Transportation Research @ UofT: Overview and Suggestions to Optimize Your Experience

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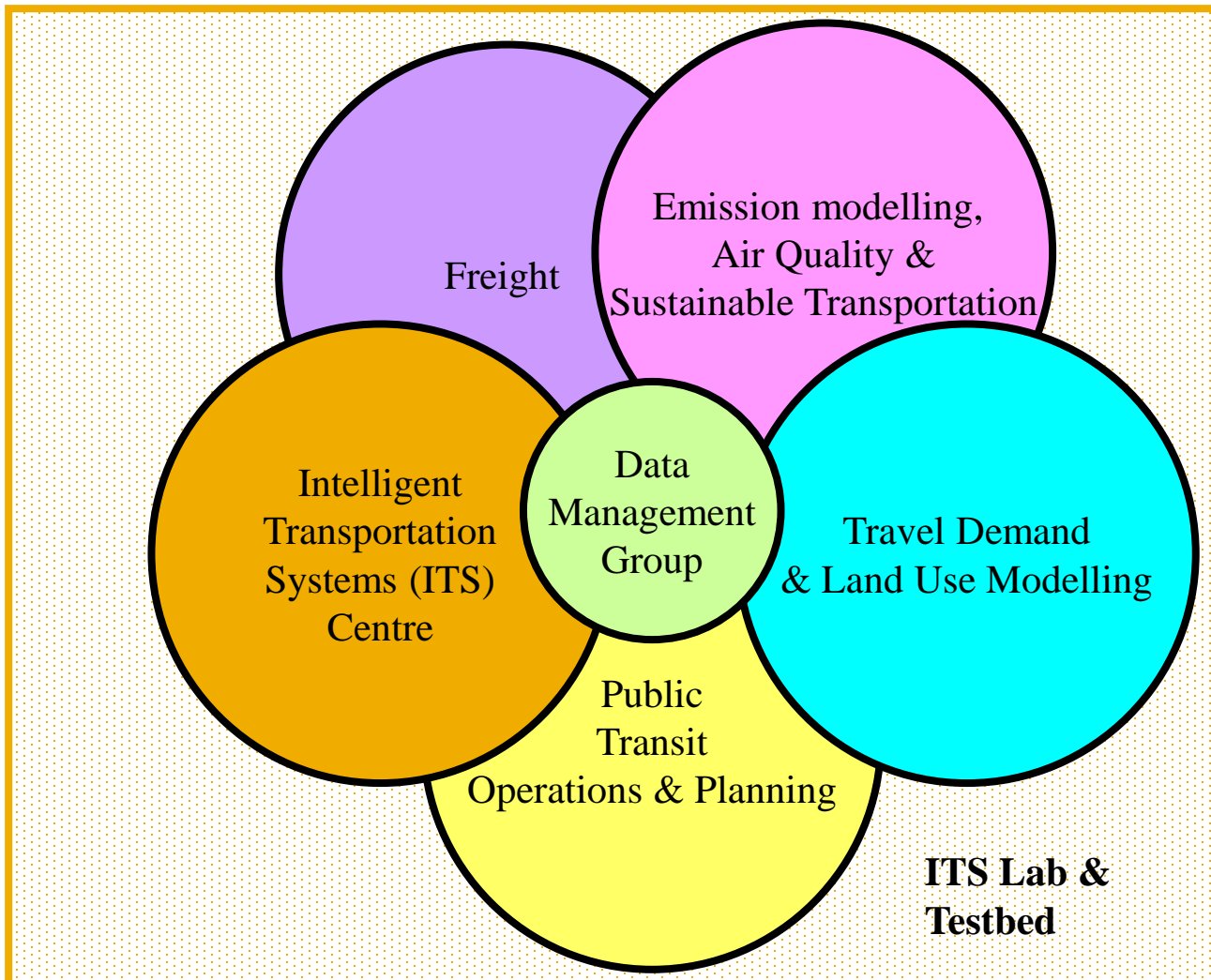
Adapted from previous presentations by
Prof. Mark Kortschot & Prof. Matt. Roorda

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ITS lab

Outline

- Transportation Research at UofT
- Why finish quickly?
- What does your supervisor want?
- How to plan your thesis.
    - Hypothesis and Objectives
    - Scheduling
- Specific tips for keeping the project going smoothly.
- The end product.

