COVER PAGE

INSTITUTION: Indiana State University

COLLEGE: School of Technology

DEPARTMENT: School of Technology

DEGREE PROGRAM TITLE: PhD in Technology

FORM OF RECOGNITION TO BE AWARDED/DEGREE CODE _____

SUGGESTED CIP CODE: _____

LOCATION OF PROGRAM/CAMPUS CODE: Terre Haute, Indiana

PROJECTED DATE OF IMPLEMENTATION: Fall 1997

DATE PROPOSAL WAS APPROVED BY
INSTITUTIONAL BOARD OF TRUSTEES _____

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SIGNATURE OF AUTHORIZING
INSTITUTIONAL OFFICER

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DATE

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DATE RECEIVED BY COMMISSION FOR
HIGHER EDUCATION

_____ _____
COMMISSION ACTION (DATE)

Indiana State University
Approved Proposal
March 1997

Doctor of Philosophy
in
Technology

Submitted by

Indiana State University
School of Technology

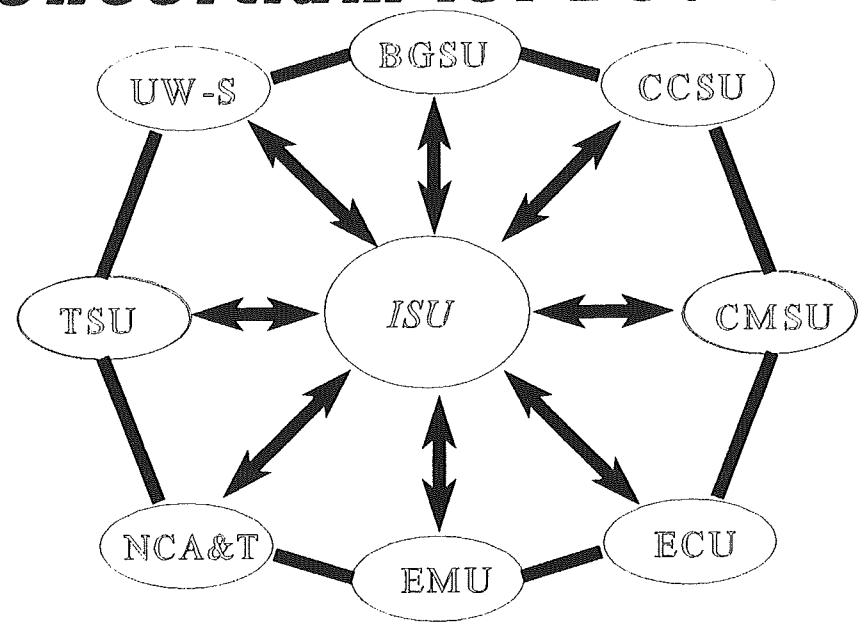
as a part of a

University Consortium

organized to promote
Advanced Studies in Technology

March 1997

Consortium for Doctoral



Studies in Technology

- Consortium -

A partnership or group formed to undertake an enterprise beyond the resources of any one member.

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A. ABSTRACT

DOCTOR OF PHILOSOPHY IN TECHNOLOGY

Offered by
Indiana State University
School of Technology
as a member of
A Consortium of Universities Organized to Promote Advanced Studies in Technology

The Doctor of Philosophy Degree in Technology is proposed through the School of Technology at Indiana State University to be offered by a consortium of nine universities. The program incorporates the traditional conventions of academic rigor and instructional quality, but also uses alternative delivery strategies and a unique organizational structure. The reasons for forming a consortium are to access specialized resources and increase economic efficiency. Additionally, graduates will have been exposed to a wider knowledge base resulting in enhanced problem-solving skills required in an information-based society.

The dimensions of scientific, sociological, and political organizations are changing more rapidly in response to technological innovation and global economics. The resultant pressure on various human adaptive systems is evident as people are forced to participate in this change. In this complex environment, technology becomes a means that people use to solve problems, optimize opportunities, and contribute to human well-being. Graduates will be prepared to provide leadership in seeking solutions to problems in the societal/technological interface.

