Systems Synthesis Project
Course Guide
for
Students & Faculty

2009/2010
Academic Year

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Carnegie Mellon University

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1. GOALS

The major goal of the Systems Synthesis project course is to provide MSPPM, MAM and MSHCPM students with the skills necessary for structuring, managing, and carrying out projects in an organization. Textbooks and lecture courses cannot provide these skills. Instead, students need to acquire them through first-hand project experiences in relatively small groups with the guidance of seasoned faculty. Therefore, from its beginning in 1969, Heinz College has required students to complete a Systems Synthesis project.

Systems Synthesis projects must also contribute significantly to solving or ameliorating important problems of the public sector, non-profit sector, or arts organizations. Systems Synthesis has potentially enormous benefits for service to public and non-profit organizations with the resources of nearly 22,000 student hours and approximately 2,500 faculty hours of project work per year!1 If the school selects important projects, and project teams use rigorous methods and make sound recommendations, Systems Synthesis can make significant and substantial contributions to public policy and non-profit management.

1.1 Problem Structuring and Solving Skills

There are four educational goals of Systems Synthesis. The first is to develop skills in problem structuring and solving including how to:
- define a problem, its boundaries, and a project's scope;
- determine a client's requirements;
- identify/obtain data or information;
- determine data limitations;
- determine appropriate analytical methods and theories;
- design alternative solutions;
- characterize and manage risks of alternatives; and
- document results and communicate recommendations.

Structuring a problem and doing procedural work is intellectually challenging, and somewhat of an art. It requires project teams to initially formulate the “problem” and move to precise conceptualizations and sets of coordinated steps to meet the desired ends.

1.2 Project Management, Teamwork, and Communication Skills

The second educational goal is to develop students' project management, teamwork, and communication skills. Each project team member and a team as a whole need to learn how to:
- develop/effectively use the capabilities of each member;
- take initiative and responsibility;
- design tasks that are feasible, linked, and phased;
- keep members informed and coordinated;
- communicate results and obtain useful feedback;
- professionally resolve interpersonal problems; and
- meet deadlines.

Being able to participate effectively on a project team, either as a manager or a team member, is a highly marketable skill.

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1 130 students x 12 hours per week per student x 15 weeks per semester = 21,600 hours. Also, an estimate of faculty time is 14 projects x 1 faculty member per project x 12 hours per week per faculty member x 15 weeks per semester = 2,520 hours per year.
1.3 Capstone Experience

The third educational goal is to provide a capstone experience for Heinz College MSPPM, MAM and MSHCPM degree programs — integrating, synthesizing and putting into practice skills and materials from several courses. Lecture courses contribute primarily to a student’s knowledge, comprehension, and analytical skills. Higher-level educational goals addressed by Systems Synthesis are synthesis — to provide new solutions from a variety of inputs and analytical steps — evaluation and recommendation. Students need to learn how to:

- frame technical/organizational/economic/political criteria;
- conduct applied multidisciplinary research;
- learn new methods, theories, or skills as needs arise;
- draw on the comparative advantages of individuals;
- be alert and receptive to new ideas;
- evaluate alternatives from many perspectives;
- be able to work comfortably with partial knowledge; and
- develop contingency plans.

Project courses provide the opportunity to “put it all together” and critically evaluate alternatives.

1.4 Organizational Experience

Lastly, MSPPM, MAM and MSHCPM graduates work in organizations which have missions, strategic plans, personnel, other resources, ongoing projects, cultures, practices, etc. Graduates need to learn how to quickly:

- fit into an organization,
- get on board in projects, and
- add value to organizational outputs.

Indeed, work experiences gained from student projects provide strong comparative advantages to graduating students in job interviewing and getting job offers. Modern organizations are moving rapidly away from the hierarchical structure inherited from high-volume production to loose networks of entrepreneurial teams engaged in high-value production.

2. PROJECT MILESTONES

While Systems Synthesis projects may differ considerably in format, there are several requirements common to all projects. A number of these requirements can be stated in terms of project milestone events. Detailed discussions of several of the items follow.

