Teaming Up: An Educational Experiment in Systems Thinking

Gregory J. Clark
Shelia Covert-Weiss
Ford Motor Company
Information Technology Headquarters A
1333 Fairlane Circle
Allen Park, Michigan 48101
313.594.3634 / 313.594.3571
gclark@ford.com / scovertw@ford.com

Abstract: Ford Motor Company teamed with the University of Michigan to offer six MBA students the opportunity to learn Systems Thinking and apply it to a real business issue ("Shadow IT") in a short 8-week period. This paper explores the experiences of the students learning a new and different analysis tool juxtaposed against the standard set of business analysis tools offered by their MBA curriculum. The effect on the students of the "forced marriage" of Systems Thinking to the standard action learning program at Michigan is revealed. Finally, we will also discuss the highly successful results of this project and how it has affected the application of Systems Thinking at the Ford Motor Company.

Ford Motor Company has, as do most companies, many issues or "opportunities for improvement". Ford also has, as do most companies, many "tools" and/or "processes" for dealing with these issues or opportunities. We also find that we have many issues that defy solutions – we continually are applying many tools and processes to these issues but rarely seem to make any progress at resolving the issues – or at least no sustainable progress.

Every now and then someone at Ford is bold enough or desperate enough to reach far down into the toolbox and suggest Systems Thinking / System Dynamics as a new approach to solve a particular persistent problem. Several times over the past decade we have had reasonable success with the tools and the results, but with the particular issue "resolved" and the desperation relieved the tool (Systems Thinking / System Dynamics) is forgotten. This forgotten tool syndrome leaves Ford employees who may want to be bold enough or who are desperate enough with a huge hurdle to overcome if they want to apply Systems Thinking to their particular persistent problem: How? Who? When? Even if one wants to apply Systems Thinking they have no easy way to do so.

A small group of people at Ford with positive experiences with Systems Thinking decided to approach the issue of underutilization of Systems Thinking in the Company systemically (though not with an entire set of causal loop diagrams and a full blown simulation). Since the methodologies have been successfully used at Ford our questions centered on the lack of sustainability in the application of Systems Thinking tools inside Ford. Several themes emerged:

- Systems Thinking is not a generally accepted methodology in business (or Ford)
- There are no internal resources willing to acknowledge they could apply the methodologies

- There is little experience with building Systems Thinking capacity internally
- "Flavor of the Month" mentality exists at Ford ("this new Systems Thinking stuff will blow over")
- Ford's internal reward system is geared towards "doing" not "thinking"
- Ford is unique and "packaged" methodologies or Business Simulations don't apply
- There is a small local pool of "Systems Consultants"
- There is no hiring pool of trained or knowledgeable in the methodologies
- No "pull" from Ford for academically trained Systems Thinkers / Dynamicists

An opportunity presented itself to address several of these themes simultaneously, the University of Michigan MAP (Multidisciplinary Action Projects) Program.

> Multidisciplinary Action Projects (MAP) is an integral part of the core curriculum for full-time, first-year MBA students. Over the course of seven weeks, a team of five to six MBAs thoroughly analyzes a business problem or opportunity for a host company. Faculty specialists guide the students through their analyses and recommendations. The students are prepared for challenging MAP projects having already taken core courses in accounting, corporate strategy, economics, finance, human resources, marketing, operations management, and statistics.
>
> MAP has two primary goals:
> - to help the organization address a real business issue and
> - to create an outstanding academic learning experience for our MBA students.
>
> MAP projects need to be both multidisciplinary and challenging. They may involve the design or improvement of an important business process or the solution to other business problems. Projects can reside virtually anywhere in the organization (University of Michigan 2003)

Ford had sponsored many successful MAP teams over the years with this major state university near our worldwide base of operations in Dearborn, Michigan. The opportunity here was to not only bring a real business issue to MAP but also to bring the methodology that we wanted to use in analyzing the real business issue – Systems Thinking. For Ford, this encapsulated the University of Michigan MAP within a Systems Thinking "mega project". This was our experiment.