Core Strength

Core Transportation Faculty

- Eric Miller:
  - Transportation Planning and Land Use Interaction
- Baher Abdulhai:
  - Advanced Traffic Control and Management
- Amer Shalaby:
  - Public Transit and Mass Events Transportation
- Matthew Roorda:
  - Goods Movement
- Khandker Nurul Habib:
  - Planning and Demand Modelling
- Marianne Hatzopoulou:
  - Emissions, Air Quality & Sustainable transportation

Close Affiliates

- **Heather MacLean:**
  - Environmental Aspects and Alternative Fuels
- **Tamer El-Diraby:**
  - Associate Professor and Director, I2C
  - Infrastructure Information Management
- **Shoshanna Saxe**
  - Sustainable urban infrastructure
- **Daniel Posen**
  - Life cycle assessment, GHG emission, Sustainability

- **Judy Farvolden**
  - UTTRI Program Director
- **Pat Doherty**
  - Events and Communications coordinator

A centre of excellence for transportation research

A space for government/industry/academic collaboration

Dedicated to providing evidence in support of decision making

Graduate Programs

➢ Ph.D.

→ 4 years of funding

➢ M.A.Sc

→ 2 years of funding

➢ M.Eng.

→ No funding

Why Finish Quickly?

o Graduate school is expensive!!!!

Salary-Student: $25K – $8K tuition – fees + TAs = $18K

→ $18K/12 = $1,500/month

→ about $75/working day

Salary-Entry level: $65K – $11K = $54K differential

→ $54K/12 = $4,500/month

→ about $225/working day: 3 times of $75/day

LOST SALARY!

Listening to this lecture has at least $18.75 opportunity cost!

How long is the program?

	TARGET	ACTUAL
→ M.Eng. –	1 year	22 months
→ M.A.Sc. –	18 months	24 months
→ Ph.D. –	48 months	54 months

At the end of your Ph.D., most will realize that every experiment documented in your thesis could be repeated in about **two months!** (Unless you are running inherently long term experiments.)

Why plan?

"Give me six hours to cut down a tree, and I will spend the first four sharpening the axe."

Abraham Lincoln

→Planning is the key to efficient research.

→Planning is the key to finishing quickly.

→Planning is much harder than doing.

Preparing a Plan

- Logistics – what data, software, and materials are needed to be successful?

- Time plan for the entire project

  - Project definition

  - Literature review

  - Experiments – Intermediate milestones required.

