

Workshop

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Structure

- Answer some of your questions or apprehensions?
- Difference between taking course work and working on doctoral research
- What is your motivation or goal going forward?
 - What (are you doing), who (cares), and where (would you like to be in five years)?

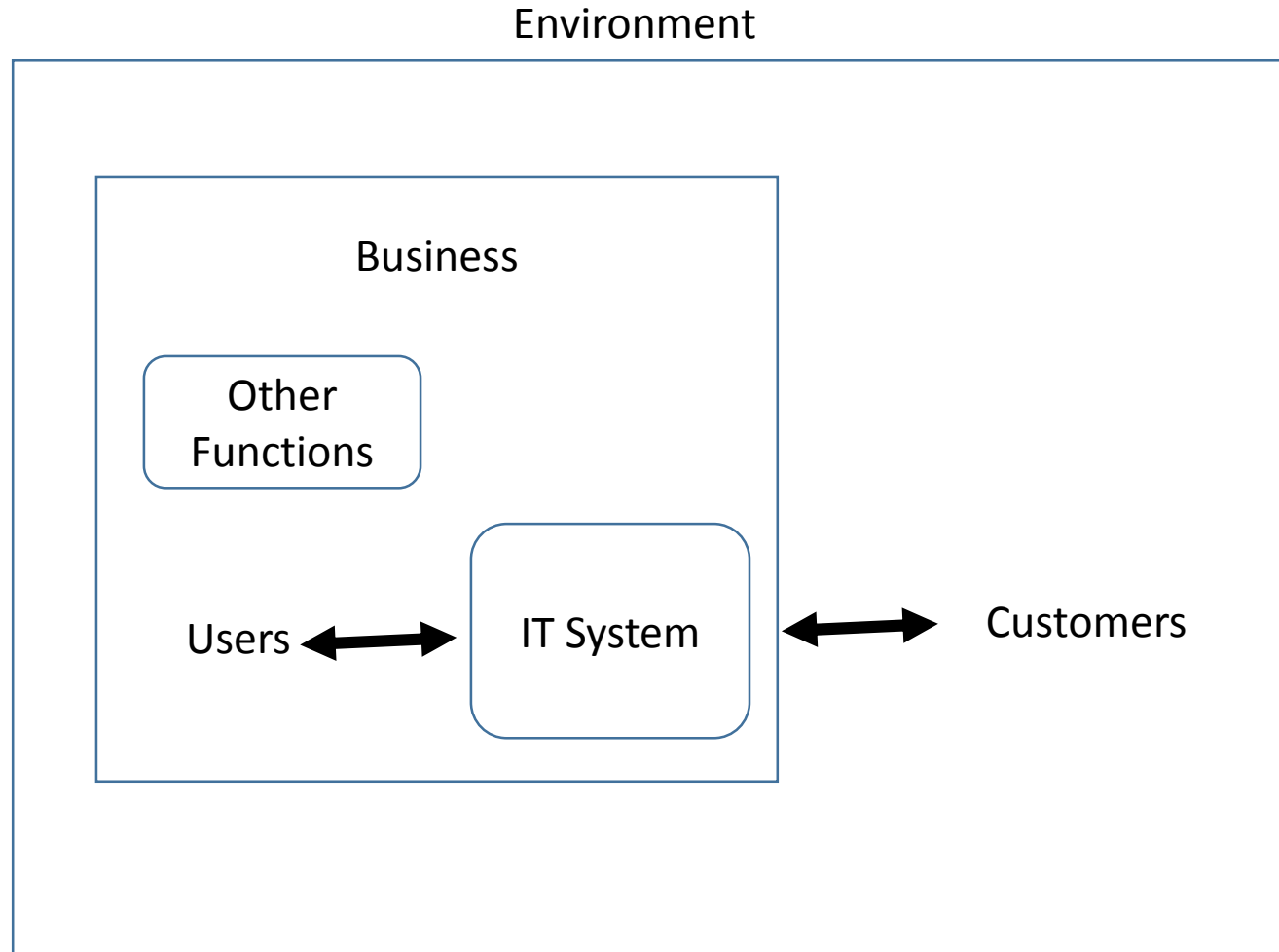
Goals for Discussion

- **Philosophy**
- Research Questions - Examples
- Role of Research Proposal in a thesis
- Feasibility of research project
- Structure and contents of Research Proposal
- Overview of research process
- Experience sharing and open discussion