Program requirements include a minimum of 90 credits in 5 areas of study: (1) a general technology core directed toward the study of conceptual, ethical, instructional, and philosophical dimensions of technology; (2) a research core emphasizing concepts of formative and summative methodologies; (3) a major area of specialization; (4) cognate studies; and (5) internship. Proficiencies in two areas of research are required. Residency can be met by using several options designed to provide the opportunity for dedicated study. The dissertation is a measure of student success in performing research and using higher order skills of analyzing, synthesizing, and evaluating.

Organization of this program is centered on the use of a collaborative model maximizing the use of resources. Innovation and technological advancement in communications provide opportunities for meaningful interaction between faculty/student, faculty/faculty, and student/student without concern for geographic distance. The Graduate Consortium Coordinating Council, chaired by the PhD Graduate Program Coordinator at Indiana State University, has both logistical and administrative responsibilities.

Employment markets for persons holding a PhD in Technology will include universities and postsecondary education institutions, private industries, and government agencies. The international market will also provide unique opportunities. The expertise of graduates with a technology preparation will provide them with opportunities to be employed in positions where their knowledge will be influential in making policy decisions.

Introduction

Technology, as an area of study, evolved in response to the rapidly changing needs of the industrial sector and demand for employees who could use advanced technological systems with expertise and skill. During the early 1960's, industry began to employ industrial arts teachers to fill the void between those in engineering and the skilled craftsperson on the shop floor. These broadly educated technical teachers provided flexibility and adaptability to newer technologies and fit nicely in the middle technical management arena.

In response, a group of industrial arts professors decided that a new technology major that retained the flexibility and adaptability of industrial arts was needed to meet the advancing use of technology in industry. This new major replaced the pedagogy of education with management experiences and student teaching with industrial co-operative internships. Graduates of this degree program were prepared to meet the growing needs of industry for persons who could apply technological knowledge to solve problems of production and distribution in industry. The new major, called "Industrial Technology", was started in several mid-western universities and was taught by industrial arts professors who had industrial experience and preferred to teach the industrial aspects of technology.

The National Association of Industrial Technology (NAIT) was formed and incorporated under the laws of the State of Ohio on March 17, 1967. Its primary purpose was to ". . . foster the improvement of curricula of industrial technology within institutions of higher education." (The National Association of Industrial Technology, 1988, p. 1). NAIT was authorized by the U.S. Office of Education to be the accrediting organization for industrial technology programs. The official definition of industrial technology, adopted by NAIT (1988), is:

> *Industrial Technology is a field of study designed to prepare technical and/or technical management-oriented professionals for employment in business, industry, and government.* (p.1)

Concurrently, the engineering schools were decreasing the emphasis on technical laboratory courses in favor of greater emphasis on mathematics and science. This change to data-driven theoretical/design was an effort to improve the research capabilities of graduates of engineering schools.

About the same time that programs in industrial technology were developing in teacher education-oriented schools, the engineering profession developed a program designed to apply

engineering principles to application of existing technology. Originally, implementation of this program occurred primarily at the community technical college level. More recently it has been introduced at the university baccalaureate level. This curriculum was developed to prepare students in the application of mathematics and science, using engineering principles, to solve technological engineering problems.

This new major was called "Engineering Technology" and was accredited by the Technology Accreditation Commission of the Accreditation Board of Engineering and Technology (TAC/ABET). Programs in engineering technology, because of the accreditation process, are usually located in universities that have a school of engineering. This differs from programs in industrial technology, which are usually located in universities that have a school of technology.

The definition of engineering technology is as follows:

> *Engineering Technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities; it lies in the occupational spectrum between the craftsman and the engineer at the end of the spectrum closest to the engineer. (Accreditation Board for Engineering and Technology, 1986, no pages given)*

The Current Dilemma

The profession of industrial technology faces several important challenges: (1) a rapid acceleration in both the pervasiveness and complexity of study of technology in the global community; (2) a new definition of the essential body of knowledge including technical specialization, curriculum, instruction, research, and philosophy necessary for professional leadership; and (3) a rapid aging of the membership of the profession. The current educators involved in the study of technology have matured, requiring preparation of persons graduating from a doctoral program that will meet the employment needs for the future. These employment needs include: universities, two year post secondary colleges, technical colleges, business and industry, and selected government agencies such as the Departments of Energy, Transportation, Commerce, and Education.