For Ford, the goals of the experiment were modest:

- Create two more Systems Thinkers in the world
- Learn about teaching Systems Thinking in the Ford environment
- Engage a local, major source of employees in exploring Systems Thinking [1]

[1] In no way do we mean to imply that Systems Thinking or System Dynamics is not known or practiced or taught at the University of Michigan. However, from Ford's perspective Systems Thinking is not part of the mainstream MBA curriculum nor do we see large numbers of University of Michigan graduates working at Ford practicing Systems Thinking.

- Learn about the system our business problem lives in

For Ford, the obstacles were also modest:

- Have the University accept the methodology and Ford "teaching" it to the MAP students
- Convince enough MAP students (who may know nothing of Systems Thinking) that they want to embark on this learning journey
- Develop the curriculum to teach the MAP students
- Gain acceptance inside Ford to allow the MAP students to use non-traditional tools to analyze a real business problem that already "belonged" to someone else
- Find the time and resources to run the MAP

Ford's proposal for the MAP team was explicit on the Systems Thinking approach:

> "The MAP teams will approach the project using Systems Thinking tools. Systems Thinking offers a set of tools and a framework for looking at issues as systemic wholes. It is a language that offers a way to communicate about dynamic complexities and interdependencies. Most Western languages are linear – their basic sentence structure encourages a worldview of "x causes y". Because of this we tend to focus on linear causal relationships rather than circular or mutually causative ones. Yet, a web of interconnected, circular relationships causes many of the most vexing problems confronting managers and corporations today. To enhance our understanding and communication of such problems, we need a language and a set of tools better suited to the task – Systems Thinking tools." (Ford 2002)

For an academic grounding our proposal included:

> "For more information regarding Systems Thinking see:
> - "Business Dynamics. Systems Thinking and Modeling for a Complex World" Sterman, John D. (2000)
> - "Systems 1: An Introduction to Systems Thinking", Kauffman, D (1981)
> - "The Fifth Discipline Fieldbook: Strategies and Tools for Building a Learning Organization", Senge, Peter M. (1994)" (Ford 2002)

Many other resources were used as well including *The 'Thinking' In Systems Thinking* (Richmond 2000), *Study Notes in System Dynamics* (Goodman 1989), and *Appreciative Inquiry* (Cooperrider and Whitney 1999) as well as most of the "Pocket Guides" from Pegasus

The Chief Information Officer / Vice President (and Systems Thinking proponent) offered up a business issue and the political cover to engage the Ford organization. To entice the student population the business problem was put forth as:

> "BUSINESS PROBLEM TO BE ANALYZED

In large corporate Information Technology organizations, a tendency exists for "Shadow IT" – activities that are funded, staffed, and launched outside the corporate IT function – to develop. These activities tend to create problems, including:

- Extra operations cost to integrate and manage non-standard infrastructure.
- Higher business risk (disaster recovery, information security, other audit issues) resulting in incomplete business solutions.
- Downstream scalability and large-scale operations challenges due to the original system being built on a shoestring budget and not planned for large business use.
- Skills dilution of technology focus across multiple systems platforms.
- Intellectual property loss as "shadow IT consultants" leave the Company.

Given the problems that result from Shadow IT organizations, then why do they continue to thrive? Various case studies offer many theories and combinations of reasons including but not limited to the following:

- An organization that prides itself on being apart of the Company mainstream, and believes they are quicker, smarter, and more efficient.
- Employees in decision-making roles who want to use their favorite consultant.
- Leaders who have been offered "deals" by vendors that seem too good to be true.
- Lack of confidence in IT for various reasons, such as limited IT support, incapable people assigned to that department or business area, or the perception that nobody is assigned to it, forcing them to navigate through a large, complex IT organization to get answers.
- Situations where IT work is being labeled as something else (i.e. marketing, advertising, preventative maintenance), hoping to avoid having their initiative cut as discretionary IT spending.