Before we get started - A bit about my philosophy

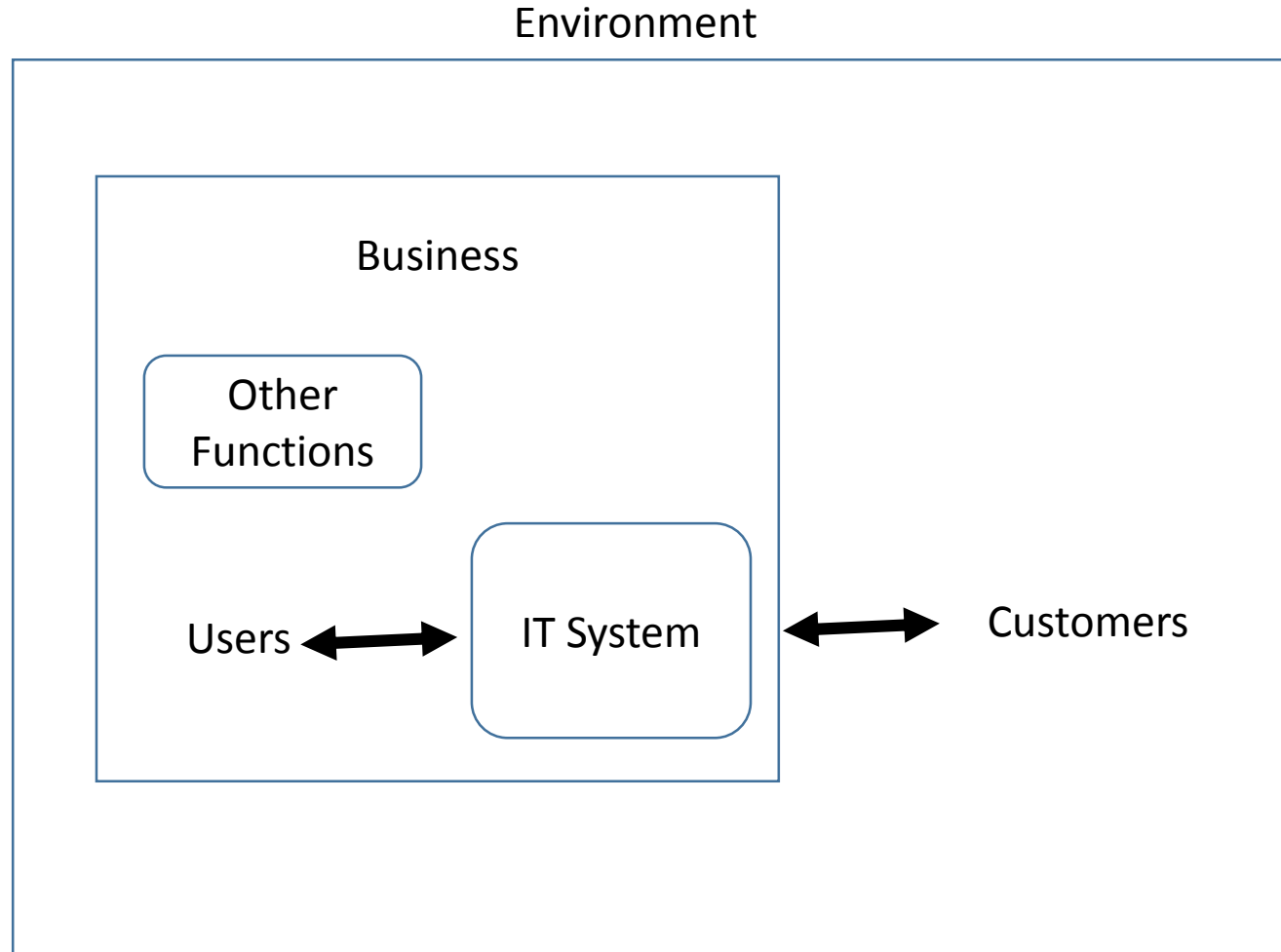
- Coordinated about 10 Ph.D. Dissertations and was a committee of many (over 25)
- Always wanted the thesis/dissertation of the student to solve a real world problem
 - Research proposal came out of a real world challenge as opposed to extending an existing theory and look for a real world to test it for relevance
- Examples of some of the dissertations supervised

Framework



Framework with an IT/Digital Focus

- How to be innovative?
- How to plan options to meet goals?
- How to extract user needs/knowledge?
- How to ensure its accuracy?
- How to design for performance (execution, storage)?
- How to evaluate its output effectiveness?
- How to make sure users adopt it?



