UMR - UNIVERSITY TRANSPORTATION CENTER ADVANCED MATERIALS AND NON-DESTRUCTIVE TESTING TECHNOLOGIES - EVALUATION REPORT 2001

Identification Number: R-5-38004

Project Title: Center Assessment Project

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Project Objective: To develop evaluation instruments that captures key organizational performance, apply the instruments and provide feedback to the Center for improvement.

Student Involvement: One (1) graduate student.

Project Abstract: The Assessment Project is an effort to find ways to assess the Center's readiness to foster effective research efforts. This is an ongoing process that serves two purposes: center evaluation and the development of methodologies to enhance R&D management practices.

Background:
The Assessment Project is an on-going project that aims to make the Center more efficient and productive through improved technology management. Dr. Halvard E. Nystrom, Assistant Professor in the Engineering Management Department, heads the project and graduate students from the Engineering Management Department have been assisting him in this project.

During the first phase of the project, which started in January 1999, they developed an Innovative Capability Audit for the Center. Working with Nishaj Attassery, they assessed the technological capabilities of the Center to do high quality research and to meet the expectations of its customers. This phase involved the adaptation of a survey for the Center members to assess the current condition of the Center, which included resources, strategy formulation and implementation of tasks. The customers were asked to fill out a survey on their expectations from the Center. The results of the survey were presented to the Center members in order to discuss the condition of the Center, its alignment with customer expectations and to identify action that could improve its performance. This strategic session was held on Tuesday, 05/04/99, with very active participation by the students, faculty and staff.

The second phase of the project started in January 2000 with Vivek Agarwal. The two main objectives of the second phase of the project were to: assess any changes during the prior year using the Innovative Capability Audit; and develop tools and methods to highlight the technical research capabilities of the center, and latent customer needs. Research organizations have capabilities to provide new knowledge that is valuable to customers, however they often require input from the customers to identify valuable areas for future research. Customers understand their tacit needs, but are not aware of what the research organization can perform to generate value. The second phase developed a technology map to help the Center and its customers to identify the areas of current research to help determine future research directions that would be likely to generate significant value.

It was observed that the key to the identification of latent technological needs would be a communication mechanism between the center and the customers. In order to develop a communication mechanism, a common terminology was needed to document current, planned and needed areas of technology development. To do this, a taxonomy of the relevant technologies of the Center was developed and a survey using the taxonomy to identify current areas of strength in the center and also future emphasis was administered in April 2000. The survey accessed the condition of the center in terms of technical skills & intellectual capabilities and facilities available for research in the field of infrastructure management and research areas pertaining to specific process, product or material.

The results of this survey were presented to the Center's industrial partners in a graphical form as a three dimensional Technology Map, in order to stimulate the desired discussion regarding the Center's strengths and areas of future opportunities. However, the desired results were not achieved. The Technology Map was too broad to provide useful stimulus for dialogue. The reason the Map was broad was that if the mapping exercise were done in greater detail, it would take an excessively detailed and long survey, and consume too much of the Center's resources. The Technology Map can be useful to categorize the Center's activities in general, but it was not found to be an effective tool to identify latent customer needs.

Third Phase - 2001:

In the continuing effort to improve the performance of the UTC, the third phase of the project, which started in January 2001 with Shashank Pendse, has three objectives. The first is the continuation of the Innovative Capability Audit to observe not only the Center's current condition, but also trends over the last three years. The second is to identify opportunities to share information within the Center through application of knowledge management. It is intended to provide value to the Center participants in a way that will support sustainable operation. The third objective is to provide a safe communication tool between faculty and their students regarding strategic issues, technical interaction, guidance and communication and satisfaction from the learning opportunity.

In order to achieve these objectives, the CIES-MOT Survey process includes the following activities.

- Develop the survey instrument, during the month of March 2001.
- Coordinate the collection of the surveys starting 4/2/01.
- Analyze the results by April 16.
- Plan and facilitate the Strategic Session on April 27, 2001, to discuss the results and proposed activities for improvement.
- Provide feedback to faculty on faculty-student communications.
- Document the total process.