Programs from which professors of technology have previously graduated have failed to address the study of industrial technology and are frequently narrowly focused on procedures of

theoretical research. The universities do not have laboratories for industrial technology study nor do they have an adequate array of specializations. In addition, many departments are frequently housed in schools of education which provide limited opportunity for specialization in technology within an education doctorate. These doctoral programs frequently do not address the essential integration of the study of technology with the sciences, engineering, or management. Further, they frequently focus on their originally designed purpose of studies in education.

During a time of global economic and technological competitiveness, economic survival is increasingly dependent on the ability of the education community to assure technological diffusion to all sectors. Industrial Technology, as a profession, has a mission to provide education that addresses technological development and diffusion of information.

A Proposed Solution

A PhD in Technology, taught through a collaborative consortium model, is proposed as a solution to the current dilemma. The maturation of the discipline of technology during the past half century has logically and consistently evolved to a level of academic sophistication that requires professionals having defined technological knowledge and laboratory skills.

Consortium Model. The recommended organization of nine universities, with Indiana State University as the degree-granting university, is an effective model. The following reasons are given in support:

> The number of industrial technology professors in the consortium provides a large pool from which to select persons with outstanding qualifications and expertise.

> Laboratories which have speciality equipment and organization are not homogeneously distributed, but these facilities are available by selecting and using existing resources from the consortium members.

> The number of people who have doctorates as compared to the number that is needed is greater than any one university could produce. By using a consortium model, resources are combined making it possible to deliver a quality program without a

significant increase in new resources. The more effective use of resources by several partners will permit the universities to admit and graduate a larger number of students.

> Consortium member institutions, by working together and sharing expertise, will provide a climate for both individual and institutional growth. This collaborative process will increase the rate of technological diffusion as compared to the single institution model which is prevalent in present doctoral granting universities.

> The composite resources of the consortium will permit a greater variety of concentrated efforts in research and instruction. This will promote better understanding of the diffusion and application of technology.

> Communication systems have been developed which permit the educational process to occur without regard to geographic location or distance.

The consortium model addresses the key issue of expertise and resources, but does introduce additional complexities. These are primarily in the areas of logistics of organization and administration. Students outside of Indiana will have the additional requirement of attending two different universities during the program. Administration will be more complex than the conventional single institution program. Coordination, consensus, and innovation issues all increase with the model. In response to these issues, new strategies and structures for administration have been planned. The goal is to develop an organization of universities which can deliver quality programs more effectively and efficiently than conventional models of advanced graduate studies. We are confident that the proposed consortium model will accomplish this goal.

B. PROGRAM DESCRIPTION

B-1 Description

The proposed Doctor of Philosophy in Technology program is designed to prepare students for positions of leadership in the public and private sectors of society. At the conclusion of the program, graduates will have developed skills in research procedures, will have acquired expertise in instructional processes, and will be able to provide service to the industrial and educational community.

The proposed program maintains most of the traditional requirements characteristic of advanced graduate study, but is unique in using the resources of a consortium of nine universities linked together by alternative communication systems. These member universities have programs staffed by faculty having expertise in many areas of technology. Additionally, laboratories with specialized equipment are available that provide opportunities for research and study. Each university will bring to the consortium a unique philosophical quality and extensive library holdings that add depth and quality to the program.

Alternative communication technology will be used to deliver key components of the program such as the general technology core, linking campuses to better serve students. This will allow all members of the consortium to capitalize on the efficient use of existing resources while maintaining quality.

B-2 Objectives

The objectives of the program are to:

> *Enhance the level of study in selected technologies* at the consortium universities by providing opportunities for research in development, application, and technological transfer;

> *Prepare students to become specialists who can provide leadership* in areas of research, curriculum design, content development, and instructional strategies in teaching technological information;

> *Prepare students to provide service to the industrial community* by assisting in the

development, application, and transfer of technological information;

> *Prepare students* to become leaders in the institutions of higher education, postsecondary schools, government agencies, and industries in the application and transfer of technological information.

B-3 Admission Requirements

Application for admission shall be made to the Indiana State University School of Graduate Studies. The decision to admit shall be based on the recommendation of the Graduate Consortium Coordinating Council in consultation with the PhD Graduate Program Coordinator. This recommendation shall be forwarded to the Dean of the School of Graduate Studies at Indiana State University.