Formulating a Research Question

- **Environment** - What mechanisms organizations use to make their people innovative? – Organizational
- **Planning** - How does one generate options to reach a business goal and select one that meets most criteria
- **Analysis** –
 - Resource managers make decisions on allocating resources among competing priorities. What knowledge do they use it, so it can be captured for reuse? – Analyzing decision process
 - How to accurately document what the user said about their requirements, so systems can be designed – Analyzing operational processes
- **Design**
 - How to improve the system performance of a knowledge management system? – technical system operational (performance time) efficiencies
 - How does one store business (operations research) models for future search and retrieval? - technical system (storage) efficiencies
- **Implementation- evaluation and user adoption**
 - How to validate an expert system for its effectiveness in making decisions? – evaluation of output accuracy
 - Electronic Medical Records are used by hospitals to share patient data across multiple care delivery units, but their use has been somewhat mixed - adoption by users to realize benefits

Environment - Innovation



- S. Nambisan, R. Agarwal, M. Tanniru Organizational Mechanisms for Enhancing Users' Propensity to Innovate in Information Technology, MIS Quarterly, 1999, Vol. 23, No.3, Sept. 365-395
- Work at companies that wanted to support innovation among employees
 - Empirical testing of a theory - Role of knowledge transfer mechanisms used to support innovation

Theory - Innovation is key to organizations

Ideas get generated by individuals in an organization, if right environment is provided

To generate ideas, theory says people need to be aware of new knowledge, have the ability to test this knowledge for its viability, and have the motivation/intention to do so

This research focuses on awareness

– How do organizations make their employees become aware of new knowledge?

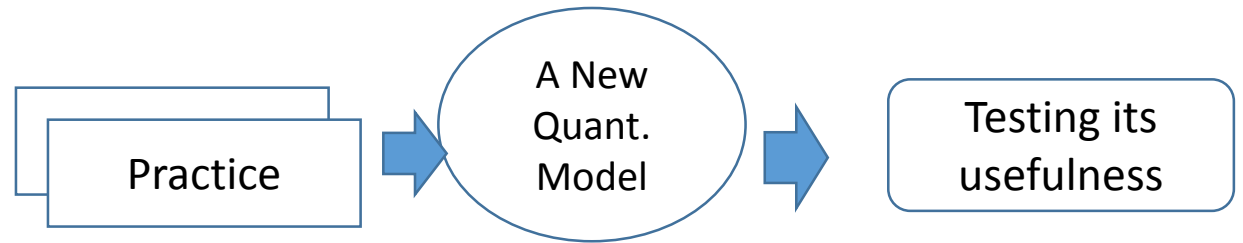
-- New knowledge can come from many sources – internal as well as external

Different knowledge sources were identified from research

These were tested empirically in multiple organizations to see which mechanisms seem to be viewed as most effective

Planning - Alternatives

- H. Jain, M. Tanniru and B. Fazollahi, MCDM Approach for Generating and Evaluating Alternatives in Requirement Analysis, Information Systems Research, 1991, Vol.2, No.3, 223 239.
- Understand and improve process used in corporate budgeting in organizations
 - Use algorithm modeling to test group decision making theory



Executives evaluate alternatives to decide which one's get funded
Our practice showed that managers make trade-off decisions between return and risk. Methods like optimization, multi-criteria decision making, etc. are used.

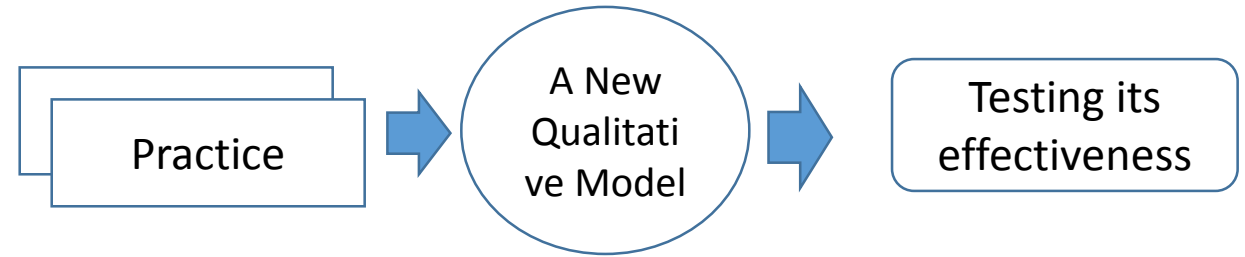
No method seem to provide an effectively way to rank order goals and allow alternatives presented that trade-off among goals (certain reduction in high priority goal for a larger improvement in low priority goal, etc.)

