

The [Tennenbaum Institute](#) (TI) was founded at Georgia Tech to study how large, complex organizations change over time to adapt to new requirements and opportunities and to react to crises. Consider the U.S. healthcare system's need to transform into a system that provides affordable and quality healthcare, the U.S. military's need to change from fighting traditional wars with major powers to fighting terrorism and insurgencies, the need for information and telecommunications companies to adapt to converging and rapidly emerging domains or the need of manufacturers to operate on a global scale, collaborating with partner organizations.

These types of needs did not arise overnight. However, it is fundamentally difficult for such organizations to change continuously to adapt or react in real-time. Thus, organizations often are faced with the need to transform themselves significantly, once dramatically new requirements or opportunities are perceived, or a crisis is at hand. This process is called [Enterprise Transformation](#).

The Tennenbaum Institute has developed a unique strategy for studying and addressing enterprises and their needs to transform. By joining our program, you can become prepared for an exciting career engaging in and leading the transformation of today's enterprises to meet today's and, hopefully, tomorrow's needs and challenges.

Domains in Transformation

Our focus is on the healthcare and manufacturing domains, where significant change is needed for enterprises to remain competitive, and perhaps even solvent. The goal is first to understand the forces driving the need for change and the current (or *As-Is*) state and structure of the organization and then specify the *To-Be* organization, as well as the transformation plan in terms of intents, scope and means.



Healthcare. The cost of healthcare in the United States, as a percentage of GDP, has been steadily increasing for many years and far exceeds the costs of other developed nations. Unfortunately, the quality of care in the U.S. is not comparable to that of other developed nations, especially for chronic rather than acute health problems and especially for lower income people. The overarching difficulty is that the "system" is basically an immense federation of entrepreneurs with no one in charge. More formally, healthcare in the U.S. is a complex adaptive system. Our initial models of this complex system have shown that two issues underlie the system's deficiencies - information and incentives. Operational information does not flow efficiently among the elements of the system. Further, the vast amount of information generated daily is not used to provide an evidence base for affordable, quality healthcare. Incentives in the U.S. healthcare system are not aligned with

enhancing affordability and quality. Providers are reimbursed for their activities rather than their health outcomes. The pressures to reduce costs significantly undermine the possibilities for enhancing value, particularly in the sense that a healthy, productive population is important to global competitiveness. Our research focuses on developing mathematical/computational models of the healthcare system, including serious games, and using them to inform policy and management, by demonstrating the economic impacts of providing better information and different incentives to patients, providers, suppliers, and other stakeholders. Our models are benchmarked against various national databases, as well as applied in specific areas such as diabetes, traumatic brain injury and public health.

Global Manufacturing. For a number of years, manufacturing companies have been rationalizing their business and production processes, and outsourcing those processes which can be done more effectively or efficiently by other companies. Outsourced processes typically have been well defined activities, such as accounting, payroll, or the manufacture of a specific part or subsystem. This type of collaboration is very well defined, and can be handled by traditional contracting practices. A new trend is emerging in which the nature of collaboration is dramatically changed - in Network Centric Manufacturing (NCM) many firms collaborate across the spectrum of activities from product development and design, through manufacturing, to product support during useful life, to end-of-life treatment. In NCM, processes located in different companies, different continents, and speaking different languages are expected to interact as if they were co-located and speaking a single language. NCM raises a number of fundamental questions, from the design of collaborative manufacturing networks, to the strategies for managing them, to the technical details of process interfaces and process controls. These questions, in turn, pose fundamental challenges to our ability to model such systems, to discover, articulate, capture, create, and re-use relevant knowledge, and to provide the kinds of decision support needed in such large scale, collaborative systems. Examples of the kinds of research being conducted include helping a major automobile company envision the factory of 2030 and begin to develop the organizational structure, strategies, skills and methods to create and operate that factory; helping a major aerospace company develop the global delivery system needed to support network centric manufacture of a next-generation aircraft; or helping a major aerospace company develop a model-based approach to facility development that will parallel the model based approach to new airplane development. Our research on global manufacturing depends on solid knowledge and skills in the traditional operations research (OR) methods (decision analysis, statistics, stochastic processes, and optimization), along with strong skills in modeling and simulation, enthusiasm for computation, and good people skills.



Research Themes

Several themes underpin this notion of organizational change and transformation; TI's graduate students address them in their research.

Change. Enterprises face constant change in today's global business environment. Institutional pressures, regulatory requirements, technological advancements, innovations, and economic conditions require enterprises to reassess and often change their mode of operation, business processes, product and service offerings, and interfirm relationships. Change is thus a core element in the study of enterprise transformations. We study drivers and enablers of change from strategic, technological, process, human, and organizational culture perspectives. Specific research questions include how enterprises adapt to change, what conditions facilitate or inhibit change, and how to successfully implement and manage change initiatives.

Architecture. Enterprise architecture is the structure of organizations and relationships between them within the overall enterprise. Often, architectures are not designed; rather they emerge over time. A fundamental question is how to conceptualize, design and improve architectures to support enterprise objectives, exhibiting robustness as these objectives change over time.

Networks. Virtually all of today's products and services are created and delivered through complex and large-scale inter- and intrafirm networks. This is particularly the case for healthcare and global manufacturing. We study how the structure and dynamics of complex networks enable and drive strategy, collaboration, operations, innovation, knowledge, and value creation. Specific research questions include how to effectively manage, lead, and design complex networks, how networks evolve over time, or what implications globalization, culture, incentive structures, and policies have on the performance of networks.