The consortium of universities shall actively seek to recruit and admit students promoting the concepts of diversity and ethnicity in the program. This goal of promoting diversity in the student population is reflected in the composition of membership of universities in the consortium and is consistent with the goals of the Strategic Plan for Indiana State University and the School of Technology.

Admission requirements include:

> Bachelor's degree from an institution accredited by the North Central Association of Colleges and Secondary Schools or similar accrediting body;
> Minimum undergraduate grade-point index of 3.0 and minimum graduate grade index of 3.5 (on a 4.0 scale);
> Graduate Record Examination with a score of 500 minimum on each of the general tests;
> Five letters of recommendation; and
> Two years of validated appropriate occupational experience.

Students with strong credentials may be considered for admission if one of the following criteria is not met: (1) undergraduate grade point average, (2) Graduate Record Examination scores, (3) graduate grade point average but not below 3.0, or (4) occupational experience. The decision to waive one of the criteria will be included in the recommendation coming from the PhD Graduate Program Coordinator.

The interpretation of the appropriateness of occupational experience shall be by the Graduate Consortium Coordinating Council in consultation with the PhD Graduate Program Coordinator. Occupational experience must have occurred prior to admission and cannot be a part of the internship requirement.

Faculty employed on tenure track positions by consortium member universities, including Indiana State University, may be admitted to the PhD in Technology program. In this admission situation, it is not permissible for the chairperson of the Doctoral Student Program Planning Committee or the Director of Dissertation to be employed at the university in which the applicant is employed. The same guidelines shall be applied to the development and evaluation of the preliminary examination, the intent being to eliminate the possibility of conflict of interest between faculty and student.

Projected Enrollment. No more than 45 students (5 per consortium member) will be admitted during the first year of program operation. The number of new admissions for the second year of operation could be between 15 and 25 students, with an additional 25 students in the third year of operation. It is anticipated that the consortium will have approximately 85 admitted students within three years of starting operation. The number of students admitted each year will be based on the evaluation of current program resources by the Consortium Coordinating Committee (advising the PhD Graduate Program Coordinator). Consultation will be held with the deans representing the universities in the consortium prior to setting admission quotas.

It is strongly recommended that students **not** be advised to take courses with the anticipation that they will be admitted to the program at a later date. This process of informal advising of students who may successfully complete the recommended courses, a "banking" concept, can raise the expectations of an individual that admission is forthcoming. However, admission cannot be assured to an individual based only on course work.

B-4 Student Program Planning Committee

Upon a student's admission to the program, the faculty member on the Graduate Consortium Coordinating Council representing that student's consortium university, in consultation with the PhD Graduate Program Coordinator, shall serve as temporary program advisor. The Student Program Planning Committee shall be organized within the first academic year of the student's studies.

The Student Program Planning Committee will be composed of five graduate faculty members: two graduate faculty members will come from Indiana State University; two from the major area of specialization, and one faculty member from another consortium university. The temporary advisor, in consultation with the student, shall determine the membership of the committee. The chairperson of the Program Planning Committee shall be determined by the committee and student. The committee and chairperson shall be recommended for approval to the PhD Graduate Program Coordinator.

B-5 Program Requirements

A minimum of 90 semester hours of graduate credit, in five program areas approved by the Program Planning Committee (see Figure 1.) , are required to complete the program. These program areas are: (1) General Technology Core, (2) Major Area of Specialization, (3) Internship, (4) Research Core and Dissertation, and (5) Cognate Studies.

Residency. The requirement for residency can be fulfilled by enrolling in a minimum of 9 semester hours per semester, with a majority of the credits from the resident university, during each semester of residency and by:

> Completing two consecutive semesters at Indiana State University, or
> Completing two consecutive semesters, one at Indiana State University and the other at the university at which the specialization is being completed, or
> Completing a one day per week attendance for one academic year, requiring enrollment in 9 semester credits offered by the consortium, at a consortium site.

Research Proficiencies. Two research proficiencies are required. Approved research proficiencies include: foreign language, statistics, and computer applications. Proficiency requirements are met by acceptable performance on the examination. Proficiency examinations will be administered according to the procedures outlined in the Indiana State University Graduate Catalog.