2.1 Overall Structure of Projects

The early weeks of a Systems Synthesis project are devoted primarily to problem definition/structuring, a unique contribution to the MSPPM, MAM and MSHCPM programs. No other project course or project has a substantial requirement for structuring problems. This is a high-value-adding activity that is sought after by employers. In parallel with problem structuring, work must proceed on certain data collection, analysis, design, or other tasks that are known from the very beginning. Still other tasks, of course, are only identified later, or cannot proceed until precedence relationships are satisfied. A strong project proposal makes the job of problem definition much easier and allows the group to begin work sooner.

The second half of a project is devoted primarily to completing identified tasks, with some fine-tuning of structure. Quite often the scope of a project narrows as the critically important contributions are identified and time runs
out. At the end of the project, students incorporate client and Advisory Board feedback into their final written report. Under the guidance of their faculty advisor, they also debrief the project process and experience.

Note that each half of a Systems project requires different management skills. Problem structuring requires a student project manager who is comfortable with uncertainty and ambiguity, who is a cheerleader in dark hours, and who can grasp important features and concepts of the problem and its solution. Project task management, in the second half, requires a manager who is somewhat compulsive about closure, is time conscious, can keep track of many tasks, and can coordinate efforts of individuals. One person may have both capabilities, but it is a good idea to open up the question of who should be the second-half manager.

2.1.1 Initial Presentations

The first presentation to the Advisory Board of a Systems project takes place approximately two to four weeks after the beginning of the semester. This first presentation should cover the problem statement, scope and work plan.

A second presentation may be scheduled around mid-semester to give the core members of the Advisory Board an update on project progress.

*For more information on scheduling presentations, please see Section 3.1.*

2.1.2 Final Presentation

The final project presentation should take place within the last three weeks before the end of the semester. The final presentation should be scheduled as early as possible within this period in order to allow time for incorporation of the Advisory Board’s comments into the final report.

In order to encourage maximum attendance and prevent scheduling conflicts, please be sure to schedule the presentation (including room and equipment) and to invite the Advisory Board and other desired attendees well in advance. *For more information on scheduling presentations, please see Section 3.1.*

2.1.3 Final Report

Final project reports typically include the following components:
- Executive Summary
- Project Objectives
- Project Methodology
- Data Analysis
- Conclusions and Recommendations
- Lessons Learned
- Suggestions for Future Research and Investigation

You must provide two electronic copies of your final report (two CDs) to both the Associate Dean and the Program Director. This digital version of your report must have all of the charts, graphs, tables and graphics incorporated into the document. PDF versions are preferred.

2.1.4 Composition and Role of Advisory Board

The Advisory Board for a Systems Synthesis project is comprised of representatives of the client organization, the project’s faculty advisor, representatives of the client’s and issue’s stakeholders, and other experts in the relevant field. As such, the Advisory Board may have as many as a dozen members or more.
The role of the Advisory Board is to provide diverse — and sometimes opposing — stakeholder perspectives, and to assist in determining the scope of the project by engaging in a discussion of what is feasible, and encouraging the students to think through a variety of options, factors and approaches. Due to their positions in their fields and the community, Advisory Board members may also point the students toward data, and may help students gain access to otherwise inaccessible data.

2.2 Initial Information Packages

While it is essential that Systems Synthesis projects require project teams to define and structure problems, project advisors nevertheless must provide some initial structure and information. Appropriate materials need to be assembled and made available to students to read prior to the first class meeting. This is critical for one-semester Systems Synthesis projects for which time is short. Included in the initial information package are items such as:

- organization charts, key contact persons of important organizations;
- key papers, bibliographies from appropriate literatures;
- memos or minutes summarizing initial meetings between the client staff and the advisor;
- previous project reports on the same organization or policy issue, especially for multi-year projects;
- documents supplied by the client; and
- newspaper clippings related to the client organization or policy issue.

