MIT Supply Chain Education Partners Program

2010 – 2011 Guidebook

www.mit.edu/mlog/research

Massachusetts Institute of Technology

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Hello and thanks for the interest in CTL's Supply Chain Education Partners (SCEP) Program!

This short guide is designed to help you understand the SCEP program. It was started in the fall of 2002 with an initial group of five companies with a substantial local presence. During the first year, these firms sponsored seven different students' theses, hosted numerous facility visits, and served as corporate speakers to the MLOG class. We have had over 100 student projects conducted with companies such as adidas, Boston Scientific, Cardinal Healthcare, Chiquita, CVS, General Mills, Gillette, Intel, Lucent, Pfizer, Procter & Gamble, Reebok, Shaw's Supermarkets, Shell Oil, Solutia, Unilever, Wal-Mart and others.

Students benefit by being able to work closely with professionals on a challenging supply chain problem that will turn into their thesis. Companies benefit by having a student team bring new insights and approaches to a current supply chain project.

The rest of this document is divided into four sections. First, it explains how the program works and lays out the timeline for the 2010-2011 academic year. It then discusses typical deliverables that result from the project. The third section provides some tips in determining the types of projects best suited for the program. Finally, we provide a template for a project scope document along with some samples from previous years.

Please feel free to contact me directly if you have any questions or concerns about the upcoming year's Partner Program.

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1. Process and Timeline

The master's thesis project follows the academic calendar with the projects starting in August and finishing the following May. The cost for the program is $10,000; and in order to participate, the company needs to be a member of the CTL Supply Chain Exchange.

The first step for a participating company is to select both a project topic and a project lead to act as the main point of contact. Section 3 of this document provides some guidelines on project definition. We are glad to work with companies during the summer to help define the project scope and description. We use a 1-2 page scope document (see the template and examples in Section 4) to summarize the project. The project scope document should be completed by August 6, 2010.

During orientation in August, the students are given scope documents for each of the potential projects. We strongly encourage companies to present their project in person at MIT and meet the students. We have set aside two Thursday afternoons during the orientation period for company presentations: August 26 and September 2 (others afternoons added as needed). You can combine this visit with an information session about your company to get a head start in the recruiting process.

In September the students bid on the projects and then are assigned projects and thesis advisors. The kickoff meeting should take place by early October to formalize a project plan and define resource requirements. Throughout the fall semester, the student-company team will complete the problem description and begin data collection. Additionally, students will conduct a literature review on the problem using MIT's research libraries as well as select/learn analytical and methodological approaches. The students submit an interim report at the end of December.

In January, the students have more time to work on their research projects and can more easily spend some time on site (if needed). The sponsor company must cover any travel expenses. Also, on January 13, 2011, all students from MLOG and ZLOG (its sister program in Zaragoza, Spain) prepare a poster about their thesis research and present it at a special Poster Session & Networking Night.

Throughout the winter and early spring the student team continues to meet regularly with the company team to review their analysis and interim results. The projects wrap up in early May and all students present their thesis results at a research event May 24-25 at MIT. All CTL Supply Chain Exchange member companies are invited to this event.

The thesis project is an academic requirement for the MLOG students and must be completed by the deadline in order for the student to graduate. The timeline for these projects is shown below for the 2010-2011 academic year.

2010-2011 Timeline

Date	Topic
June-July	Finalize project scope
August 6	Submit final scope document
Aug. 26 & Sept. 2 (others if needed)	Partner company presentations to the MLOG class (with optional info session for recruiting)
September 24	Finalize student-project matching
October - April	Project work with regularly scheduled meetings
January 13	Poster Session & Networking Night
May 6	Final Thesis due to MIT for graduation
May 16	Final Executive Summary due
May-June	Final presentation to partner company – date and format to be jointly agreed upon by company, student(s) and advisor
May 24-25	MLOG ResearchFest

2. Deliverables

As part of the project, each student team provides the following deliverables to their sponsoring company:

- Final thesis report. This is also turned into MIT for credit and a grade.
- Executive summary of research project. This is a 2-5 page summary of the research project that is suitable for wider distribution within the sponsoring company.
- Final presentation to sponsoring company on results and conclusions. This in addition to the MLOG ResearchFest. It can be held at the company's location in late May to early June to share the results with a larger audience.

The sponsoring company needs to commit to the following:

- Payment of $10,000 fee for the project and active membership in the MIT Supply Chain Exchange,
- Assignment of a single dedicated resource to act as project lead able to meet regularly (in person or via phone/video conference) with the team,
- Access to data as needed in a timely fashion,
- Payment of any out of town travel expenses to partner company site.

The master's thesis is a publicly available document. If there is a concern about keeping some information confidential, MIT offers a standard NDA that must be used for SCEP projects. We are glad to provide it upon request. Intellectual property for the thesis remains with MIT.