Preliminary Examination. Preliminary examinations shall be the responsibility of the Student Program Planning Committee. The proctor for the preliminary examination shall be the consortium university's PhD Program Coordinator. The student must satisfactorily pass both written and oral examinations in the areas of (1) general technology, (2) area of specialization,

and (3) research. Preliminary examinations shall be available twice each year using the same dates as those established by the School of Graduate Studies at Indiana State University.

The preliminary examination shall be prepared by the members of the Doctoral Student Program Planning Committee working with the PhD Graduate Program Coordinator at Indiana State University. The preliminary examination will be based on guidelines established by the Consortium Coordinating Council. The questions in the examination must address the (1) General Technology Core, (2) Major Area of Specialization, (3) Cognate Studies, and (4) Research Core. Evaluation of the examination shall be by the student's Program Planning Committee. The School of Graduate Studies shall advise the Registrar's Office on the oral and written examination results.

Course Credit Recognition. Transfer and consortium member course credits are defined according to the following guidelines. Courses taught in the degree program are reviewed by the Graduate Consortium Coordinating Council to determine acceptability. Because of this process, consortium member credits are not re-evaluated as transfer credits, but are posted on the student's record at Indiana State University as an approved consortium university credit, just as through the course were taken at Indiana State University.

Transfer credits are those credits coming from other universities, or courses which have not been approved by the Graduate Consortium Coordinating Council. These must be subjected to the normal transfer process. Transfer credits must come from institutions approved by an appropriate regional accrediting agency, such as North Central, offering course work leading to an advanced degree. The number and appropriateness of transfer credits shall be evaluated by the Doctoral Student Program Planning Committee and recommended by the PhD Graduate Program Coordinator as a part of the student's program plan.

The number of semester hours of graduate credit transferable from other institutions is not determined by a specific rule. The dissertation and a minimum of 30 semester hours of work defined in the program of studies should be taken as a part of the course work offered by the consortium.

B-6 Admission to Candidacy

The requirements specified in the Indiana State University Graduate Catalog shall be used as criteria to guide the decision making process for student admission to candidacy. To meet these criteria a student must complete:

> 80 % of the course work in the program plan with a minimum GPA of 3.0;
> 50 % of the residency requirement;
> 50 % of the approved program at the 600 level or higher (or equivalent); and
> Two research proficiencies.

Dissertation Committee. This committee's membership will normally be the same as that of the Program Planning Committee, with the Director of Dissertation being selected from the committee by the candidate. The composition of the committee can be changed with approval of the PhD Graduate Program Coordinator and the Dean of the School of Graduate Studies. Voting composition shall not exceed five members. The dissertation shall follow guidelines and format specified by the Indiana State University Graduate Catalog.

Time limitation. Generally, the candidate must complete the program within seven years of admission or four years from advancement to candidacy. Graduate work will generally not count towards the degree if taken seven years prior to admission. Graduation will not be granted during the semester in which the student is admitted to candidacy. Students cannot graduate during the same semester in which the research proposal is accepted.

B-7 Graduation Requirements

The doctoral degree candidate must complete the following steps toward graduation:

> Make application for graduation at least one semester after admission to candidacy;
> Complete a minimum of 90 semester hours of graduate course work above the baccalaureate degree with a grade point average of 3.0 on all course work completed after admission to the program;
> Satisfactorily complete preliminary and proficiency examinations;
> Complete and defend a dissertation;
> File the original and two copies of the dissertation with the School of Graduate Studies at Indiana State University and one with the PhD Graduate Program Coordinator;
> Be recommended for the degree by the Program Planning Committee to the PhD Graduate Program Coordinator; recommendation to award the degree shall be by the Dean of the School of Graduate Studies at Indiana State University.

B-8 Anticipated Student Clientele

The study of technology as a discipline has evolved during the past half century into degree programs within broad fields such as manufacturing, construction, communication, transportation, and biotechnology. The Industrial Technology Baccalaureate Program Directory, 1996 edition, lists over 1,690 members of the National Association of Industrial Technology (NAIT). These members are located at 134 institutions in 42 states. Additional membership in NAIT is in post secondary two-year institutions. The Industrial Teacher Education Directory, 1995-96, sponsored by the National Association of Industrial and Technical Teacher Educators and the Council on Technology Teacher Education, lists 232 institutions of higher education having baccalaureate and masters degrees in technological studies with 2,361 faculty. The average institution size is 10,176 students. Graduates of these programs will be a primary source of students. Other students will come from industry, government, and faculty currently teaching at the university without doctoral degrees.