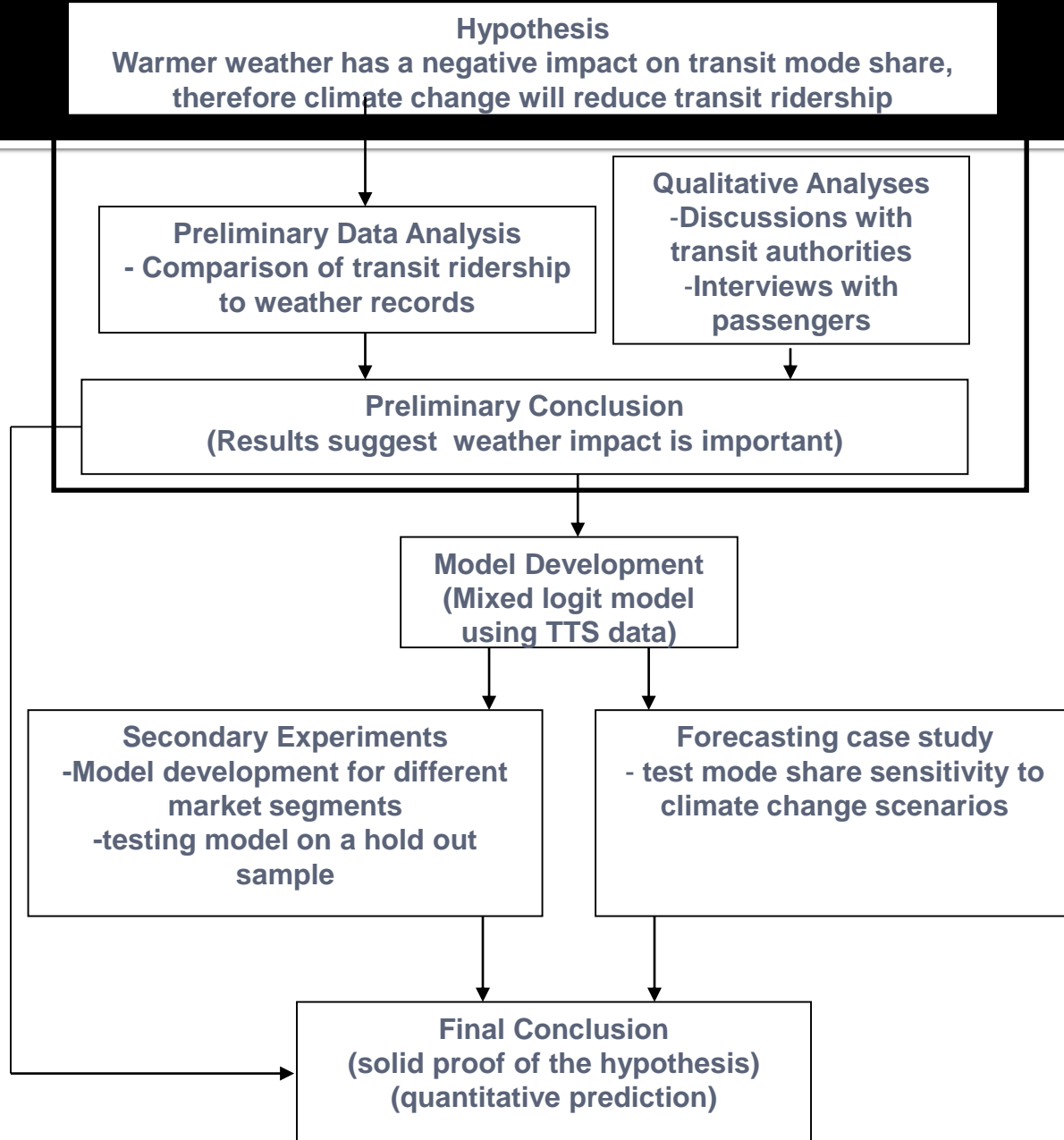 - Analysis

  - Write-up

Knowing where you want to go

- This is the CRITICAL factor!

- You must have a clear idea of your overall goal to work efficiently.

- Planning involves breaking down your objective into smaller, more manageable parts.

Thesis organization

- Detailed Table of Contents

- Flow Chart

- Start with your hypothesis and objectives

- Detail all the elements of the thesis (simulation series A, series B, etc., analytical models, computer simulations etc.)

Example flow chart for a Thesis

Hypothesis
Warmer weather has a negative impact on transit mode share,
therefore climate change will reduce transit ridership

Preliminary Data Analysis
- Comparison of transit ridership to weather records

Qualitative Analyses
-Discussions with transit authorities
-Interviews with passengers

Preliminary Conclusion
(Results suggest weather impact is important)

Model Development
(Mixed logit model using TTS data)

Secondary Experiments
-Model development for different market segments
-testing model on a hold out sample

Forecasting case study
- test mode share sensitivity to climate change scenarios

Final Conclusion
(solid proof of the hypothesis)
(quantitative prediction)

Changes in direction

- Your preliminary ideas about the direction of your work may be drastically modified by the results you collect along the way.

- Each time you change direction – new flow chart and more planning.

- Investigating a general area and deciding that you will "see what comes up" is procrastination, and is a recipe for an extended stay in the department.

Think critically

- Distinguish between what is important and what is not by THINKING about it.

- Think about your data.
  - What is causing the trends you are seeing?
  - What are some possible explanations?
  - What clever tests could be designed to distinguish between the possibilities?

- Critical thinking is the key attribute of a good researcher.

Talk to people about your research

- Other students
- Other professors
- People at conferences

- Your grandmother

Weaker graduate students

- Sometimes don't really know what to do, and thus procrastinate.