However, it is important that the student(s) have enough details and context to conduct research that satisfies thesis requirements. The details of a project as well as the sponsoring company can easily be disguised and hidden in the thesis. Some common practices include:

- Disguising the name of the company,
- Not publishing certain cost numbers,
- Providing ranges for relevant numbers, and
- Randomizing numbers to provide the gist of the analysis, but not allowing back calculation of confidential information.

Note that the responsibility lies with the company to disclose which information is confidential. Further, it is the responsibility of all members in the team to make arrangements for disguising data and conducting a submit/review process in a timely manner to meet the MIT thesis deadline that enables students to graduate.

3. Defining a Good Project

Based on experiences with master's thesis projects, we have found that successful projects share three characteristics: a focus on answering a question, a research rather than consulting orientation, and timely access to data and required personnel.

First, they all focused on answering a **tightly defined question** that is of interest to both the sponsoring company, but also to other companies. All good research starts with a question to answer. Some examples of good research questions that have turned into theses include:

- Under what conditions does direct store delivery make sense?
- What is the optimal delivery frequency to replenish stores and how should it be determined?
- When should a firm use dedicated versus for-hire assets?
- How can we improve the demand forecasting of customized fashion items?
- How can a company make plans with uncertainty in both demand and supply?
- How can uncertainty in demand be incorporated in my transportation procurement process?
- How can the product management process be improved to consider supply chain capabilities?
- How can vendor managed inventory (VMI) programs be cost or value justified within the XXX industry?

These are all excellent starting points for a research thesis. On the other hand, here are two examples of less desirable research questions along with recommendations on how they can be transformed into better questions.

- *Where should I locate my distribution center?*
   This question is too company specific. Instead, the thesis could answer the question, "What factors influence the location selection process?" Then, the student could include the company problem as a case study to illustrate the methodology.

- *What is the closed-form optimal inventory replenishment policy for a multi-echelon, multi-stage assembly network with stochastic demand, randomly distributed lead times, and elastic pricing?*

    This is a great research question…for a PhD student! We need to make sure that the question can be explored by a student with master's level skills in eight months. A modification of this question could be: "What factors impact safety stock placement in a multi-echelon network?" Then the students could understand the current situation and, perhaps, simulate the network to understand where the trade-offs might be. The more theoretical topic can then be picked up by the faculty member and our PhD students.

- *What supply chain strategy is best for my company?*

    This research question has two problems. First, it is too company specific. But more importantly it is overly vague and open ended. The student could go in a million different directions – none of which might be close to the one you are actually interested in. In this case, the best approach is to narrow the question down to one aspect of supply chain management, say, performance metrics, and ask the question, "How should a performance management system be established within the XXX industry?" Then, the student could include a company specific case study as part of the thesis.

The second characteristic of successful SCEP projects was that the sponsor understood that these are **research rather than consulting** projects. Granted, the line between the two can be rather fuzzy at times. Generally, though, a consulting project is one that 1) applies a well-known methodology or approach, 2) uses personnel who have performed these types of studies before, and 3) are expected to come up with a specific actionable answer. A research project, on the other hand, is one that 1) applies a new or non-traditional methodology to the problem at hand, 2) uses personnel who have not solved this problem in this specific way before, and 3) are not sure what they will come up with.

A good example of a project that is more consulting than research is a supply chain network design (SCND) project that aims to locate facilities using cost and demand data. Such projects, while tricky, often follow a very well defined process and use traditional optimization tools. Hence, they are best solved using packaged software and personnel who have conducted a dozen or so similar studies, resulting in a recommendation like "put DCs in Atlanta, Chicago, and Reno." Research in SCND would instead consider general network strategies, evaluate new optimization approaches, etc. The result could be insights such as: "if product is made more modular, then we could use postponement on final assembly and reduce the total safety stock levels in the system" or "the optimization approach should incorporate a broader set of scenarios regarding volatility in exchange rates and commodity prices to make robust global sourcing decisions."

A good example of a project that is more research than consulting is one that was conducted for Reebok in 2004[1]. The initial question focused on how to better forecast

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[1] For more details on this project, see either "When Delaying Decisions is Good," by Anne Field in the June 2005 *Supply Chain Strategy Newsletter*, Harvard Business Review Press, vol. 1, no. 4, pp. 5-7. Or the

personalized (team and player name) NFL jerseys – a notoriously difficult fashion item to predict. If this was a consulting project, the team would have looked at available demand management software in the market and delivered a 'better' forecasting engine. The students, along with a faculty advisor, took a different tack. They observed that demand for a particular jersey was driven primarily by the success of the sports team. But, they noted, if Reebok could perfectly forecast NFL championships, then perhaps they should get out of the apparel industry and move to Las Vegas. They came to the conclusion that highly variable, unpredictable demand was not going away. Rather than focus on the forecasting they looked at how the supply chain could be more responsive to this uncertainty. After a lot of analysis, they found that by postponing the majority of the jersey personalization, they could make the whole process more agile and thus reduce the shortage of hot demand jerseys and excess supply of the slow moving jerseys – which was the real problem after all.