Survey Process:

The survey includes all the active Center participants including faculty, administrators, staff, students and visiting scholars, so that all the voices in the Center can be heard. The Survey addresses the following three areas:

1. Continuation of the **Innovative Capability Audit** that has been performed during the previous two years. This allows for the assessment of new needs and changes over time. It consists of the same questions and format as was used in the 2000 survey. However, the questions that were used to generate the technology maps were removed.
2. A set of questions to document and assess the **knowledge management needs** for the Center is added, which deal with the types of information that can add value to the Center if it were shared. Knowledge management is an area of increased interest in many organizations since knowledge can be the greatest asset in an organization, yet much of it is routinely lost due to attrition or graduations. Key researchers were interviewed to identify the information that exists in the Center that would be of value if it were shared. This set of questions is designed to obtain representative information regarding these information needs, and to facilitate the eventual implementation of the project.
3. A set of questions to assess the **effectiveness of communications** between the research faculty and their students is also included. This need had been identified by Center participants and is described in more detail in the Faculty-Student Communications section below.

Faculty-Student Communications:

There are two major objectives in the utilization of student researchers. One is to help the students gain educational value through their research activities. The other is to generate valuable research that will advance the level of science and engineering in these areas. For both of these objectives, it is valuable for the student researchers to have a clear view of the larger context in which the research is being performed. They should be aware of the goals of the research programs, and the impact that they might have. These students should also have a clear understanding of their role within the research program and more specific research projects, and understand what deliverables they will be expected to provide by the end of their tenure. If the students understand this larger, more strategic perspective, they are likely to learn more from their experience and provide more value to the research effort.

The following questions express the intent of the effort to clarify the effectiveness of the faculty-student communication. Many of the responses do not have a definite interpretation whether a certain response is good or bad. The intent is to provide the students a safe channel to voice their opinion. This feedback can then be provided to specific faculty so that they can assess the implications. They are then in the position to improve the communication efforts in areas that might need improvement.

The first step is to obtain support for this task from Center management and the center faculty. Once the survey is completed, the results are provided to each faculty, if there are three or more respondents working on their projects. Each student is provided the opportunity to waive this rule so that the results can be shared even if there are fewer than three students commenting on a specific faculty. To provide a safe environment for student input, at no time will individual student responses be reported.

Survey Results:
The statistics of the survey respondents, presented in Table 1, show the participant breakdown and highlight the growth in the Center, particularly in the number of students.

TABLE 1. Survey participants

	2001	***2000***	***1999***
Staff	3	3	2
Students	24	16	12
Faculty	7	7	7
Total	34	26	21

Innovative Capability Audit (ICA):
The data collected from the survey shows the perception of the Center participants regarding the capability of the Center in its ability to foster effective research. These results are intended to provide insights to the Center participants during the strategic self-assessment session. Table 2 provides the results from the ICA. It shows that the major strengths are in the area of strategic formulation, with scores of 1.9, 2.1 and 2.0. (In this section the score ranges from 1, which represents an excellent performance compared to ideal, but realistic conditions, to 5, which represents needed improvements.) This means that the center has individuals with the knowledge and experience to formulate their own technology strategy. In addition they are aware of external developments and recognize their importance. The major weaknesses are in the area of equipment and organization.

The table also displays the results from the two prior audits. It shows that these assessments are very similar to the assessments in prior years. This is important, since many of the participants change from year to year due to the graduation. Since the results are very consistent it validates that these results are not just the evaluation of a few individuals, but it reflects a specific Center culture and strengths. Some of the changes

that can be seen are the improvement in resources, the improvement in communication, but there has been some deterioration of strategy formulation and organization.

TABLE 2. ICA responses for the last three years

(Scale: 1=Excellent, 2=Good, 3=Average, 4=Lacking, 5=Needs improvement)

	2001	***2000***	***1999***
Resources:			
Equipment	2.7	2.9	2.7
Personnel	2.5	2.8	2.5
Access to Info	2.3	2.4	2.3
Strategy Formulation:			
Internal strengths	1.9	1.6	2.1
Awareness of events	2.1	1.9	2.2
Recog. Of importance	2.0	1.8	2.2
Implementation:			
Organization	2.6	2.3	2.4
Culture	2.2	2.2	2.3
Communication	2.4	2.6	2.6
Overall Capability:	**2.3**	**2.3**	**2.4**

Table 3 shows the results of the ICA segregated by the type of respondent. It shows very little difference in the student response compared to faculty/staff. The students are a little more generous in most of the questions.