PROJECT SUMMARY

The MAP Project Team will be assigned three "Shadow IT" situations. The team will document the history that led to the Shadow IT initiative and the systems structure that reinforced and sustains this outcome. The MAP team will look for systems archetypes that are components of this system and highlight them. Using Systems Thinking methods and tools, the team will identify the highest leverage interventions and make specific recommendations that, if implemented, will result in fewer Shadow IT initiatives in the future as measured in absolute numbers, absolute expenditures, and expenditures as a percentage of total IT spend." (Ford 2002)

And the specific deliverables from the MAP Students were:

"The goals and deliverables for this Project are:

- specific recommendations that, if implemented, would result in fewer Shadow IT initiatives in the futures
- Systems maps describing the Shadow IT situations

- identification of systems archetypes that are components of the systems
- identification of the high and low leverage actions that could be taken to change the Shadow IT situations
- a final presentation to the IT&EBI Operating Committee on the findings, specific recommendations, and the process (with electronic copies)" (Ford 2002)

The University and a sufficient number of MAP students were convinced and our proposal was accepted. Now all that remained were the details of the curriculum and running the MAP Program at Ford.

The main goal of the project for Ford was to build Systems Thinkers who have real world experience. To achieve this goal we used the standard process used in developing systems thinking maps (Kim 1995), with a few variations.

Below is the process as documented by the students: (Sadowski 2002)

1. Get the Story
2. Identify Themes
3. Validate Themes
4. Name the Variables & Graph Behavior over Time
5. Create Focusing Questions
6. Identify Structures – Draw Causal Loops
7. Validate Causal Loop Diagrams
8. Create Systems Map
9. Plan an intervention

1. Get the Story

Our assumption was the students would be on site forty hours per week, for the full eight week course. We used the above nine steps to "calendarize" the work. We began with an overview and brief understanding of Systems Thinking. We introduced the concepts of mental models using such tools and exercises as "right hand/left hand" and "ladder of inference". By using these techniques up front in the process, the students were able to begin to grasp the concept of listening and absorbing the data they were going to collect. The work up front also presented them with tools to questions assumptions within the data and each other. This lowered the defense mechanism in the room and helped them to appreciate the conversations as inquiry and explicit revelations of thought.

After the initial introduction to the concept of mental models and systems thinking, we introduced the concepts of the three other Organization Learning disciplines to assist them in the journey to using Systems Thinking and Systems Dynamics. We used dialogue to explore what their assumptions were regarding the course and the opportunities and concerns they had in this project.

One of the first discoveries we learned on this journey to building systems thinkers is that the students were certain they had capacity already to build causal loops and systems maps. We also learned how eager they were to prove these facts to us. To help everyone uncover his or her own

capabilities we used a simple exercise. We asked each student to read "The Tale of the Windfall Abbey" (Welbank 1992) and be prepared to discuss and describe the situation. After a lively conversation, we asked the students, as a group, to "diagram, using causal loops, the story". The results were far exactly what we were looking for. As a team, and as an individual, the task, as given, was impossible for them to complete. They were, however, able to use other tools to clarify and build understanding around their own mental models, leading to an appreciation for shared understanding and team learning. The loops, they learned, were harder to produce without following a process of development and having a greater understanding of their own mental models. They learned to understand their own mental models and how easy it is to interpret the raw data (the story of the Abbey) and loose sight of actual system they were going to model. Gathering the information was now much more clearer for them. They would need to discipline themselves to acclimate their listening and sharing to the story they were collecting rather than the story inside their own system.

The students were ready to collect the information from the field on the "real world" system we wanted them to explore. The students had free access to any and all material on the subject. They brainstormed a list of characteristics they were searching to interview on the topic. We provided them with full access to all the levels within Ford IT. They interviewed over 40 people involved in the system as well as conducted follow up interviews.

