

AC 1998-370: Master of Science in Technology: Program Design, Development, and Implementation

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ABSTRACT

The Department of Technology at Northern Kentucky University designed, developed and implemented a Masters of Science in Technology (MST) program based on the needs of the students and the local business and industry community. Analyses of these needs indicated that technical opportunities exist for individuals having specialized skills in technical areas and in technical management at advanced levels. This led to the development of two tracks for the MST program, Industrial and Engineering Systems and Technology Management. This paper describes the process used by a knowledge-based organization (university) to design, develop and implement the program. It provides decision or intervention points for institutions considering similar graduate offerings.

INTRODUCTION

Northern Kentucky University (NKU), the newest of Kentucky's eight state universities with an enrollment of 12,000 students, was founded in 1968. It is located in the metropolitan area of greater Cincinnati, serving the tristate regions of Kentucky, Indiana, and Ohio. The mission of NKU is to: educate, be a resource to the community, and enrich life in the service area. As reaffirmed in the institution's Strategic Plan, although the University's primary mission is to provide a quality, undergraduate education for the citizens in our service region, the development of selected graduate programs in areas of demonstrated need is considered a high priority. This is not only important to the future health and growth of the institution, but it is also responsive to the changing needs of a growing, metropolitan region.

The new MST program is consistent with the University mission. The MST mission will be achieved through a program of study, which includes course work and experiences, composed of a common body of knowledge and two areas of specialization, Industrial and Engineering Systems and Technology Management.

The objective of this paper is to discuss the design, development, and implementation of the MST Program in the Department of Technology (DOT) at NKU. It focuses on the *process* that includes: a team approach, justification for the new program, institutional and state level approval, successful recruitment of students, and finally its successful implementation.

PROGRAM DESIGN AND DEVELOPMENT

The following steps were used in designing and developing the program.

- Form the MST team, composed of DOT faculty and administration and regional business and industry leaders.
- Develop instruments to survey alumni for needs assessment and analysis.
- Review similar programs at other Kentucky and U.S. universities.¹
- Review the program approval process at the institutional and state levels.
- Analyze existing NKU Masters program proposals.
- Develop a Gantt Chart and Critical path, which includes items, related to the design, development, and implementation processes.

Team Approach

The Department of Technology at NKU offers degrees at the Bachelor and Associate levels. It offers two ABET accredited Bachelor of Science (BS) degrees in Electronics Engineering Technology and Manufacturing Engineering Technology. The department also offers BS degrees in Industrial Technology (Manufacturing), Construction Management, Industrial and Labor Relations, Business Teacher Education and Industrial Education. At the associate level, it offers degrees in Aviation Administration, Construction Technology, Industrial Education, Industrial Production Technology, and Industrial Supervision. Therefore, the department has a very diverse faculty. The initial MST team was formed with the members of the DOT faculty. Later, members were added from administration, other departments offering Masters Degrees on campus and a Business and Industry Advisory Group (Figure.1).

Figure.1. MST Team Building Steps

Add	<i>Representatives of Community Business and Industry</i>
Add	<i>Directors of other NKU Graduate Programs</i>
Add	<i>Dean of the College</i>
Add	<i>Chairperson of the Department</i>
Add	<i>Faculty members with terminal degree</i>
Choose Team leader	<i>Senior faculty member</i>

Mohrman's (et.al.) works provided great insight into the team process. She indicates that, "Creating a team-based organization differs from simply using teams; it requires the ultimate redesign of the entire organization."² While our MST approach is not designed to rework the University, it is definitely a paradigm which allowed us to move outside the traditional bureaucratic box. Members of the team moved in and out of various functions related to the program development (Figure. 2). We also incorporated Galbraith's "Star Model"³ into the design of our MST Team and development process. Our strategic design considered the ramifications for each entity outlined by Galbraith, such as tasks, people, structure, rewards and processes (Table. 1).