Complexity. The enterprise of healthcare delivery in the U.S. and the global manufacturing networks of NCM are, without doubt, complex systems with many stakeholders, often with conflicting interests and degrees of independence seldom seen with traditional systems. Research in this area focuses on formal definitions and models of complexity, assessments of the complexity of markets and enterprises within the framework of these definitions and models, and development and evaluation of methods for designing and managing complexity.

Collaboration. Increasingly, collaboration involves complex interactions among participants who are separated by geography, time, organizations, and corporate identity. We study ways to enable collaboration in this new setting, using a broad spectrum of approaches, including interaction protocols for both physical and virtual meetings, technologies to support simultaneous and asynchronous meetings, technologies for identifying, capturing, and making explicit important common knowledge, technologies for rapidly formulating alternatives and carrying out what-if analyses, and technologies for creating and capturing new enterprise knowledge.

Innovation and Integration. Innovation is the process of creating change in the marketplace. In today's global and dynamic market, innovation is not only considered a core business necessity, but also key to a overall competitiveness. It is common knowledge that companies that fail to innovate tend not to survive. We study how enterprises create and manage innovations in complex organizational systems. Specific research areas include the examination of the value and impact of innovations on enterprises, the management of innovation, the role of information and incentives on innovative behavior of enterprises, and the complexity of innovation networks.

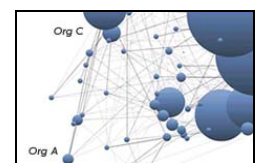
Methods and Tools

TI is creating new, cutting-edge methods and tools to enable the process of enterprise transformation. Graduate students are involved with developing such methods and tools and using them to study problems of interest in their research.

Systems Modeling. Complex systems cannot be studied effectively if they cannot be explicitly described. New systems modeling tools, like SysML, provide the technology to enable formal modeling of complex systems. What is needed are the modeling practices, including modeling libraries, that allow large scale modeling to be fast, correct, and effective.

Organizational Simulation, Games and Visualization. Transformation involves considerable risk due to significant uncertainties and costs. Executives would like to be able to experience the transformed enterprise before making critical transformation decisions - to drive the future before writing the check. TI is developing new technologies to enable this capability, ranging from detailed constructive simulations of organizational behavior and performance, to online games where managers and policy-makers interact with the to-be enterprise to explore its characteristics. Visualization is a key technology to facilitate understanding of complex datasets presented by such simulations and games.

Economic and Financial Modeling. A primary consideration when entertaining changes of complex organizational systems is the economic value of such change. Beyond the costs of changes, those who invest in change want to know what these changes are worth. Hopefully, the worth far exceeds the cost. Research in this area focuses on characterizing and modeling the future cash flows created by current investments in change. This often involves consideration of the multi-stage nature of such investments, as well as the significant uncertainties associated with future returns.



Statistical Modeling and Data Mining. Today's world is awash in data. But what senior executives really need is useful information. New methods are needed to extract such information from large, complex corporate and government datasets, to support long-term transformation decisions.



Organizational Culture Change. Fundamental change is often quite difficult because one has to manage the “as is” enterprises while also trying to create the “to be” enterprise. Research in this area often involves case studies of how major change evolved in, for example, the retail and automobile industries. Also of significant interest is how new inventions provide the basis for market innovations and how such changes can be anticipated or at least identified.

Recent Dissertations and Theses

A sample of recent dissertations and theses of TI graduates is shown below.

- Modeling and Analysis of Complex Technology Adoption Decisions: An Investigation in the Domain of Mobile ICT
- Process and Outcome Factors of Enterprise Transformation: A Study of the Retail Sector
- The Economics of Enterprise Transformation: An Analysis of the Defense Acquisition System
- A Real Options Approach to Modeling Investments in Competitive, Dynamic Retail Markets
- Assessing the Maturity of Information Architectures for Complex Dynamic Enterprise Systems
- Tamper-Resilient Methods for Web-Based Open Systems

The Tennenbaum Institute has an excellent placement record, reflecting both the quality of the people we admit and the rigorous training and supportive environment we provide. Many of our students have gone on to teach in major research universities similar to Georgia Tech, while others have pursued careers in government and private industries, at prestigious firms such as the Boston Consulting Group and Goldman Sachs.

Candidate Qualifications and Application Process

Candidates should apply for enrollment in one of Georgia Tech's academic units relevant to the candidate's background and interests. Information on the application process, including deadlines, contact information, and addresses, is available from Georgia Tech's Office of Graduate Studies (www.grad.gatech.edu).

TI's desired candidate qualifications include:

- Education in engineering, management, computer science, public policy, economics, or related discipline
- Interest in enterprise transformation, in particular healthcare and global manufacturing, as outlined above
- Experience and interest in modeling, analysis, simulation, and visualization of complex organizational systems
- Strong work ethic and motivation to publish in peer-reviewed scientific journals
- Ph.D. students are preferred, but exceptional M.S. student candidates will be considered
- Previous programming/web development experience is highly preferred
- Previous industry experience is highly preferred
- Excellent skills in English writing and verbal communication are essential

In addition, applicants should submit a cover letter and resume via email to Dr. Rouse or Dr. McGinnis. The cover letter should state the academic unit and degree of application and should summarize background and research interests. Please include “TI Graduate Studies Application” in the subject line. Applications will be reviewed upon receipt and on an ongoing basis. Early applications are encouraged. Georgia Tech is an AA/EOE.

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