To collect the data the data, the students worked in pairs. They assembled 5 open-ended questions to ask each participant. They received training and instructions from the Ford IT instructors (liaisons) on "how to conduct a data gathering interview." After obtaining the info, they shared the data with each other, by "dumping the data". This elaborately named process includes, the interviewees stating their notes, while another student writes the notes to a "flip chart" which everyone can read and ask questions of clarity around. Each sheet was coded with the interviewer's info and numbered, allowing the students to refer to personal notes for answers to questions from each other later in the process.

2. Identify Themes

After "dumping" all the data, the team was asked to read and absorb the data (including any printed material). The team participated in many dialogues to create a team understanding of all of the data. During these dialogues the Ford instructors were explicit about moving from the single data points to patterns of behavior. The instructors also continued to question assumptions around the data themes, challenging the students to verify their assumptions with the data points. In the end of the dialogue the themes emerged and were documented.

3. Validate Themes

To validate the themes the students returned to the flip charts, notes from interviews and written material. Each data point was checked against a theme to verify the existence. Data points that were not present in the themes were examined and the students determined if they were "one of's" (data that were not present enough to be representative of the system) or if a new theme were emerging.

After a list of themes was assembled the students wrote an e-mail to all of the interview participants describing the emerging themes. They asked for feedback or questions. Feedback from the interviewee's concurred with the findings.

4. Name the Variables & Graph Behavior over Time

For the students the concept of naming variables (using the standard methodology) and graphing the behavior of the variable over time was one of the more difficult areas of study. Recognizing perception versus reality, the concept of time as a relative notion, sticking with descriptors with no direction, were all very difficult to master. Instructors knew and tried to impart the importance of clear variable names.

During this time the instructors used great care to keep the focus by time boxing the exercise and having the students work in pairs, then share, then, repeat with new partners. Instructors provided lists of common variables and many illustrations of behavior over time.

5. Create Focusing Questions

When the themes and variables were assembled, the instructors asked the students to continue the dialogue to "dig deeper" on the themes keeping the variables in mind. At this point we (the Ford Instructors) introduced the notion that digging deeper provided them an opportunity to reveal mental models. We encouraged the students to use the mental models to form questions and hypothesis around the themes. After having put their own mental models away for so long it seemed odd to begin the task to reveal and use them again. The Ford liaisons were attempting to help the students "lower the water level" to revel deeper level patterns and structures within the system.

In digging deeper the students were able to uncover elements of the themes that would provide insight and learning for others looking at the systems. Unlike the initial conversations with the students, where they were sure they had answers and could rush to solve problems, the instructors began to see evidence that the students were becoming more interested in allowing the system to emerge than in finding the right answers.

In forming the focusing questions, the students were able to appreciate which stories were necessary to diagram and uncover. Using all of the themes or even the right themes now was no longer a question. They began to understand and implement the concept the "better is the enemy of the good." This revelation coupled with their questions lead them to focus on a few stories that they could map and grow understanding among the participants.

6. Identify Structures – Draw Causal Loops

Racing against time, the students found themselves with plenty of variables, graphs and themes they agreed to explore, but it was week six and the question before them was "Can we close a loop?" The instructors introduced the archetypes as models to guide them on their development of loops. We encouraged them to "find" their story within the archetypes and try to model it. We started with a simple vicious loop. When the students tell the story they say they struggled

for hours to close and produce one good loop, but in reality it took them several attempts and perhaps an hour of contemplation. After closing one loop the rest flowed more easily.