A goal programming method was proposed to test how an organization can evaluate different IT projects based on the goals they meet

The method is applied to a real world case

The results were evaluated by managers for “face valildity” – are they reasonable?

Analysis – Knowledge Extraction



- R. Agarwal and M. Tanniru, Knowledge Acquisition Using Structured Interviewing: An Empirical Investigation, Journal of MIS, summer 1990, Vol.7, No.1, 123 140.
- Improve acquisition of knowledge from experts in building AI systems
 - Use content analysis to test theories on structured interviewing and expert decision making

Executives make resource allocation decisions and this is complex process. Even before they try to trade-offs between risks and returns, they first need to understand various factors that contributed to risks and returns (competitive factors, market demands, opportunities to lead, organizational capabilities, etc.)

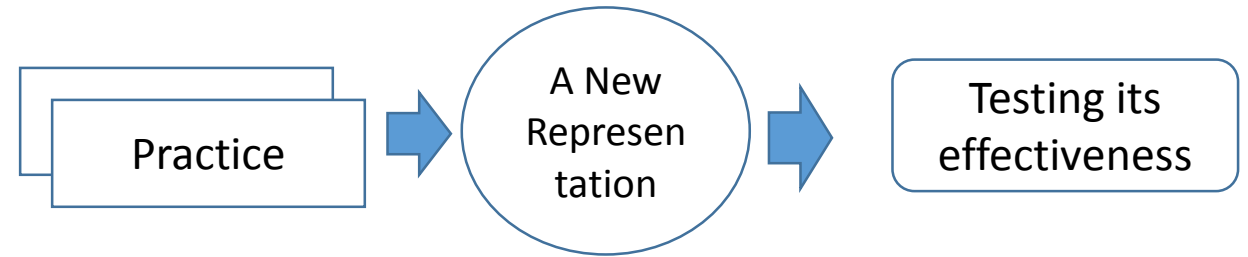
What are these factors?

Because these are complex, how do we get the experts to tell us, as this knowledge is difficult to extract. Tacit knowledge can be extracted better with semi-structured interviews than unstructured interviews. Not much research was done in this area Interviewed 30 using all three methods (structured, semi-structured based on some cues - hybrid, or unstructured. Defined knowledge as rules, factors, situations, etc.

Demonstrated the effectiveness of hybrid approach

Analysis – Verification of Communication

- S. Sakthivel and M. Tanniru, Information System Verification and Validation during Requirement Analysis using Petri Nets, Journal of MIS, Winter 88 89, Vol.5, No.3, 33 51.
- Check for consistency in the process knowledge acquired during systems development
 - Use algorithmic modeling of process knowledge to test for its consistency



Practice shows that we document systems to capture the flow of processes and work in organizations. The current practice leads to errors, inconsistencies, etc. as the size of the system document grows, and business users and IT don't understand each other well.

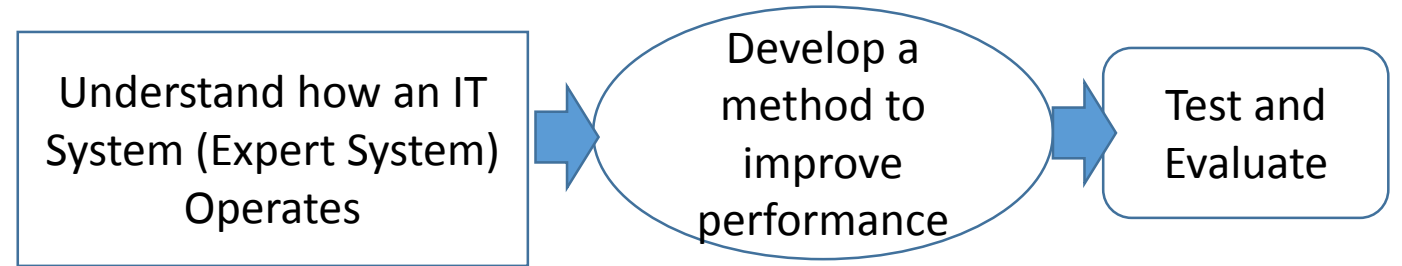
Petri Nets in Engineering are shown to be effective in detecting errors – missing, inconsistent, redundant information

Can this representation be applied to business requirement analysis in business?

