March 28, 2003; and June 20, 2003.

	NAME	EXPECT GRAD DATE	E-MAIL	ORGANIZATION	SUPERVISOR
1	Alexiu, Gabriela	Sep 2003	gabriela_alexiu@yahoo.com	Carleton University Ottawa, Canada	Petriu
	Tentative Title: <i>Scalability of virtual private networks</i>				
2	Allen, Michael	Dec 2003	Allenmh@rogers.com	Carleton University Ottawa, Canada	Callahan
	Tentative Title: <i>Schedule behaviour: a political perspective</i>				
3	Dumitrescu, R. Tudor	Sep 2004	razvandumitrescu@sympatico.ca	Marconi Ottawa, Canada	Ajila/Bailletti
	Tentative Title: <i>Changes in product line architecture due to product market repositioning</i>				
4	Fang, Chris	Jun 2004	fangvijian@yahoo.com	Alcatel, Ottawa, Canada	Bailletti
	Tentative Title: <i>How trust and commitment within a development team affect project schedule overrun</i>				
5	Gao, Peter	June 2004	gaofeng71@yahoo.com	Carleton University Ottawa, Canada	Bailletti
	Tentative Title: <i>The evolution of the P2P technology and two of it applications: instant messenger and file sharing</i>				
6	Hao, Yanxia	June 2004	yanxia_hao@yahoo.com	Carleton University Ottawa, Canada	Bailletti
	Tentative Title: <i>How telecommunications equipment suppliers compete during periods of industry meltdown</i>				
7	Ibrahim, Altamash	June 2004	Albrahim@ntgclarity.com	NTG Clarity Toronto, Ontario	Callahan
	Tentative Title: <i>Retaining leading telecom consultants</i>				
8	Li, Zhibin	Dec 2003	alex_li@sympatico.ca	Nortel Networks Ottawa, Ontario	Bailletti
	Tentative Title: <i>How a company's participation in standard setting affects its market share</i>				
9	Liao, Jiye	Dec 2004	jiye_liao@hotmail.com	Carleton University Ottawa, Canada	
	Tentative Title: <i>Investment decision making model for telecom service providers</i>				

10	Liu, Ying	June 2004	yliu6@connectmail.carleton.ca	Carleton University Ottawa, Canada	Bailetti
	Tentative Title: <i>How launch aggressiveness affects the performance of new products in new to the world markets?</i>				
11	Miller, Scott	June 2004	scottmiller@ottawa.com sjmiller@canada.com	Nortel Networks Ottawa, Ontario	Callahan
	Tentative Title: <i>Changes that occur to software architecture following organizational change</i>				
12	Mohan, Dinesh	June 2004	mohand@nortelnetworks.com	Nortel Networks Ottawa, Ontario	Callahan
	Tentative Title: <i>Success measures for standards management within telecom product development organizations</i>				
14	Muegge, Steven	June 2003	steve@muegge.net	Carleton University Ottawa, Canada	Callahan
	Tentative Title: <i>Independent Start-Ups and Corporate Spin-Outs in the Ottawa High-Tech Industry</i>				
15	Muñoz, Jairoh	Dec 2004	jairoh@canada.com	Carleton University	Callahan
	Tentative Title: <i>Success and failure determinants in telecom service development</i>				
16	Napoles, Rodolfo	Dec 2003	rnapoles@ca.ibm.com	IBM Ottawa, Canada	Bailetti
	Tentative Title: <i>Evolution of model driven development tools</i>				
17	Peng, Zheshi	June 2004	zpeng2@connectmail.carleton.ca	Carleton University Ottawa, Canada	Bailetti
	Tentative Title: <i>The evolution of the market for Linux-based infrastructures</i>				
18	Qin, Edward	June 2004	hqin@cisco.com	Cisco	Bailetti
	Tentative Title: <i>How Cisco makes its acquisitions successful</i>				
19	Sajjad, Aamer	June 2004	asajjad@ntgclarity.com	NTG Clarity Ottawa, Canada	Callahan
	Tentative Title: <i>What factors distinguish customer involvement in fast and slow clock-speed development projects?</i>				
20	Sonti, Jagdish	Dec 2003	jsonti@cisco.com	Cisco San Jose, California	Bailetti
	Tentative Title: <i>The evolution of wireless LANs</i>				