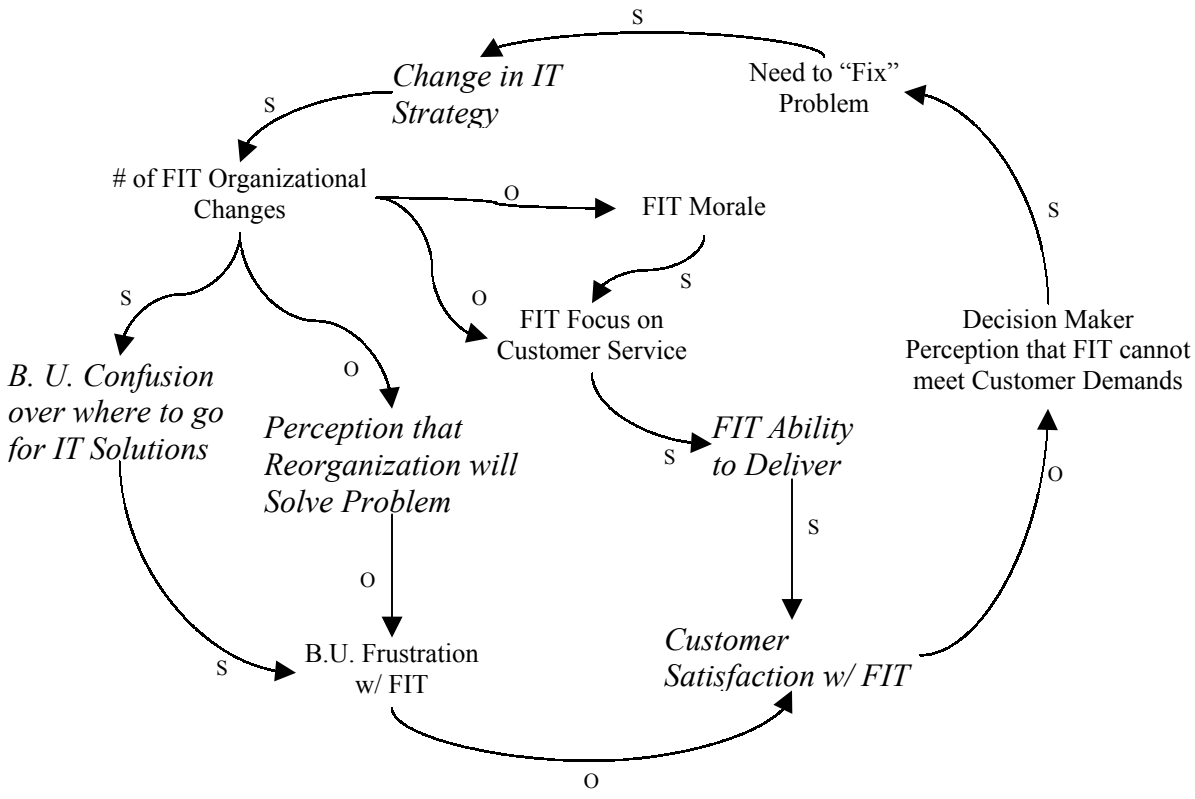
The instructors challenged them to think about the archetypes and use them as guides. Within two days the students had produced 10 small loops, each containing at least three, no more than five variables. They were able to use loop language and give examples to validate the maps. They had managed to create a way to describe a complex system in words that promoted understanding and appreciation.

7. Validate Causal Loop Diagrams

The students validated the loops in three different ways. They returned to the data they had collected and validated that the stories were accurate using data points. The students also used the behavior over time graphs to validate the loops. Lastly the students invited other Ford systems thinkers and system dynamics practitioners to review their loops and validate for clarity and ST/SD methodology.

8. Create Systems Map

After the students had built the loops, building the maps actually became very simple. They found they could clarify and streamline loops while connecting the stories together. They used the archetypes as guides for this exercise. Following is an example of a systems map that joined several loops together.



9. Plan an Intervention

The students needed to find areas of leverage recommend interventions in the system. The Ford instructors explained that each variable within the system is a leverage point but finding variables that would cause the greatest positive impact while managing the risk involved would be tricky. The students reviewed and contemplated many scenarios but managed to find at least three areas to consider. Within their report out they included the risks we could now see from the systems maps and the assumed gains from implementing the actions.