TABLE 3. ICA responses for the students, faculty and staff in 2001

(Scale: 1=Excellent, 2=Good, 3=Average, 4=Lacking, 5=Needs improvement)

	Center	**Students**	**Fac/Staff**
Resources:			
Equipment	2.7	2.7	2.7
Personnel	2.5	2.4	2.6
Access to Info	2.3	2.3	2.3
Strategy Formulation:			
Internal strengths	1.9	1.9	2.2
Awareness of events	2.1	2.0	2.4
Recog. Of importance	2.0	1.9	2.2
Implementation:			
Organization	2.6	2.3	2.4
Culture	2.2	2.2	2.3
Communication	2.4	2.6	2.6
Overall Capability:	**2.3**	**2.3**	**2.4**

Summary of Comments
The participants were provided the opportunity to describe the Center's strengths and weaknesses in their own words. The following summarizes their comments.

The Center has:

- Good people (14 comments)
- Good projects and facilities (7 comments)
- Good professional connections (3 comments)

The Center needs:

- More organized and clean labs (8 comments)
- Better laboratory equipment, supplies and technical assistance (8 comments)
- Better internal communications (3 comments)

One of the open questions asked participants that have been in the Center one year or more to comments on the changes they have noticed. These deal primarily with increased size, and improved performance, and are summarized as follows:

- More students (2)
- More projects (2)
- Lot of activity
- Increase in center size
- New structural lab
- Increase in office space and labs
- New personnel - Jason
- Improved communications (2)
- Improved performance
- More chaos

Student/faculty communications results:
The objective of the student/faculty communications section was primarily to provide individual information to the involved faculty from their students. However, we can observe the overall tendencies in the responses. In order to describe statistics of these questions the following responses were coded with these numerical values:

- Strongly agree = 1
- Slightly agree = 2
- Neutral = 3
- Slightly disagree = 4
- Strongly disagree = 5

Therefore, low scores reflect agreement with the statement and high scores reflect disagreement with the statements.

TABLE 4. Responses of students to the communication questions

Question	Mean	Std. Deviation
I personally participated in choosing and shaping the scope of my research	2.22	1.25
I understand the deliverables that will be expected from me	1.52	0.65
I understand the timeframe in which these deliverables will be expected	1.39	0.64
I understand my role within the research project	1.26	0.44
I understand the broader objectives of the research project	1.35	0.76
I receive sufficient time from my advisor to discuss technical issues	1.65	0.76
It is the student's responsibility to take initiative to find solutions in the research projects	1.74	0.74
I feel comfortable discussing my own ideas with my advisor	1.43	0.65
I am provided with adequate technical direction by my advisor for research	1.48	0.65
I get satisfactory academic advise from my faculty	1.70	0.69
I expect my advisor to provide opportunities to improve my written and oral communication skills.	2.09	1.18
I fee that my advisor has provided adequate opportunities or me to improve my communication skills	1.65	0.76
I am satisfied with the level of learning I have gained from my research	1.74	0.74
I find it valuable to work with more than one faculty	1.83	
I find no contradiction in the advise given by both professors	2.33	
I feel comfortable working with two professors	1.67	

Strategic Session:

The strategic session was scheduled before the end of the semester to discuss the results of the survey, while the memories of doing the survey were fresh in the minds of the participants. The format was similar to the one that was performed in May 1999. However, special focus was provided to data management to identify effective ways to share Center information. The session had three phases:

1. Summary of information from surveys.
2. Small group interaction to discuss the results and identify action that can improve the situation.
3. Total group interaction to focus on recommended action and its prioritization.

Participants:
The Strategic Session was held at the University Center East on Friday April 27, 2001 at 3 p.m. In attendance were 18 students, Dr. Nanni, Dr. Myers, Dr. Watkins, Ravonda McGauley, Gayle Spitzmiller, Sue Tripp and Jason Cox. Facilitating the meetings were Dr. Nystrom and Shashank Pendse.