- Can busy themselves with a few courses, T.A. duties, "preparing for comprehensive exams", facebook and youtube.

- Spend all their time on easy to manage, short term tasks (reading specific papers, doing specific analysis) rather than looking at the "big picture".

- Are satisfied with brief trivial meetings with their supervisor – even happier when the meetings are cancelled.

Good graduate students

- Have multiple things on the go, and always have something to do if there is a delay on one aspect of their thesis.

- Put aside specific time for their thesis, when they will not do short term things like answering email, studying or T.A. work.

- Make "big picture" planning a regular exercise : Understand the overall scope of their project and how what they are doing today will fit in.

- Are not satisfied with brief trivial meetings with their supervisor – are upset when the meetings are cancelled.

Your supervisor (in general)

- Has a mortgage, kids, in-laws, back pain and a leaky basement

- Always busy with multiple tasks, many of them due yesterday

- May be secretly happy when you cancel a meeting, unless a paper is overdue.

- Has many students and often can't remember details of your last discussion.

- Needs to be prompted to action.

- Wants you to be punctual, industrious, careful, and creative.

- Wants you to drive your project forward and to show initiative and enthusiasm.

- Cares about your project – but not as much as you should.

- Will still have a career even if you don't finish.

You and your supervisor

- This is the key relationship during graduate work.

- You deserve adequate time from your supervisor, and s/he deserves adequate work/effort/talent from you.

- You should meet on a regular basis.

- You should make it a point to talk about the big picture.

- Don't walk out of meetings having discussed only trivial details unless you KNOW how those details fit into the overall plan.

A poor meeting with the supervisor

- Student: "I did the experiments/modelling we discussed last week, but instead of Y increasing with X, it decreased a bit and then levelled off."

- Blank stare from supervisor

- Blank stare from graduate student.

- Supervisor finally pitches in with a few suggestions, only half of which student really understands, although he is too intimidated to point this out.

- Meeting adjourns after student promises to work on the suggestions, and before he gets out of the office, the supervisor is already answering email.

- Repeat endlessly.

A good meeting with the supervisor

- Student: "I did the simulations we discussed last week, but instead of Y increasing with X as expected, it decreased a bit and then levelled off."

- Blank stare from supervisor.

- After a brief pause student suggests: I think the problem could be our assumption K , and I plan to test this by rerunning the simulation with a better assumption Q that was used by Dr. G.'s 2018 paper in Transportation Research Part Z.

- Supervisor nods helpfully, and after the student explains in more detail, thinks to herself how easy it is when a student is competent and motivated.

- Move on to next issue.

Other useful traits

- Methodical, meticulous, reliable
  - Documentation is thorough, dated.
  - Experiments , coding, calculations are trustworthy

- Industrious
  - Must put in the hours to achieve results.
  - 40 hrs/week should be enough if working efficiently.

- Creative
  - Ability to devise good hypotheses and experiments.
  - Quite different from the exam passing skills that won you a place in graduate school, but correlated to those skills nevertheless

Tips to keep your project running smoothly

- Identify the critical path
    - Do you need to learn some software, acquire some data, or develop a model before other tasks can be done?

- Schedule concurrent tasks
    - You should always have something to do if there is a delay in one task.

- Have backup plans in mind
    - If there is a significant risk of part of your research not working out.

Tips to keep your project running smoothly

- Test extremes first, to confirm that there is something worth testing, then fill in the intermediate points.

- If possible do a trial run through all parts of your thesis: Data collection, modelling, analysis etc. Don't collect all data first, leaving the analysis to the end.

Writing Up

- The most important element of any document is the

    ## STORY.

- The key to a good story is a proper outline and appropriate organization.

- Do some write up as you go. It helps you identify missing things, weak points.

Conclusions

The keys to efficient research are:

1) A clear objective, preferably founded on a strong scientific hypothesis.

2) A clear grasp of the overall scope of the work, and the various elements that will form part of the final document.

3) A detailed plan, with manageable subtasks well defined.

4) The use of the experienced researcher's tips – concurrent tasks, testing extremes, testing every part of the thesis on a trial set of data.

5) Critical thinking at every step.