At the completion of the eight-week program the students presented the results of their work to the Chief Information Office / Vice President for Ford and 15 of his direct reports. The goal of their presentation was to provide the operating committee an opportunity to understand the system the students had been investigating and for the Vice President's team to learn as a team – both about the area of investigation ("Shadow IT") and Systems Thinking.

The University of Michigan MAP project also had a prescribed process for grading and completion. This process included traditional weekly reports on the progress of the project. The students met with the University professors weekly to turn in the reports as well as engage in a verbal report out. The reports were fairly prescriptive and geared to traditional MAP projects. They included financial reports, project plans with schedule, outlines, work in progress, methodologies being employed and the results of their investigation. Additionally, a final paper and report out was due to the University that focused on the interventions with cost savings and revenue forecasting as opposed to the systems maps and learning that Ford was interested in.

It was apparent to us at Ford that University was looking for a standard business consulting practicum. What Ford was looking for was an opportunity to grow more systems thinkers, an appreciation for the discipline and an opportunity to learn and apply the concept in a real world environment. Both the University and Ford had different goals and the students assumed they needed to carry the burden of this alone. Ford liaisons were unaware of the struggle until half way thru the project. Upon discovery of the burden both the University and Ford worked hard to understand and appreciate the differences, however neither party was able to bend to accommodate for that work. Subsequently, there have been improvements on both sides to help future MAP projects to be successful.

Following is the list of documented results of the project.

1. Deeper appreciation and opportunities for use of Systems Thinking methodology Information Technology at Ford Motor Company.
2. Five new systems thinkers. Five of the six students were new to the concept when the course began. All six continue to practice and have used Systems Thinking in various forms over the past year. They continue to share pieces of this work with the Ford instructors. Two of the students have returned to Ford to work part time in their final year on various Systems Thinking projects.
3. Since the overwhelming favorable response to the effort, many in Ford and the University of Michigan asked the Ford instructors to propose yet another MAP project. The second Systems Thinking MAP project concluded 22 April 2003.

4. The possibility to working more closely with the University of Michigan on building capacity around Systems Thinking / System Dynamics has been discussed and proposals are presently being developed.
5. Some of the recommendations made by the students as areas of leverage to consider in the business issue studied have been implemented.
6. Some Systems Thinking investigations have been conducted in other parts of Ford and the Ford Research Laboratories are incorporating elements of the methodology.

Overall this has been an extremely positive experience from the Ford perspective, the University of Michigan perspective, and the students who participated. Acceptance of Systems Thinking to enhance thinking and strategy, although not embraced by all, is certainly considered a viable alternative in the process toolbox at Ford – and not just for the bold or desperate.

Bibliography

Cooperrider, David L., and Whitney, Diana. 1999. *Appreciative Inquiry.* San Francisco: Berrett-Koehler Communications, Incorporated.

Ford. 2002. *Using Systems Thinking to Analyze Ford "Shadow IT" (MAP Proposal to the University of Michigan).* Allen Park, Michigan: Ford Motor Company internal documentation

Goodman, Michael R. 1989. *Study Notes in System Dynamics.* Waltham: Pegasus Communications, Incorporated.

Kim, Daniel. 1995. *Guidelines for Drawing Causal Loop Diagrams.* Waltham: Pegasus Communications Incorporated.

Richmond, Barry. 2000. *The "Thinking" In Systems Thinking.* Waltham: Pegasus Communications, Incorporated.

Sadowski, Michael, and Yoon, Yuliya, and Ruiz Ayala, Jose Ramon, and Michelsen, Antonio Asali, and Lin, Lei, and Gutierrez, Marco V. 2002. *Final Presentation – OCM*. Allen Park, Michigan: Ford Motor Company internal documentation

University of Michigan. 2003. *2003 MAP Host Company Information and Project Proposal Packet.* < http://webuser.bus.umich.edu/programs/map/01map/2003InfoPkt1.htm>

Welbank, Margaret. 1992. *The Tale of the Windfall Abbey*. The BP Exploration Process Review Team

Back to the Top