21	Sun, Zheng	June 2004	bill_sun@hotmail.com	Carleton University Ottawa, Canada	Ajila
	Tentative Title: <i>Intelligent Collaborative Support for Software Project Development</i>				
22	Tanev, Stoyan	Dec 2004	stoyan@rogers.com	Carleton University Ottawa, Canada	Bailetti
	Tentative Title: <i>Competitive intelligence in small and medium size technology companies</i>				
23	Wu, Jian	Dec 2004	rabc.jian@on.aibn.com	Carleton University Ottawa, Canada	Callahan
	Tentative Title: <i>The formation, structure and performance of international strategic R&D alliances in China</i>				
24	Yepez, Carlos	Sep 2004	cyzambra@connectmail.carleton.ca	Carleton University Ottawa, Canada	Callahan
	Tentative Title: <i>Role of venture capital investment process in new venture success</i>				
25	Zhen, Wei	Jun 2004	wzhen@connectmail.carleton.ca	Carleton University Ottawa, Canada	Bailetti
	Tentative Title: <i>Managing the outsourcing relationship between Chinese suppliers and foreign firms</i>				
26	Zhang, Terence	June 2004	tyzhang@connectmail.carleton.ca	Carleton University Ottawa, Canada	Bailetti
	Tentative Title: <i>Early sales of industrial products in new markets.</i>				

10. INVENTORY OF RESEARCH QUESTIONS

When searching for a topic for your TTM thesis, your first step is to examine the information our faculty provides about their research programs in the webpages that they maintain.

Frequently, TTM students find it convenient to first define one, two or three research questions that they can then discuss with potential thesis supervisors. Research questions focused on engineering and technical issues may be found by examining the webpages of the faculty in the Department of Systems and Computer Engineering.

Below is a list of research questions focused on issues relevant to three engineering management sub-fields: i. product and service development; ii. sources of competitive advantage; and iii. technical entrepreneurship, innovation and commercialization. Most of these research questions have been developed working with executives of telecommunications companies. This list is to be used only as a sample of potential research questions. It does not limit you in any way.

1. How can technology increase the effectiveness and efficiency of development projects and organizations responsible for portfolios of development projects?
2. What model best explains the adoption of new applications? What model best explains the adoption of new product categories? (e.g., what model would you use to predict the adoption of location based wireless applications vs the model you would use to predict the adoption of 3G?)
3. How do the sources of competitive advantage change across stages in the technology life cycle?
4. What are the differences in the way development teams define requirements across stages of the technology life cycle?
5. How to predict the duration of a competitive advantage?
6. What are the factors that distinguish technology companies that exhibit sustainable growth from those that do not?
7. For each stage of the technology life cycle, what factors distinguish successful development projects from unsuccessful ones? For each horizon? For each clock speed?
8. For each stage of the technology life cycle, what are the factors that distinguish successful from unsuccessful technology-based start-ups? For each horizon? For each clock speed?
9. How can technology help protect technology companies from unexpected attacks by external and internal agents? Industry meltdowns?
10. What are the characteristics of successful market and investor offers at each stage of the technology life cycle and what are the differences in market offers and investor offers across stages? Across horizons? Across clock speeds?
11. What are the differences between desirable leadership attributes across stages of the product life cycle? Across horizons? Across clock speeds?
12. Is it better to classify development projects using Moore's stages of the technology life cycle model, the horizon-clock speed model, or Clark-Wheelwright's change in product-change in process model or Kotler's growth model? (i.e., How to classify development projects so we can better identify critical success factors for different projects?)