The current employment demand for persons having technology-based doctoral degrees is very high. Potentially, the primary employers will be:

> Two-year post secondary institutions as represented in Indiana by the Ivy Tech State College and Vincennes University;
> Universities having programs in technology with a high service and teaching mission and offering master's degree programs;
> Industries that are trying to meet world market requirements by being consumers and innovators of technology;
> Government agencies that may utilize personnel having an advanced degree with preparation in technology.

B-9 Student Financial Support

Participating members of the consortium will provide both fellowships (payment for service performed), scholarships (tuition payment or waiver) and/or faculty load release (applicable to faculty in a consortium university being released from normal responsibilities to pursue advanced course work) to support one doctoral student per year, up to a total of three per institution, for

students admitted to the program.

Payment for tuition credit will occur using the following guidelines.

> The consortium member, or student, will pay the tuition for courses being taken by the fellowship student to the university offering the course.
> All consortium participating universities shall charge the resident rate of tuition for courses delivered to other universities in the consortium.
> Graduate students serving the required one semester residency at Indiana State University (1) will be given fee and tuition wavier by Indiana State University for all registered Indiana State University credits, (2) will be paid the fellowship (living costs agreement) by the sending university, and (3) will be required to provide 20 hours per week of service per week to Indiana State University.

If a consortium university has funds in addition to the amount required by the consortium, that university may choose to support additional graduate students. The consortium recommends that the amount of support should be $1,000 per month living costs plus an additional $2,500 per academic year tuition reimbursement.

B-10 Model for Curriculum Delivery

In a consortium, logistics of the program delivery system (see Figure 1.) become complex. Critical components of the system are (1) selecting and using the best available expertise, (2) using the most efficient and effective means of delivering the program, and (3) providing opportunities for individuals and consortium universities to participate. The "Home University" refers to the university which offers the courses. Courses offered for registration purposes to the consortium member universities would allow students to pay tuition at the resident rate of the delivering university.

Program Area	Distribution System	Institution(s)	Credit Allocation
Specialization: Manufacturing, Aerospace, etc	Classroom, Laboratory	University with an approved program, plus other contributors	24 - 30 semester credits, resident fee paid to home university
Internship	Field based	Location of student at time of study	6 semester credits, resident fee paid to home university
Research Core & Dissertation	Classroom, internet, satellite, micro-disk, video tape	Indiana State University	27 - 30 semester credits, for dissertation credit, resident fee paid 2/3 to Indiana State Univ, 1/3 home university
General Technology Core	Internet	University having expertise	12 - 18 semester credits, resident fee paid to home university
Cognate Studies	Classroom, Laboratory	Location of student at time of study	12 - 18 semester credits, resident fee paid to home university

Note: "Home" university refers to the university which offers the course. For example, for a course offered over the internet, all fees would be paid at resident rate to the university offering the course.

Figure 1. Illustration regarding consortium member participation in the delivery of program components.

C. PROGRAM MODEL

The PhD in Technology program is presented as a model (see Figure 2.) with five areas of required study. Courses are not identified, but Topical Areas of Study are given, to assist the Graduate Consortium Coordinating Council in defining the parameters of an area of study. Examples of Major Areas of Specialization (see Appendix A) were developed in greater detail as part of the proposal development process. These, and additional Major Areas of Specialization, will be developed by the consortium universities that will offer the specialization. In all cases, the Graduate Consortium Coordinating Council is the governing body responsible for approval of curriculum.

C-1 Proposed Curriculum

The program of study requires study concentrations in five areas; completing a minimum of 90 credits of graduate study beyond the baccalaureate, with a majority of this course work at the 600 level or above. The overall program is designed to provide the planned opportunities for