2.3 Peer Review of Students and Individual Consultations

The advisor (or advisors) of a Systems Synthesis project assign individual letter grades to team members at the end of each mini. While grades are the advisor’s responsibility, it is important to conduct a peer review in which each team member provides a written evaluation of all other members and him/herself. Reasons for peer review are:

- the results of peer review inform the advisor for grading purposes;
- the results also provide the basis for feedback in individual consultations with students; and
- peer review – the giving and receiving of constructive criticism in a professional manner – is an activity that professionals will increasingly be asked to undertake, so it is worthwhile to get some practice.

Exhibit 2 is a sample peer review instruction sheet and form. Note that the instructions list criteria for both research and teamwork activities, providing structure for open-ended questions on accomplishments and areas needing improvement. Also, there is an overall evaluation on a five-point scale, the results of which can be summarized as in Exhibit 3. This exhibit shows the average score of each student, on a scale of 1 to 5 where 5 is the best, and uses randomly assigned identification numbers (1 to 13 in this case) for students.

The milestone events in Exhibit 1 call for a minimum of two peer reviews, one at the middle of the semester and another at the end of the semester, with individual consultations at mid-semester. Some advisors process peer reviews monthly. The recommended format is to have the advisor conduct and summarize the peer review, and then have individual meetings with each team member.

The basis of the meetings can be the overall performance of all team members, using a chart as in Exhibit 3 with the identity of the particular student in the meeting given, plus a summary of the written comments. While peer review information has flaws, such as misinformation stemming from personality clashes, it is nevertheless concrete, and supplements and informs the faculty advisor’s assessment.

Feedback is essential for the development of individual team members, especially at mid-semester. For students doing a good job, it provides rewards and an opportunity to discuss future work in an upbeat setting. For students
doing poorly, it lets them know while there is still time to fix problems so that they can improve in the second half of the semester.

2.4 Student Evaluation of Advisors

Students in Systems evaluate their project advisors just as they do in other Heinz College courses.

3. ADMINISTRATIVE MANAGEMENT

3.1 Scheduling Presentations: Calendar, Room Reservations, Computing

Initial and final presentations should be scheduled and organized in a way that encourages maximum attendance and prevents schedule conflicts.

- Check Heinz College events calendar at <http://www.heinz.cmu.edu/events/index.aspx> for available dates and to check for potential conflicts. Rooms must be reserved well in advance of presentations to insure space availability. To secure a room in Hamburg Hall, please send email to: hzrooms@andrew.cmu.edu.
- Rooms at the University Center can be secured by using Space Quest, an on-line reservation system at <https://acis.as.cmu.edu/gale2/servlet/r25webapp>.
- Before scheduling any of the presentations, consult with the administrative assistants of the Dean, Associate Dean and the appropriate Program Director; and ask them to add the presentation date(s)/time(s) to their calendars. This should be done as early in the semester as possible, but, at the very least, one month in advance. The deans’ calendars fill quickly, so the earlier you do this, the better chance you have of seeing them at your presentations.
- Schedule the presentation using the “submit an event” function on the calendar Web page. <http://www.heinz.cmu.edu/SubmitAnEvent.aspx>
- Send reminder invitations to administrative staff (Deans, Program Directors) at least one month in advance. An invitation to the Heinz Community should be posted on org.heinz at least two weeks in advance.

Most presentations require **computing equipment**. Please adhere to the following guidelines when you schedule presentations.

- Most, but not all classrooms in Hamburg Hall have built in projection and data outlets. If you are not sure about the facilities in the room for your presentation, send mail with your questions to heinz-computing@andrew.cmu.edu.
- If you need to borrow a laptop computer and/or data projector for a presentation, please email the request to heinz-computing@andrew.cmu.edu specifying the date, time, location and software needed, at least three weeks before the presentation. If you do not know how to connect a laptop to the projector or data outlet, include that information in the request and someone will instruct you.
- If Heinz College cannot meet your needs for a computer at your presentation, you can request a computer from the CMU Instructional Technology office. More information about their services and how to request them are at <http://www.cmu.edu/computing/class-event/>.
- If your presentation involves a technical component, it’s a good idea to include that component in your rehearsal. You can borrow a laptop and/or projector for rehearsal purposes in the same way as you would for your presentation.
- If you want to use your own systems project computer for your presentation, please email that request to heinz-computing@andrew.cmu.edu one week in advance of the presentation or rehearsal. These computers are secured via an alarm system, so their removal needs to be scheduled with the computing staff.
3.2 Budget