13. How can a theory of development projects increase the effectiveness and efficiency of product development organizations?
14. What is the product design theory that can help manage development projects and portfolios of development projects?
15. How does customer involvement affect the success of development projects? What are the right models, tools and processes for involving customers in development projects? Does customer involvement change based on Moore's stages? Three horizons? Clock speeds?
16. How does the nature and frequency of announcements of new product introductions vary across stages of the technology life cycle?
17. What are the right models, tools and processes for involving suppliers, investors and distributors in development projects? Does supplier involvement change based on Moore's stages? Horizons? Clock speeds?
18. How do development processes and sales mechanisms change across stages of the technology life? Horizons? Clock speeds?
19. How to support the virtual global teams that develop products?
20. How to compare product development processes? (e.g., what criteria to use when comparing XP vs CMM?)
21. What is the link between technical skills, creativity, and development processes?
22. What is the relationship between a company's market position and technology adoption?
23. How to measure the progress of projects at different stages of the technology life cycle? Horizons? Clock speeds?
24. What are the political and social factors internal to the company that affect the success of development projects?
25. How do trust and conflict affect time to market and product success? What determines trust between development team members? Between customers and team members? Does high degree of trust between members of development teams decrease development time? Product success?
26. What roles (spanners, gatekeepers) increase the success of product development projects?
27. How to concurrently manage the development of products that are different stages of the technology life cycle? How to concurrently manage incremental and radical innovation? How to concurrently manage the three horizons?
28. How to remain close with existing customers while simultaneously protecting the company from missing important market and technology shifts?
29. How to protect a company from industry meltdowns? From unexpected attacks from internal and external agents?
30. What are the right models, tools and processes for developing products fast?
31. What is the relationship between development speed and product success for each stage of the technology adoption life cycle? For each horizon? For each clock speed?

32. What is the relationship between motivation, creativity and development project success?
33. What is the relationship between the CEO's level of technical understanding and product innovation?
34. How to best measure the success of an organization that manages a portfolio of development projects (PDO)? What are the characteristics of effective PDOs?
35. What is the relationship between the horizon-clock speed matrix and the stages of the technology life cycle?
36. How to accelerate the rate of change in behaviour and skills so observable behaviours and existing skills become desirable behaviours and required skills?
37. How does the acquisition of companies affect product development?
38. How do activities completed prior to the date development efforts ramp-up affect development project success? (e.g., how does the source of product idea, type of market research affect success?) How does the extent of external agents (e.g., customer, supplier, investor, partner) involvement in activities completed prior to development affect product success? How does the full time assignment of multifunctional teams affect product development?
39. Does the practice of frequent prototyping accelerate the adoption of new technology?
40. Are frequent team performance reviews by higher management associated with shorter product development time? Is the number of tests of what the team knows associated with time to market?
41. Does the reuse of proven components decrease cycle time? Product success?
42. Do development teams dominated by extroverts outperform development teams dominated by introverts?
43. Is the proportion of stakeholders who share a view of "what the project is" associated with development time? Product success?
44. Is the risk level that shareholders are willing to bear associated with the amount of funds allocated to horizon 2 and 3 initiatives? Is volatility in revenue associated with the proportion of investments in horizon 1?
45. Is time spent in the concurrent design of the supply chain, product and process associated with development time?
46. Is capacity outsourcing associated with development time? Product success?
47. Is the overlap in company and supplier projects associated with shorter development time for the company? Greater product success?
48. How to model relationships anchored around product development efforts?
49. How does a group affect an individual's creativity?
50. How to accelerate the adoption of a new technology? What factors contribute to the replacement of an existing technology?

51. Do technology companies tend to predominantly resort to acquisitions for filling technology gaps during boom times and resort to partnerships during downturns?
52. Do partnerships amongst technology product vendors tend to fall apart during periods of strong economic growth?
53. Do technology companies prefer to partner with a much smaller company for reasons of control?
54. What is the relationship between the size of the potential market and the amount paid to acquire a company?
55. Do acquisitions fail at a greater rate during boom periods than acquisitions carried out during periods of economic downturn?