The major differences between a consulting and research project are:
- Consulting projects look for specific numeric results while research looks to uncover insights,
- Consulting projects result in production ready tools and approaches while research projects develop prototypes that prove concepts, and
- Consulting projects cover all aspects of the problem (e.g., study all 17 DCs in a network) while research projects focus only on portions of the problem that are illustrative (e.g., study one large and one small DC, not all 17).

For research projects the end result is never really known at the start of the project. In fact, the unintended and unforeseen results are some of the main benefits of a research oriented project. By letting the team explore, they can usually come up with valuable insights that would not have come up under a more standardized consulting engagement.

The third, and most important, aspect of successful ZLOG projects is **availability**. These projects usually require extensive data, interviews, and site visits. It is critical that the student has timely access to the people and data that are relevant to the analysis. The number one source of failure in these projects is lack of availability of the sponsoring company. If the project relies on the students meeting with resources external to your company (e.g., clients, suppliers, etc.) it is *critical* that these are lined up and agreed upon before the project starts.

In summary, the three characteristics of successful projects are:
- Developing a well defined problem that has general interest beyond the company,
- Having a *research* rather than *consulting* focus on the project, and
- Providing access to data and people as required.

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original MLOG thesis by John Parsons, "Using A Newsvendor Model for Demand Planning of NFL Replica Jerseys," MIT Thesis, 2004.

4. Project Scope Document

This should be 1 page – enough to give the students a feel for the project and for you to understand the boundaries.

Template

Working Title	
Proposed by	Name and contact info
Key Research Question / Hypothesis	What single over-arching question will this research try to answer?
Team Profile	Number of students
Project Description	A short paragraph on what the project will accomplish – an abstract.
Data Type & Sources	Where will the data come from and what will it look like?
Potential Methodology	• Will this project involve modeling (simulation, econometric, optimization, network, system dynamics,…)? • Will this project involve field work? (survey [many observations, structured responses], interview [few observations, semi-structured responses with more depth than a survey], case study [focused observation, unstructured response, open ended]) • Will this project involve conceptualizing? (Delphi [very few observations, panel of experts, undefined], Synthesis [creating a new framework from existing literature])
Sponsor Contact	If a sponsoring company is involved, who is the primary contact? Name and contact info.
Communication Plan	What are the expectations throughout the project regarding availability and communication (site visits, phone calls, etc.).
Is	• Detailed listing of everything that this project IS going to cover, explore, etc. This is a good place to list critical assumptions and set expectations.
Is Not	• Detailed listing of everything that this project IS NOT going to cover, explore, etc. This is a good place to list critical assumptions and focus the project.

Example 1

Working Title	**Analyzing the Level of Service and Cost Trade-Offs in Transportation**
Key Research Question / Hypothesis	What is the cost to shipper and carriers of requiring/providing superior cold chain quality and customer service?
Project Description	Chiquita Brands International considers themselves industry leaders in cold chain management and customer service. Chiquita and their salad division Fresh Express are continually touting their superior performance as a competitive advantage in the marketplace. Chiquita's contracted carriers are continually monitored and upheld to the strictest industry standards. This thesis project is designed to quantify the additional cost, if any, of superior cold chain management and customer service performance (e.g. on-time delivery). Specifically: • How do strict cold chain quality standards impact the rates that shippers pay for freight? • How do strict customer service standards impact the rates that shippers pay for freight? • What types of additional costs do carriers incur when they meet strict cold chain and customer service performance standards? It is understood that the thesis scope will evolve, dependent upon student interests and availability of qualitative and quantitative data.
Data Type & Sources	Students will analyze historical Chiquita carrier rate and performance data as well as cold chain quality monitoring data from Sensitech. Furthermore, Chiquita will facilitate communication with their preferred carrier base for carrier insight and qualitative data gathering.
Company Contact	Joshua Merrill, Logistics Planner, Chiquita
Is	• A unique opportunity to study a transportation issue from both shipper and carrier perspective • Very relevant to today's transportation industry • Development of a quantitative model with qualitative insight • A project with cross-functional value between supply chain, marketing, and sales that will help drive improved profitability in a large company
Is Not	• Expected to be a consulting project with an all-encompassing solution for Chiquita

Example 2

Working Title	Impact of Mixing Centers on Leadtime and Safety Stock
Key Research Question / Hypothesis	What are the financial and service impacts of the introduction of a mixing center within a retail distribution network?