Each Systems project will have a total budget of $700 assigned to it at the beginning of the semester. The Faculty Advisor of each Systems project must appoint a Financial Manager for the group within the first two weeks of the project. The role of the Financial Manager is to ensure that the project stays within budget by approving and tracking expenses, reviewing monthly accounting reports, and limiting spending to ensure no cost overruns. Need for additional funding should be brought to the attention of the Faculty Advisor as early as possible, so he/she may request any additional funds they deem appropriate from the Dean’s office.

The Financial Manager will receive an accounting report and telephone report each month from the Program Office. The Financial Manager should review the report to verify that the charges posted to the account are correct and valid. Each Systems project will have its own budget and account string for managing expenditures associated with the project. Only those expenses that are necessary to the project should be charged to the account. **Consulting services and/or outsourcing of data analysis may not be purchased.** Food may be purchased for formal presentations with clients or panelists. However, budgeted funds may **not** be used to cover food for working meetings. The maximum amount allowed for any meal reimbursements is $40.00 per meal/per person, any amount over that limit will not be reimbursed. Alcohol is **not** reimbursable.

Telephones are to be used only for project-related calls. All local and long-distance calls are charged to the Systems project budget. Students making personal calls must reimburse the Systems project. The Financial Manager should collect these monies each month after reviewing the telephone report and identifying personal calls. This money should be given to Diana Pawlowski in the MSPPM Program office, HbH 1103, and she will deposit it to your project account.

Purchases should be made by the group’s Financial Manager, using one of the university’s auxiliary services groups such as the university bookstore and university catering. If purchases are made with personal money, a reimbursement can be requested by providing the **original receipt(s),** account string, and a detailed justification to the Program Office’s administrative assistant; but please note that tax is **not** reimbursed. You are required to abide by the university’s “30-day rule” for processing reimbursements; this means that you must submit all receipts for reimbursement as soon as possible so that your request can be processed within the 30-day timeframe. Receipts for expenses more than 30 days old will not be reimbursed by the university.

Clients are responsible for their own travel costs.

Project teams will be held strictly to their budgets.

3.3 Facilities

Each project group is assigned to one of the project rooms designed to facilitate group work.

- **Keys** to systems rooms are distributed to students through Heinz College Facilities Manager Glenn Molzer, (mailto:gm1j@andrew.cmu.edu, phone 412.268.4739). There is a $25 replacement fee for lost keys.
- **Keep your systems room door locked** at all times when unattended to avoid theft.
- **Voice Mail** is set up automatically on all systems telephones with instructions posted near the phone. Direct any questions concerning voice mail to Glenn Molzer.
- Questions concerning systems rooms (e.g. furniture, lights) should be directed to Glenn Molzer.
3.4 Computers and Software

- Each Systems group receives at least one computer dedicated to the Systems project. At the beginning of each semester, the project’s Faculty Advisor will request the initial software set. Once the computer has been placed in your Systems room, the group members are responsible for administering the computer.
- If you need additional software, please ask the Faculty Advisor to make that request by sending email to heinz-computing@andrew.cmu.edu.
- There is no charge for software that is licensed under an unlimited licensing agreement by the university or by Heinz College. Some software packages do have an additional charge — even if that software has a licensing agreement with the university or with Heinz College. Such charges will be assessed to your project budget. If you are not sure about the charge for software you wish to use, email your questions to heinz-computing@andrew.cmu.edu.
- Heinz College’s website has dedicated space for each Systems project to post information about its activities. Each group should enter the information directly to the site; go to https://www.heinz.cmu.edu/systems/admin/ to enter and/or update your project information.