11. ENGINEERING MANAGEMENT AND MANAGEMENT JOURNALS

The journals most relevant to the engineering management aspects of the TTM program are:

- IEEE Transactions on Engineering Management
- IEEE Transactions on Software Engineering
- Journal of Engineering and Technology Management
- Journal of High Technology Management Research
- Journal of Product Innovation Management
- R&D Management
- Research Policy

The journals most relevant to both the management and the engineering management aspects of the TTM program are:

- Academy of Management Journal
- Academy of Management Review
- Administrative Science Quarterly
- California Management Review
- Communications of the ACM
- Creativity and Innovation Management
- Harvard Business Review
- IEEE Transactions on Engineering Management
- IEEE Transactions on Software Engineering
- Information Systems Research
- Journal of Business
- Journal of Business and Economic Statistics
- Journal of Consumer Research
- Journal of Engineering and Technology Management
- Journal of High Technology Management Research
- Journal of Management Studies
- Journal of Marketing
- Journal of Marketing Research
- Journal of MIS
- Journal of Product Innovation Management
- Journal of the Academy of Marketing Science
- Journal of the ACM
- Management Science
- MIS Quarterly
- Operations Research
- Organization Science
- Organization Studies
- R&D Management
- Research Policy
- Sloan Management Review
- Strategic Management Journal

Most of these journals are available online through Carleton University's Library.

HEC Montréal rates management journals. Their ratings can be found at:

http://www.hec.ca/recherche/liste_revues_html.htm

12.POLICIES FOR THE ETHICAL CONDUCT OF RESEARCH

All research that involves human subjects as participants (including those projects that utilize questionnaires and interviews) must be reviewed and approved by a University Ethics Committee, before the research begins, regardless of

- whether it is funded (e.g., by grant, award, fellowship, contract) or is non-funded;
- whether funding is internal (i.e., from the University), or is from an external source (including domestic and foreign public and private sources);
- whether participants are drawn from University sources, or from any other sources (e.g., workplaces, residences, public places, day care centres, hospitals, other universities, the military, public/private/separate schools);
- whether participants are paid or unpaid;
- whether it is conducted inside or outside Canada;
- whether it is conducted on University property, or at another location;
- whether it is conducted in a laboratory or in the field;
- whether it is conducted in person, or by some other means (e.g., mail, telephone, computer link);
- whether information is collected via direct observation, apparatus, questionnaire, interview, or review of records or other materials not normally available to the public;
- whether it is experimental, correlational, qualitative, or descriptive in nature;
- whether it is conducted to acquire basic or applied knowledge (e.g., safety and function assessments of equipment and materials, product development assessments, personnel selection, consumer preferences, and product evaluation);
- whether the information collected has as its focus the human participant, or some aspect of the environment with which the human participant interacts;
- whether the research is a pilot study or a fully developed project;
- whether it is primarily for teaching or demonstration purposes, or whether the primary purpose is the acquisition of new knowledge.

The process to obtain University approval takes at least three weeks. When there is an issue the process takes longer. Thus, you need to take care of this early on in your research program.

The Most Recent Version Of Carleton University's Policies And Procedures For The Ethical Conduct Of Research can be accessed at http://www.gs.carleton.ca/ors/ors_policy/ethpol00.htm

The most recent copy of Carleton University's Handbook of Research Policies and Procedures can be accessed at: http://www.gs.carleton.ca/ors/ors_policy/index.html

13. INSTRUCTIONAL OFFENCES¹

The Senate of Carleton University has enacted the following regulations for instructional offences at the graduate level:

Any student commits an instructional offence who:

- (a) cheats on an examination, test, or graded assignment by obtaining or producing an answer by deceit, fraud, or trickery, or by some act contrary to the rules of the examination
- (b) submits substantially the same piece of written work to two different courses. Minor modifications and amendments or changes of phraseology do not constitute a significant and acceptable reworking of an essay or paper
- (c) contravenes the regulations published at an examination or which are displayed on the reverse side of a properly authorized examination booklet
- (d) commits an act of plagiarism. Plagiarism will be deemed to have occurred when a student either:
 - (i) directly copies another's work without acknowledgement; or
 - (ii) closely paraphrases the equivalent of a short paragraph or more without acknowledgement; or
 - (iii) borrows, without acknowledgement, any ideas in a clear and recognizable form in such a way as to present them as the student's own thought, where such ideas, if they were the student's own, would contribute to the merit of his or her own work
- (e) disrupts a class or other period of instruction if he or she:
 - (i) is a registered member of the class or period of instruction
 - (ii) is warned to discontinue any act or behaviour reasonably judged by the instructor of the course or period of instruction to be detrimental to the class, and having ignored such warning is ordered by the instructor to leave and refuses to leave
- (f) Any student found in violation of these regulations may be:
 - (i) expelled
 - (ii) suspended from all studies at the University
 - (iii) suspended from full-time studies; and/or
 - (iv) awarded a reprimand
 - (v) refused permission to continue or to register in a specific degree program, but subject to having met all academic requirements shall be permitted to register and continue in some other program
 - (vi) placed on academic probation
 - (vii) awarded a Fail or Absent in a course or examination

Allegations of instructional offence may be investigated by instructors and/or departmental chairs and, in all cases, will be reported to the faculty dean. The dean will promptly advise, in writing, the student and the University Ombudsman of the allegation and of the student's rights. The dean will review the allegation and if not resolved at that level, the allegation becomes subject to final disposition by a tribunal appointed by the Senate. Information about procedure governing tribunals is available from the Clerk of the Senate, Room 607, Robertson Hall.

¹ Carleton University Graduate Calendar, General Regulations, Section 14. This section can be accessed online at http://www.gs.carleton.ca/calendars/current/university/general_regulations.html#14

14.ANSWERS TO FREQUENTLY ASKED QUESTIONS

HOW LONG DOES IT TAKE?

Writing a thesis may take longer than you think. Even after the research itself is all done -- models built, calculations complete -- it is wise to allow at least one complete term for writing the thesis. It's not the physical act of typing that takes so long, it's the fact that writing the thesis requires the complete organization of your arguments and results. It's during this formalization of your results into a well-organized thesis document capable of withstanding the scrutiny of expert examiners that you discover weaknesses. It's fixing those weaknesses that take time.

This is also probably the first time that your supervisor has seen the formal expression of concepts that may have been approved previously in an informal manner. Now is when you discover any misunderstandings or shortcomings in the informal agreements. It takes time to fix these. Students for whom English is not the mother tongue may have difficulty in getting ideas across, so that numerous revisions are required.

Bottom line: leave yourself enough time. A rush job has painful consequences at the defence.

WHAT SKILLS DO I NEED TO DO THIS TYPE OF RESEARCH?

This type of research involves a synthesis. It requires an understanding of the relevant technologies and the use of social science research methods such as case analysis, questionnaire design, and statistical analysis. Students in the TTM program will have sufficient technology training from their undergraduate degrees and technology courses in the TTM program to understand the relevant technologies. The required social science research methods they will learn as part of their management courses and under the supervision of a faculty member.

MAY I SELECT MY OWN RESEARCH TOPIC?

Yes, you can select and develop your own research topic. You will need to ensure that the faculty member you select to supervise you feels that he/she is competent in the area you have selected.

15. TIPS

ALWAYS KEEP THE READER'S BACKGROUNDS IN MIND

Who is your audience? How much can you reasonably expect them to know about the subject before picking up your thesis? Usually they are pretty knowledgeable about the general problem, but they haven't been intimately involved with the details over the last couple of years like you have: spell difficult new concepts out clearly. It sometimes helps to mentally picture a real person that you know who has the appropriate background, and to imagine that you are explaining your ideas directly to that person.

DON'T MAKE THE READERS WORK TOO HARD!