Figure 2: Functions related to MST program development process

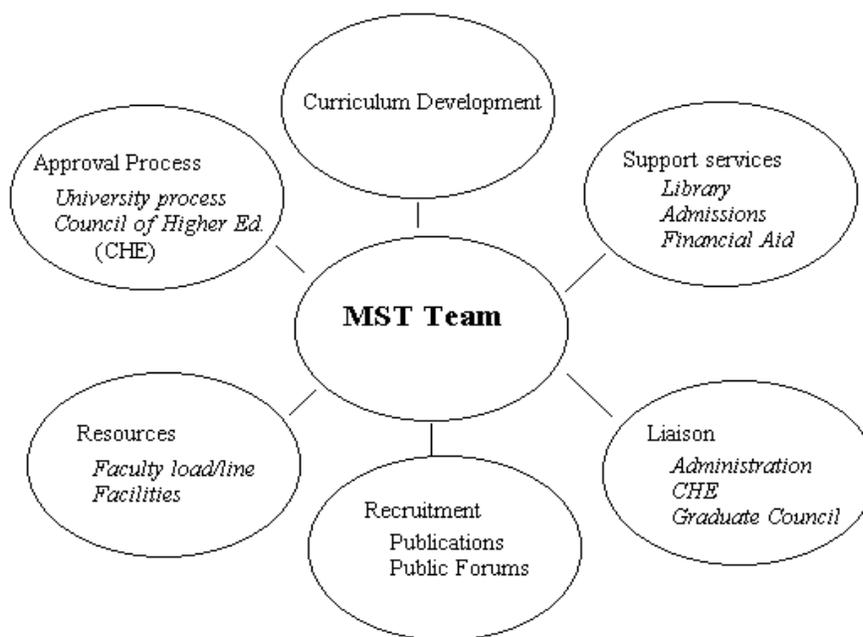


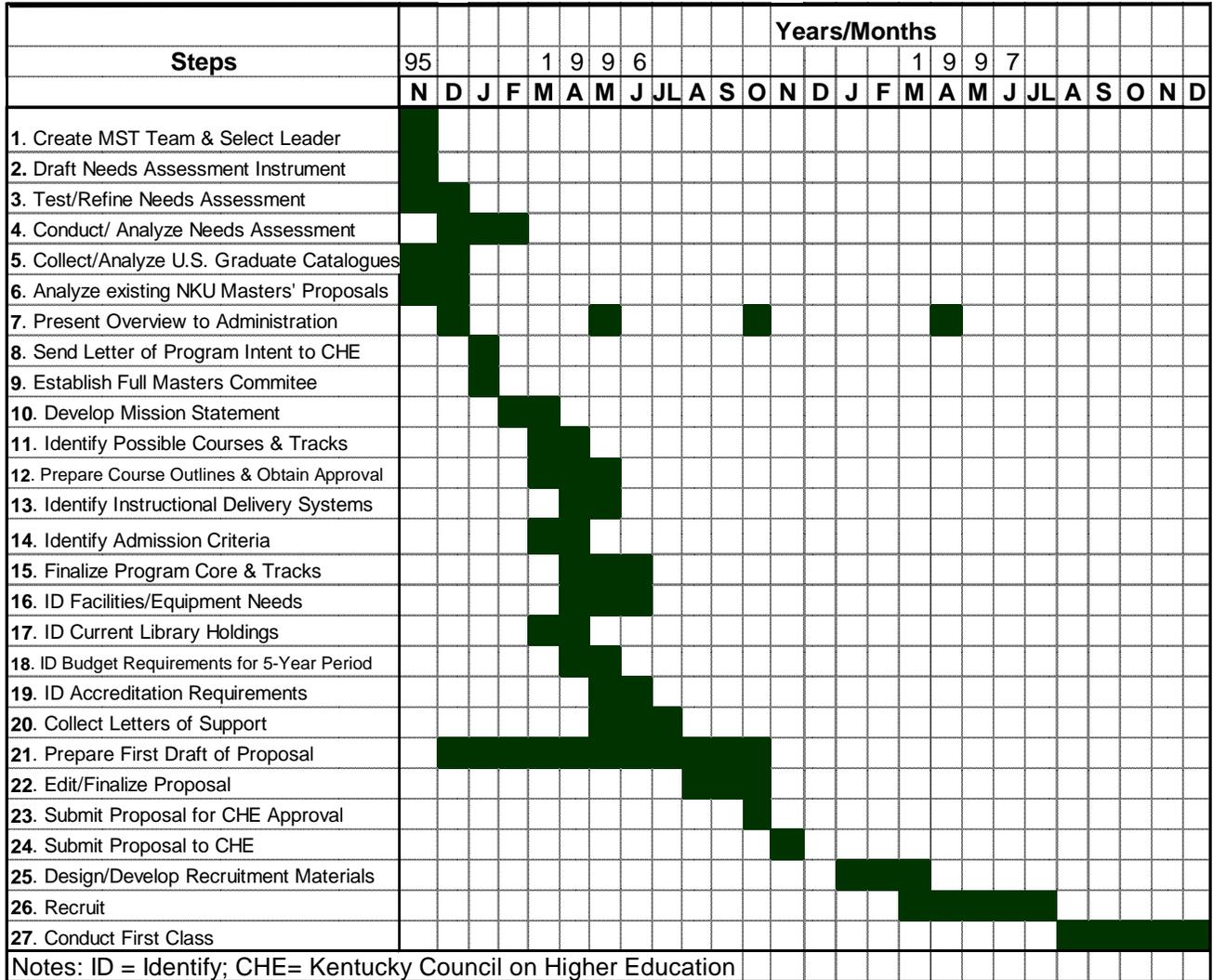
Table 1. Check list to address each entity outlined by Galbraith (Tasks, People, Structure, Rewards and Processes)³