Used multiple cases to show that what conventional data flow diagrams miss, Petri nets are able to detect.

Design – Process Performance

- D. Gulati and M. Tanniru, A Model Based Approach to Investigate Improvements in Performance of Rule Based Systems, Decision Sciences, Jan./Feb.1993, Vol.24, No.1.
- Improve knowledge base system performance at Carrier Corp.'s expert system
 - Use algorithm modeling and simulation to test “search” process used in expert systems



Expert systems use rules use and when the number of rules is large, the computer performance degrades, because of the way rules are executed (sequentially)

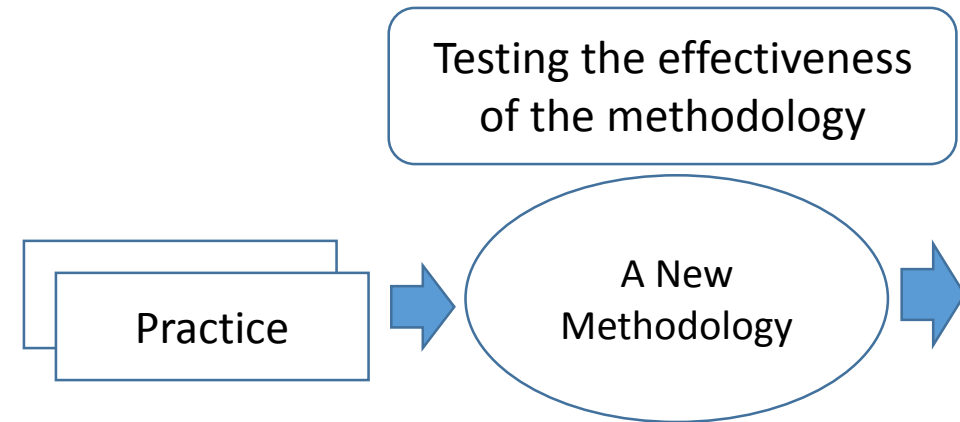
Rules can be re-ordered based on how the expert system executives rules, so that performance can be improved – an output can be generated faster

We identified different ways to reorder rules based on the nature of inputs and past history

Simulated the time computer takes to generate an output, and showed that it does improve the performance

Design – Storage for reuse

- J. Blin, E. Stohr and M. Tanniru, A Structure for Computer Aided Corporate Planning, Policy Analysis and Information Systems, June 1979, Vol.3, No.1, 111 140.
- Improve consensus seeking in corporate planning
 - Use algorithmic models to simulate planning process for evaluation



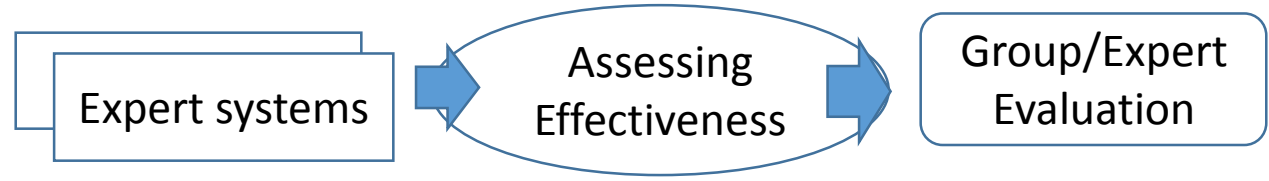
Executives make planning decisions using input from business units and developing targets. These targets have to be sent to units for reconciliation. It is often a messy process

The business units use a number of models to make decisions and these evolve over time. These models need to be stored for future user, especially as planning process needs to make trade-offs as a part of budget negotiation.