You know what few questions the examiners need answers for. Choose section titles and wordings to clearly give them this information. The harder they have to work to ferret out your problem, your defence of the problem, your answer to the problem, your conclusions and contributions, the worse mood they will be in, and the more likely that your thesis will need major revisions.

A corollary of the above: *it's impossible to be too clear!* Spell things out carefully, highlight important parts by appropriate titles etc. There's a huge amount of information in a thesis: make sure you direct the readers to the answers to the important questions.

A THESIS IS NOT A STORY

A thesis does not follow the chronology of things that you tried. It's a formal document designed to answer only a few major questions.

DO NOT INSULT THE READER

Avoid using phrases like "Clearly, this is the case..." or "Obviously, it follows that ...". Phrases like these imply that, if the readers don't understand, then they must be stupid. The truth is that they might not have understood because you explained it poorly.

AVOID RED FLAGS

Claims that are really only your personal opinion and not substantiated by the literature or the solution you have presented should not be made in the thesis.

16. APPENDICES

APPENDIX 1: GATE 0 FEEDBACK FORM

PRESENTER:

TITLE:

Evidence he/she understands what graduate level research is about

He/She has defined an important research question or problem.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She has built on the existing literature to explain why the chosen research question or problem is important.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained how his/her research would make a contribution to the academic literature and management practice.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She understands the research method that will be used to develop the thesis.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained what variables he/she is planning to measure and how they will be measured.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained what data will be collected, where it will be obtained, and how it will be obtained.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained how the data will be analyzed.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

Evidence he/she can deliver effective presentations

He/She understands the material presented.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She presented excellent slides.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She captured the audience's attention and spoke in a way that the audience could understand.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She managed time properly.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

Recommendations on how to improve

To improve, I suggest you do the following:

1.

2.

3.

4.

5.

APPENDIX 2: GATE 1 FEEDBACK FORM

PRESENTER:

TITLE:

Evidence he/she is ready to collect and analyze data

He/She has defined an important research question or problem.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She has built on the existing literature to explain why the chosen research question or problem is important.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained how his/her research would make a contribution to the academic literature and management practice.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She understands the research method that will be used to develop the thesis.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained what variables he/she is planning to measure and how they will be measured.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained what data will be collected, where the data will be obtained, and how it will be obtained.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained how the data will be analyzed.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained what results will be obtained and how the results will be interpreted.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained what conclusions can be made based on the results that are expected.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She explained the limitations of the research.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

Evidence he/she can deliver effective presentations

He/She understands the material presented.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She presented excellent slides.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She captured the audience's attention.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She managed time properly.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

He/She spoke in a way that the audience could understand.

1	2	3	4	5	6	7	NA
Strongly disagree	Disagree	Will not go along	Probably will go along	Will go along	Agree	Strongly agree	Do not know

Recommendations on how to improve

To improve, I suggest you do the following:

1.

2.

3.

4.

5

APPENDIX 3: SUPERVISOR/STUDENT GUIDELINES²

Fundamental to a satisfactory relationship between a supervisor and a student are mutual respect and a high level of professional integrity. What follows are guidelines to assist in the functioning of that relationship. These are necessarily rather general since it is recognized that different faculties and disciplines have different requirements and expectations which will supplement or give specificity to these general statements.

In those disciplines that do not assign a supervisor on admission, the student should understand that, while the department (the term includes school and institute) will make every attempt to assign the supervisor of choice, the supervisory relationship has to be consensual and determined primarily by competence in the field of the proposed thesis topic, and the availability of the supervisor.

Students in Science and Engineering should understand that their lines of research may encounter some restriction due to dependence upon the research direction of the supervisor who accepts them into the laboratory and provides a significant portion of their income out of his/her research grant.