Structure	<i>What should be the make-up of the Team (faculty, administrators, and leaders of business and industry)?</i>
Task	<i>What are the events that led to the consideration of a new program (Alumni input, business and industry input)?</i>
Task	<i>How does the program fit with the University mission?</i>
Task	<i>Is there local and state political support for the program?</i>
Task	<i>What are the opportunities/ issues /concerns /opposition (internal, state, accreditation body)?</i>
Task	<i>Are there any similar programs (possible duplication of regional or state programs)?</i>
Task	<i>Identify course work including potential interdisciplinary coursework/regional consortia</i>
Task	<i>What are the methods of instructional delivery?</i>
Task	<i>What are the academic policies and procedures?</i>
Task	<i>What is the window of opportunity (Gantt chart)?</i>
Task	<i>Are sufficient resources available (library holdings, facilities, etc.)?</i>
Task	<i>Is there enough financial support to operate the new program?</i>
Process	<i>What is the knowledge-based process analysis?</i>
Process	<i>How will performance deliberation analysis be conducted (key issues and tradeoffs that need to be solved)?</i>
Process	<i>What tasks are interdependent affecting the critical path?</i>
People	<i>What are the student needs? Day or evening program?</i>
People	<i>Are new faculty lines needed? Or will current lines be redistributed?</i>
People	<i>How many Graduate assistants will be needed and supported?</i>
People	<i>Is the Team empowered to make decisions? What are the parameters?</i>
Reward	<i>Will the program provide opportunities for faculty development?</i>
Reward	<i>How will the faculty be rewarded for serving on the program design, development, and implementation team?</i>

Time Line

The MST team developed a Gantt Chart (Figure. 3) based on 27 steps. The chart included all areas related to our new program development and also included items related to the approval and implementation of the program. It was estimated that the process would start in November 1995 with the creation of the MST team and culminate with the teaching of the first classes in August 1997.

Figure 3: Timeline for MST proposal



Justification

We addressed the following three pertinent assessment questions to justify the need for this graduate program:

- 1) *What employers or employer groups has the University worked with to determine the need for the graduate program?*

There will be a dramatic growth in technology managers and technical systems specialists during the next ten years, 1996-2006. ⁴ Professionals in these fields must continue to learn new technical skills and capabilities. They must also aggressively develop skills in state-of-the-art interactive technology and learning systems. We received significant input from the Tri-County Economic Development Corporation, The Northern Kentucky Chamber of Commerce, and the Greater Cincinnati Labor Management Council. We also received input from numerous individual companies represented on our advisory committees.

2) *What are the trends in the local industrial/manufacturing economy that indicate a demand for persons prepared at the graduate level in technology?*

There are international corporations, for example, Toyota Motor Manufacturing of North America (auto) who have located their manufacturing operations headquarters to the NKU region. In addition, Clarion manufacturing (electronics), Mazak Corporation (machine tools), and Sachs Automotive (auto components) have announced the formation of similar centers in the near future. More specifically, there are several trends that are shaping technical organizations requiring MST graduates. Some of these are:

a) Technical training specialists will be needed to explore alternatives and faster methods of delivering new skills and learning;

b) Master's level prepared students are needed to manage the complexity of rapidly changing organizations;

c) The manufacturing sector for the area over the last five years has increased by 24.5% with a 42 % growth in non-durable output and an increase in durable goods of 19%. ⁵

3) *Are there economic development strategies in the area, which could be more easily accomplished with the availability of this program?*

Businesses in the area are seeking to form partnerships with NKU to meet the retraining needs of their workforce. This economic development strategy may be more easily accomplished with the MST program. The DOT has the expertise to offer advanced specialized training and quality education for technology graduates and upper level technical managers needed by the community. Regional Business and Industry leaders supported this claim. The Northern Kentucky area has been very successful in the recruitment of new industries. Therefore, the demand must be met for advanced technically educated individuals to support this growth and ensure continued advancement.