No effective way to store these models for easy search/retrieval
Developed a data base for models
Demonstrated how it will work using a planning process used in budget negotiations

Implementation – Output Evaluation

- R. Agarwal, R. Kannan and M. Tanniru, Knowledge Based Support for the Design of Information System Controls, The Journal of Accounting Systems, Fall 1992, Vol.2.
- Test knowledge base system effectiveness in auditing an internal controls
 - Use qualitative evaluation of output from experts and KB System developed based on internal control expertise at Carrier Corp



Expert systems are known to capture expert's knowledge so they can perform as good as experts, in some cases.
How do we know that?

We selected a semi-structured domain (internal control evaluation of a manufacturing firm's operations) . We used a well established test used in the literature (Turing test)

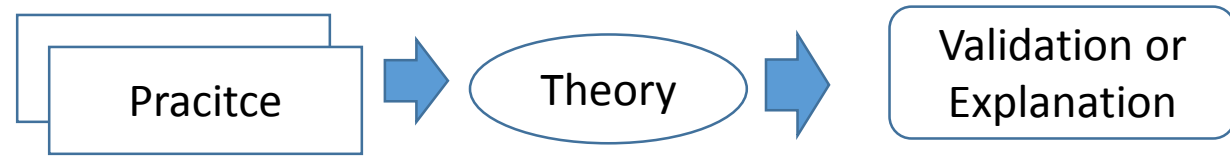
Selected five cases, 10 auditors

5 auditors and ES were given the cases to generate internal control evaluation

5 new auditors were used to evaluate blindly the five cases and six answers (w/o telling them which of the six is from a system)

Showed the system performed as good as experts in four of the five cases

Implementation – User Acceptance



- K. Fadel, Brown, S. and M. Tanniru, “A Theoretical Framework for Knowledge Transfer in Process Redesign,” Data Base, Vol.39, No.3, 2008.
- Work at Kaiser Permanente on Elec. Med. Record Implementations: Challenges in Adoption of Technology
 - Building a theory of mental models to support change from case studies

Practice in healthcare shows that EMR systems are not always adopted by physicians and in some cases by others

Preliminary research showed that this is a persistent problem.

Reviewed for research for a theory that looks at how people learn to change by altering their mental model from one representation to another – structural changes as opposed to surface level changes

We used interviews from one implementation to see if the lack of adoption can be explained by this theory

Goals for Discussion

- Philosophy and Examples
- **Research Agenda**
- Research Proposal
- Feasibility of research project
- Structure and contents of Research Proposal
- Overview of research process
- Experience sharing and open discussion

Research Agenda

- Define the problem
- What has prior research shown on how to address this problem and where are the gaps?
- Research question – addressing the gap or one of the gaps in prior research
- How do you propose to address it?
 - Is there a theory that you can rely on to address this?
 - Develop a model, an approach, or a system to address the gap
 - What are the expected outcomes that will show that if you answered the question.
 - Design the experiment to test your model/approach/system
 - Analyze the results to answer your questions
- Discussion of the results and their implication to current theory and/or future practice
- Discussion the limitations of your work and extensions to pursue from this work

Research Proposal

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An Intermediate Step: Feasibility of research project

- Is the research question too broad to get a definitive answer?
- Is the model/approach/system based on prior theory or is it extending current research?
 - If not, you need to show why the model/approach etc. is novel or create new knowledge.
 - Often this can be hard to show.
- Do you have access to the data to answer the research question?
 - If not, you have to create a simulated experiment, that approximates the real world, to test your hypothesis
- Do you have adequate sample points or enough number of cases to show that the results you have gotten can be generalizable?
 - If you happen to use small data sets, convenience sample, or fewer number of cases, then you need to enrich the analysis using multiple types of data
 - Qualitative to go along with quantitative, sometime secondary data from other sources, deeper analysis of the cases or longer time horizon to show a trend/behavior, etc.
- Is it doable in the time frame you have?

What can go wrong in the second half?

- Define the problem
- What has prior research shown on how to address this problem and where are the gaps?
- Research question – addressing the gap or one of the gaps in prior research
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Overview of research process

- Unanticipated Problems in the second phase
 - Is the test becoming too complex?
 - Is the data promised missing or has become difficult to acquire?
 - Is the outcome completely not what you expected?
 - Is the data too small to draw any meaningful conclusions/
 - Can you change the way data is gathered?
 - Does it call for broadening or narrowing the scope of the study?
 - Can you change the research question?