When a supervisor-student relationship is established, the parties should understand that they assume the following responsibilities and can have the following expectations:

Responsibilities of supervisors

- To be familiar with the regulations and standards of the Faculty of Graduate Studies and Research, and the department, especially as they pertain to the conduct of research and the production of the thesis, and to ensure that the student is aware of these regulations and standards.
- To be aware of and abide by the university's policies on conflict of interest, sexual harassment, and research ethics.
- To assist the student in identifying a suitable research topic and (where appropriate) setting up a program of study.
- To assist the student in the interpretation of research materials.
- To be available for regular and timely consultations with students and to provide notification of lengthy absences and the support mechanisms available under these circumstances.
- To convene meetings of the advisory committee as agreed with the student.
- To agree to continue supervision when on leave, or to assist the student in making arrangements for supervision during the period of the leave.
- To assist students in seeking financial support, especially in writing letters of good quality in support of scholarship and fellowship applications (e.g., well-written, informative, typed, on university letterhead), and to inform a student if a supportive letter cannot be written.
- To read in a timely fashion portions of the thesis submitted by the student and provide constructive suggestions especially vis-à-vis difficulties or deficiencies perceived in the draft.
- To indicate clearly when a draft thesis is in acceptable condition for examination or, if it is clear that the thesis will not be examinable, to advise the student in a timely fashion.
- To complete the supervisor's section of the annual audit form required by GSRO.

² Source: Carleton University, Faculty of Graduate Studies and Research.

- To discuss with the student as early as feasible, any potential joint authorships or joint ownership of data or patents which might arise, provide a written version of any understandings reached on these matters, and also ensure that student contributions to publications are adequately acknowledged. (Granting agencies and major journals have guidelines which cover some or all of these items.)

Responsibilities of students

- To choose, with the supervisor's help, a research topic which the supervisor considers to be suitable and which he/she is competent to supervise.
- To work systematically and within agreed deadlines, as far as possible, in order to meet the program deadlines specified by the regulations of the Faculty of Graduate Studies and Research.
- To be well prepared for meetings with the supervisor.
- To submit to the supervisor all research materials, as requested, and, at the agreed times, drafts of parts of the thesis for comment.
- To give serious attention to the advice and direction of the supervisor.
- To realize that the supervisor has duties and commitments that may delay access at short notice or slow down the return of a draft.
- To acknowledge direct assistance of material drawn from other scholars and researchers.
- To produce a thesis which meets the specifications and standards of the Faculty of Graduate Studies and Research and the department.
- To submit the thesis to the judgment of the department via the examination procedures specified and to abide by the judgment of the examiners, subject to any appeal on grounds of procedural irregularities.

This array of responsibilities imparts certain expectations on the part of both the supervisor and student.

Expectations of the supervisor

- To expect the student to pursue the agreed research topic, unless a change has been mutually agreed upon.
- To expect the student to give serious attention to advice concerning perceived deficiencies in the research and the thesis, and to receive a reasonable explanation when this advice is not followed.
- To terminate supervision if the student is not displaying a reasonable effort, if he/she fails to heed advice on changes deemed essential, or if the student changes the agreed thesis topic without consent.
- To have his/her contribution to the thesis appropriately and clearly acknowledged.
- To have permission from the author of the thesis for the research set out in the thesis to be used as part of the larger project, when the student has produced the research as a research assistant employed on the larger project (with the understanding that the student will retain scholarly credit).

Expectations of the student

- To be assisted by the supervisor in developing a clear and feasible research topic and in solving problems and assessing progress as the work develops.
- To be assisted to a clear understanding of the substantive and formal requirements of a thesis (e.g., length; methodology; validation of topic; degree of originality, especially in masters theses).
- To receive within a reasonable time frame a fair and thorough assessment of both the drafts and the completed thesis, and clear explanations of negative comments.
- To be permitted to seek a new supervisor if it can be clearly shown that the supervisory relationship has broken down or if the student and supervisor cannot agree on a suitable research topic (although it is understood that a department cannot, in every circumstance, guarantee a suitable replacement).
- To be protected from arbitrary changes in research direction which are detrimental to the timely completion of the thesis.
- To have his/her contribution to the thesis fairly reflected in the attribution of authorship of publications and of patents.