Project Description	Less than truckload (LTL) shipments and small package deliveries comprise the highest percentage of our inbound loads to the 14 distribution centers (DCs) within CVS's network. These loads are the most unpredictable and have a much longer lead-time than truckload (TL) deliveries. The freight is often trapped in route and can be loaded and off loaded at several LTL terminals during the journey. These multiple "touches" present opportunities for freight to be lost, stolen or damaged. LTL freight is also inefficient and costly for suppliers to ship and track.
	
	    This project will focus on shipping full truckloads of product from suppliers by combining orders for all 14 CVS DC's on one truck to a common location or mixing center. At the mixing center, these vendor deliveries would be split and cross-docked to outbound trailers for each of the CVS DCs. This process would be repeated multiple times a day for different suppliers to build full truckloads to depart nightly for each CVS DC. These loads would be given priority receiving at the CVS DC's. The expected results would be: reduced lead-time, reduced LTL loads, more control over the follow of the product, easier freight tracking, less overs, shorts, and damages from multiple touches of the product, reduced vendor order minimums and reduced safety stock resulting in less inventory in the supply chain.
	
	    This project will investigate if this strategy makes sense for CVS and under what conditions (critical number of participating vendors, types of products, etc.). This will most likely involve the building of a large scale simulation tool to test different strategies

Data Type & Sources	Purchase Order History Files, E3, Warehouse Management System Data, Descartes PO Trak-it System Database, & Shipment History from various suppliers.
Company Contact	Bill Beatson, Director, Inventory Operations
Is	• About objectively reviewing our supply chain from end to end and evaluating the cost/benefit of a cross-dock program • Determining a practical application that will optimize the total supply chain solution, even if components are sub-optimized • Developing a model to allow for the replication of the program to new suppliers and DC's • Development of key metrics to evaluate cost/benefit post implementation
Is Not	• The evaluation of outsourcing the freight management or consolidation to a third party • Determining the location of cross dock facilities • A new concept but it does require a practical model

Example 3

Working Title	Developing Decision Support Tools for WFP-Ethiopia
Key Research Question / Hypothesis	How can World Food Programme (and humanitarian organizations in general) create decision support tools based on proven methods to improve supply chains? How can you fill the gaps when data are not available? Focus decision area TBD
Project Description	There is a growing need and growing interest within the humanitarian sector in techniques that support more efficient logistics decisions. Logistics optimisation is reflected in a number of strategic and operational decisions aimed at various objectives: to maximise speed of delivery during acute emergencies, to minimise risks to the delivery process in the midst of armed conflict or natural disasters, to minimise transport costs, to minimise environmental impacts and negative impacts on local or national economies. The weights of these objectives vary from operation to operation as well as through the different phases of a single operation. Carrying out this exercise is hindered by a number of obstacles and challenges such as data availability, the time and investment required to set up optimisation models, operational chaos and a large number of uncontrollable factors (driver incentives for diversions and selling of relief items; banditry and war; seasonal effects on the infrastructure...), the variety of goods to transport and which require different vehicle types, an irregular schedule of deliveries, and intermodal transport choices (road/air/river/rail) and varying contractual terms (ranging from commercial providers, to in-kind donations by national governments or military forces). The aim of this proposed project is to explore alternative decision support models for the humanitarian logistics context based on proven methodologies, drawing on WFP's experiences in Ethiopia as well as known and documented approaches in the commercial sector. The aim is to develop a clearer understanding of approaches available to humanitarian workers, with an initial evaluation of their applicability to different types of operations and their ability to overcome the challenges inherent to the humanitarian context. The initial decision areas to explore include warehouse configuration, vehicle dispatching and regional contingency planning.
Data Type & Sources	WFP-Ethiopia, iMMAP, UN Spatial Data Infrastructure for Transport project (http://www.unjlc.org/mapcenter/unsdi)
Potential Methodology	• Data analysis and development of rules of thumb for quick, heuristic decision making • Modeling (simulation, optimization in spreadsheets or commercial software) based on GIS and other operational data available • Integrating some field work to gather data & develop a case study
Company Contact	Simon Hacker, Logistics Officer, WFP-Ethiopia
Communication Plan	Weekly or bi-weekly meetings with WFP Ethiopia via skype (likely morning before classes); potential trip to Ethiopia
Is	• Analysis of existing data, suggesting further data requirements • Development of simple analytic and heuristic decision approaches for resource-constrained environments (data may be inaccurate or unavailable) • Potentially incorporating commercial software for advanced models
Is Not	• Development of a directly implementable decision support tool • A resume builder to say you did some humanitarian work