3.5 Copying

Interim and final reports should be copied through the Fedex/Kinko's Service in the University Center. Systems teams should not use internal printers or copiers, or the Heinz College Reprographics Office for these reports. Fedex/Kinko's will charge the cost to your systems project if you provide them with the proper account string. The cost for copying will be charged to the project budget. Be sure to consult with the Fedex/Kinko’s associates about lead times for copying and binding reports.

4. SYSTEMS SYNTHESIS OPERATIONS COMMITTEE

The Systems Synthesis Operations Committee provides an organizational setting for Systems Synthesis work and a brokerage service for students, clients, and faculty ensuring that projects undertaken advance the interests of all involved groups in mutually beneficial ways.

4.1 Membership and Responsibilities of the Systems Synthesis Operations Committee

The Systems Synthesis Operations Committee includes all current Systems Synthesis advisors, MSPPM, MAM and HCPM Program Directors, MSPPM and MAM Program Chairs, and the Associate Dean.

Responsibilities of the Systems Synthesis Operations Committee include:
- identification of policy areas and organizations to target for projects;
- maintenance of a portfolio of projects in balance with student and faculty areas of interest;
- review and provision of feedback to advisors and students submitting proposals;
- review of current projects to ensure comparable standards in evaluating projects; and student grades.

4.2 Special Responsibility to Make Systems Synthesis Projects “Add Up”

Individual Systems Synthesis projects have time frames of a single semester. Nevertheless, projects in general should contribute to a larger effort or purpose. Overall, the purpose of Systems Synthesis is to serve the mission of Heinz College, and in particular with regard to education, community ties, and public service.
Heinz College has limited resources, however, so the goal is to promote projects that lead to targeted, cumulative impacts compatible with Heinz College’s educational and research programs.

To make significant impacts on public policy and management, it will sometimes be necessary to make sustained efforts in targeted policy areas or client organizations. Public policy issues generally do not have solutions per se, but rather something more like a series of debates prior to political or administrative actions are taken, in order to anticipate and ameliorate problems. It may take a large effort to gain the knowledge, analytical results, and credibility to participate in a policy debate, so it is easy to imagine not one but perhaps two or three projects in a series on a given policy problem. In such a case, each project must have its own beginning and ending, with identifiable independent outputs.

The same may be true for management-oriented projects. In particular, it takes a great deal of time to build a working relationship with an organization, to get to know the major players and win their trust. Then with a success on one project, there is generally no shortage of additional projects, all of which can add up to a significant improvement in management.
Exhibit 1: Milestone Events

Fall Projects

- **Late September:** First presentation to the Advisory Board (problem statement, scope, and work plan)
- **Late October (end of Mini 1):**
  - Second presentation (optional) to core members of the Advisory Board (update on progress)
  - Peer review of students/individual student consultations with advisor
  - Student evaluation of advisor
- **Late November/early December:** Final presentation to Advisory Board (to allow incorporation of the Board’s comments into the final report)
- **End of semester:**
  - Completion and distribution of the final report
  - Peer review of students
  - Student evaluation of advisor

Spring Projects

- **Mid-February:** First presentation to the Advisory Board (problem statement, scope, and work plan)
- **Early March (end of Mini 3):**
  - Second presentation (optional) to core members of the Advisory Board (update on progress)
  - Peer review of students/individual student consultations with advisor
  - Student evaluation of advisor
- **Mid-April:** Final presentation to Advisory Board (to allow incorporation of the Board’s comments into the final report)
- **End of semester:**
  - Completion and distribution of the final report
  - Peer review of students
  - Student evaluation of advisor
### Exhibit 2: Sample Peer Evaluation Form

Please evaluate yourself and your colleagues based on the criteria below. After each name, give a numerical value; in the space below (and within the box) please provide any comments re: your evaluation. The comments will be compiled and made available, anonymously and privately, to each team member.