Results:
The following were the key results regarding the two major session issues. The participants supported the results of the ICA survey, and during the session clarified the meaning of some of the survey results. There was very also strong support for the Knowledge Management Project. During the session the focus of the project was developed.

As shown in the ICA survey results, the equipment resource score is lower than the previous year even though the new structures lab is now available. The reason is that there is a lack of equipment to run the experiments. This is more obvious than last year since the new lab is available and the research group is larger. The personnel resource was also lower and this was explained as lack of sufficient electronic lab and computer support. This became even clearer when the participants voted on the proposed recommendations, shown in Table 5.

The discussion on the Data Management project centered around which of the areas were most important. As reflected in the survey results, the main interest was in documenting the procedures and projects. There was considerable student commitment to participate in this project. The students preferred a formal process that standardized the information and the formats. There was also support for a quality control process that would require all the documents to be reviewed by a faculty or other authorized participant before they are posted on the web. It was also clear that one of the key factors to the success of the project is to find effective ways to organize the knowledge so that it is easy to find.

During the breakout, a list of recommendations for improvement was developed. These were discussed during the last part of the session and the participants then voted by physically attaching four green dots to express their priority with the recommendations. The results are listed in Table 5 along with the votes counted for each recommendation.

TABLE 5. Results of participant votes for recommendations

Major area of need	Number of votes
Center Support Needs	
Electronic Lab assistants should provide more assistance	32
Better computer assistance	22
Lab administrator	7
Subtotal	61
Communications	
More social activities	14
Less frequent meetings	14
More clear responsibility of co-advisors	2
Better lab scheduling, perhaps on-line	2
Project expectations and responsibilities	2
Institute quarterly self-analysis with lunch	1
Subtotal	35
Knowledge Management	
Develop lab procedures guidebook	15
Document regulations for lab use	8
Subtotal	23
Recruitment	
High school recruitment activities	5
Promote CIES with t-shirts and participation in fairs	4
Student recruitment within UMR campus	2
Faculty recruitment from outside of Civil Engineering	2
Generate more visibility, brochure, truck sign, competitions	3
Subtotal	16
Equipment	
Computer software	6
One more Data Acquisition System (DAS)	2
Subtotal	8
TOTAL	143

Value Survey

In an effort to obtain feedback on the effectiveness of the CIES-MOT Survey and Strategic Session, all the participants were asked to participate in the Value Survey at the end of the Session. They were asked to rate the "impact to Center efficiency and effectiveness due to the survey and the discussions in the strategic session". They were asked to put an X on a scale ranging from none to slight to moderate to significant. Significant improvement in efficiency was defined as being able to produce 30% more value with the same amount of resources, or be able to produce about the same output,

with 30% less effort. Significant improvement in effectiveness was defined as being able to focus on activities that will provide 30% more value to our customers, by doing the "right" things.

TABLE 6. Results of Value Survey

	None (4)	Slight (3)	Moderate(2)	Significant (1)
Center Efficiency (Do it well) mean = 1.84 std. deviation = 0.31	0	0	21	6
Center Effectiveness (Do the right thing) mean = 1.60 std. deviation = 0.50	0	1	14	11

Summary: results from the study that should lead to action.

The CIES-MOT project enables the Center members to identify strategic and tactical needs and ways to address those needs. It provides a communication mechanism to review the performance of the Center that could otherwise be ignored. The Value Survey shows that the participants have confidence that many of the issues will be addressed. In fact, the results from the prior strategic session shows that many of the issues identified were addressed.

The strategic need to organize better was evident in the session. As the team grows, more faculty get involved and the location of the members get more separated, it becomes more important to document processes, identify expectations and facilitate communication within the Center. Other strategic needs that were identified included increased student recruiting, more social activities to maintain the team spirit. The short term need for better electronics and computer support came out loud and clear. The need for more equipment was also clear. There was a feedback that the student meeting should be less frequently.

The Center is an energetic, vibrant and active group, delivering quality research in a very valuable area. As it matures and grows, challenges will continue to appear that will need to be addressed one step at a time.

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