Program Objectives

MST Task force surveyed (Table 2.) graduates of NKU for the proposed MST program. Fifty five percent indicated Engineering Technology as the major area of interest and 51% indicated Technology Administrator/ Manager as the primary career goal. The majority (88%) indicated that they were primarily interested in part-time (3-6 semester hours), evening courses. Based on these responses, the Team determined the following objectives for the MST program:

- 1) *Enhance the ability of graduates to move into technical management;*
- 2) *Enhance the ability of graduates to design and implement modern industrial and engineering*

Therefore, the Master of Science in Technology program is designed to serve the needs of students who possess a baccalaureate degree in Technology or related disciplines. The objectives of the program are to provide individuals with the ability to innovate and lead

Program Description

The course work is divided into a Core and two Tracks – ***Industrial and Engineering Systems and Technology Management***. A thesis or project and comprehensive exam are required for successful completion of the 33-semester hour MST program. Core courses emphasize the fundamental skills and knowledge deemed important by industrial systems employers and technology managers. Core courses concentrate on what students need to know and be able to do before they can solve problems relating to people and technical systems in industry. All courses are three credit hours (thesis=6).

Core Courses 18–21 Hours

Applied Statistics in Technology
Project Management in Technology
Research Methods in Technology
Technical Management in a Global Economy
Computer Applications in Technology
Project (3 hrs.) *or* Thesis (6 hrs.)
(Note: Students taking project option must take 15 hours in their track)

Industrial and Engineering Systems 12-15 Hours

Computer Aided Industrial & Engineering Designs
Computer Integration in Industrial & Engineering Systems
Quality System Appraisal
Seminar in Industrial and Engineering Systems
Topics in Industrial and Engineering Systems

Technology Management 12-15 Hours

Technical Training and Development
Human Resources Management in Technology
Technical Communications in a Global Economy
Seminar in Technology Management
Topics in Technology Management

Marketing the Program and Enrollment

Local business and industry and alumni were informed about the new MST program through direct mailing of letters and information brochures. An open house (information session) was organized for the potential students. This session was attended by representatives from graduate admissions, financial aid, and the DOT faculty. NKU is fortunate to have tuition reciprocity agreements with four counties in Southwestern Ohio and two counties in Southeastern Indiana. Students in these counties pay the same tuition rates as Kentucky residents. The new program was also announced through articles or news items in local newspapers. All these efforts resulted in an enrollment of 24 students compared to the projected enrollment of 5 students, as submitted in the MST proposal that was approved by the Council of Higher Education (Table. 3). While most students have undergraduate majors in the DOT offered program areas, the program also attracted students with undergraduate degrees in non-technical areas. Also, out of 21 students 6 declared a track in Industrial and Engineering Systems (Table. 4). The 1997 Fall tuition revenue generated by MST program (117 credit hours) represents approximately 300% more than the projected tuition revenue submitted in the MST proposal. (Table.5)

Table 3. Projected and Actual Enrollment in MST*

		1997 Fall	1998	1999	2000
Full Time	Projected	1	2	4	4
	Actual	1			
part-time	Projected	5	15	18	21
	Actual	20			

*Fall 1997-Regular 19, Provisional 5, Withdrew 3

Table 4. Undergraduate major of admitted MST students and their declared tracks (Industrial and Engineering Systems (IES); Technology Management (TM)- Fall 1997

Undergraduate Major	Number of students	IES	TM
Engineering	1	1	
Engineering Technology	3	2	1
Industrial Technology	4	1	3
Industrial Education	1		1
Industrial Labor Relation	4		4
Mathematics	1	1	
Information System	2		2
Business	2		2
Computer Science	1		1
Other*	5	1	4

*Chemistry, Political Science, English, Journalism, and Anthropology

Table 5. Projected and Actual Revenue of MST program for Fall 1997

	Credit Hours Generated	Full Time Equivalent	Revenue \$125/hr
Projected	36	4	\$4500.00
Actual	117	13	\$14625.00

CONCLUSIONS

The Master of Science in Technology was developed using a knowledge-based team approach and a twenty- seven (27) step design and development process. Integral to the success of the development was a team approach, which used members from a group of diverse faculty and administration, and Business and Industry community leaders. The approved MST program has two tracks, Industrial and Engineering Systems and Technology management.

The program approval process was aided by the applied nature of the coursework since it demonstrated an experiential approach to instruction. The MST team met their stated timeline and started classes in the fall of 1997 with an initial class of 24 students.

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Kent Curtis is professor of Technology and education at Northern Kentucky University. He directs the Master of Science in Technology, coordinates the two-year program in Supervisory Development, and teaches supervision and graduate courses in research. He has published an eight-book series, *The Human Side of Work and Building Community*.

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