**Evaluation scale:** 1 = lowest, 5 = highest
- 1: very poor performance, unacceptable
- 2: less than acceptable performance
- 3: average performance
- 4: good, solid performance
- 5: exceptional performance

**Ability to identify and structure tasks**

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**Ability to carry out tasks thoroughly, accurately and in a timely fashion**

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### Exhibit 3: Sample Peer Evaluation Summary Form

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<th>Ability to Use and Integrate Results</th>
<th>Ability to Accept Responsibility</th>
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Exhibit 4: The Ten (plus Two) Commandments of Systems Synthesis

1. A systems project is the equivalent of a thesis project; please treat it with the seriousness it deserves.
   The systems project is one of the more tangible benchmarks of a student’s work at Carnegie Mellon. It is an important milestone of a student’s academic career.

2. Respectful and effective communication with the client and the advisory board is essential to a quality project.
   Keeping the client and advisory board informed of the project’s progress and doing so in a professional manner are crucial to the project’s success. Uninformed and/or uninvolved clients may diminish the project’s impact in the community. Uninformed and/or uninvolved advisory board members will result in lost time and energy – resources too precious to waste! Equally important is the ability to be sensitive to the client and advisory board’s communications needs and desires.

3. Any knowledge not possessed by the group should be obtained through research and by consulting with University and community experts.
   There is a vast universe of intellectual resources within the Pittsburgh region, more than any Systems project could possibly need. Discovering what information is lacking, where to find it, how to ask for it and how to use it is another critical learning opportunity of Systems; project teams should not expect information, resources or assistance to be handed to them.

4. Systems students are expected to put in a minimum of 12 hours of work per week on the project.
   Progress on the project will not happen during weekly class meetings; class sessions will soon become reporting and decision-making meetings. The level of success a team achieves depends, to a significant extent, on the quantity of and the quality of time that the team invests outside of class meetings.

5. It is every student’s responsibility to know what each team member is doing within the group and within the project.
   In the sport of rowing, each member of the crew must be aware of and in sync with what the other rowers are doing. Without this awareness, efficiency and effectiveness is impossible. The same is true with Systems projects.

6. You succeed as a group; you fail as a group.
   Again, in rowing, no crew member ever wins a medal for the rugged independence of her or his rowing. It is in a student’s own best interest to be selfless in assisting others on the project team.

7. Systems students are expected to treat each other with respect; gossip is not a productive way of dealing with conflict.
   All conflict should be handled within the group. Individuals must try to work out problems among themselves. If necessary, team leadership should become involved as mediators, not judges. The Advisor should be involved only as the “court of last resort.”

8. Peer evaluation is an important tool for constructive criticism and quality improvement of the team; it is not a tool for personal attacks or retribution.
   Project team members are expected to use their peer evaluations in a professional manner. It is the responsibility of the team members to understand and endorse the evaluation criteria. Participation in peer evaluations is a vital part of the Systems process; failure to do so will be considered a failure to participate fully in Systems, and it will be reflected in the student’s grade.
9. Systems students should understand the importance of fulfilling their responsibilities in a timely, professional and respectful manner.

   *Respect for the project is a student’s duty as a member of the team. Following through on commitments in a timely manner, sharing information fully but succinctly, providing timely responses to inquiries, and having regular and effective communication with the team leadership are the critical student responsibilities that epitomize respect for the project.*

10. The role of the facilitator is to structure the agenda, keep meetings moving in an organized and expeditious fashion, and to mediate internal disputes.

   *The facilitator’s key role in meetings is to help the process be inclusive and move forward. The Facilitator will encourage participation from team members who are not engaged, as well as discourage disruption, digression and obfuscation. The facilitator also will keep the meetings moving along according to the agenda timeline.*

11. The project manager has very real and meaningful responsibilities. Disregarding that authority will adversely affect your project.

   *The project manager has ultimate responsibility for all aspects of the work conducted by the group and the presentation of its findings in a public forum. They create and maintain a strong organizational structure and keep the group on-task toward completion. Failure to acknowledge and respect the burden of responsibility carried by this group member undermines everyone and everything associated with the project, and, ultimately, will cause unrest, conflict and failure.*

12. The instructor’s role is “advisory.”

   *The instructor is not the project manager. The instructor is not the boss. The instructor is there to offer guidance and support when s/he senses that the project may be going dangerously off-course, and to assist the project team in identifying resources.*