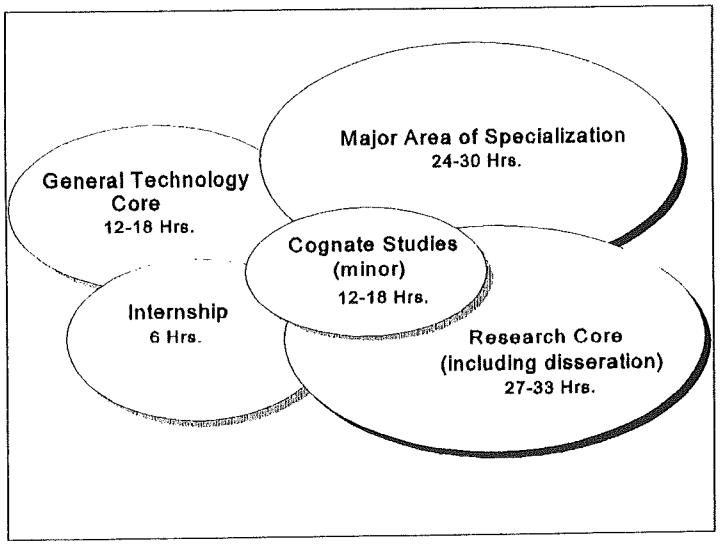

Figure 2. A curriculum model for the PhD in Technology

increasing both depth and breath of knowledge in technological studies.

It is essential that graduates of the program have completed the course work required in one (or more) of the Major Areas of Specialization. The Major Area of Specialization should be supported by the Internship. This specialized knowledge is enhanced by developing a broader understanding of the interrelations of technology with other disciplines such as science, economics, sociology, and government policy designed into the General Technology Core.

The area of Cognate Studies can be used to recognize previous graduate course work which was completed within the last seven years supporting the concept of the program. This area can also be used to address deficiencies identified during the program planning process. It is anticipated that the program recommended for approval can exceed the 90 credit minimum.

Research is critical to the advancement of knowledge in the profession. Statistical and design procedures can be applied and reinforced by the instructional methodology used in teaching the specialization area. Application can be made during the internship. The dissertation is a major piece of research including proposal writing, seeking new information, and concluding with results of the study.

C-2 Curriculum Requirements

Major Area of Specialization (24-30 credits). Specialization in a technical concentration is achieved by completing 24 to 30 credits of course work. Examples of program

specializations (see Appendix A) have been identified for manufacturing, construction, digital communications, and others. It is anticipated that additional specializations will be developed with the changing nature of technology studies. These specializations shall be reviewed and recommended for adoption, modification, or deletion by the Graduate Consortium Coordinating Council to the PhD Graduate Program Coordinator. The approved recommendation shall be sent to the Dean of the School of Graduate Studies at Indiana State University.

Topical Areas of Study: The number of new courses needed for each specialization is anticipated to be small because each consortium-member institution is currently recognized for expertise in a given field that will become that member's specialization. Specializations do not need to be limited to one university, but an effort must be made to maintain quality and consistency in the content taught. Requirements can be met by utilizing a mentor/tutorial instructional relationship between a selected faculty member and an advanced graduate student. This instructional procedure will enhance the opportunity to use current expertise and decrease the number of potentially low enrollment courses in specializations.

Internship (6 credits). The internship is designed to provide doctoral students with the opportunity to test and experiment in industry, research organizations, government agencies, and other appropriate experiential ventures associated with technology utilization, transfer, and innovation for the express purpose of developing knowledge in the specialization. A personal assessment portfolio will be developed as a part of the internship experience.

Topical Areas of Study: The purpose of the internship experience is to provide an opportunity for the doctoral student to test relevant theories linking the university experience to a process of technological transfer. The internship shall be tailored to be supportive of the Major Area of Specialization. Previous experience cannot be used to meet the internship requirement.

Research Core (27-33 credits). The research component of the program is composed of course work in research design, research methodology, and statistical analysis. A dissertation of eighteen credits shall be completed after advancing to candidacy for the degree.

Topical Areas of Study: The following areas of study are typical:

Advanced Research Methods

Statistical Analysis in Technology Research

Field Research Projects

Research Seminar
Seminar in Technology Processes
Dissertation Credit (registered with 1/3 credit at home university and 2/3 at Indiana State University)

General Technology Core (12-18 credits). The general technology core of studies is designed to provide a conceptual framework for studies in technology. This core emphasizes the relationship of technology to the societal context from which it operates. The core will be taught using internet technologies, or other approaches capitalizing on the unique expertise of professors at consortium member institutions. These courses will be required of all students.

Topical Areas of Study: The following topics of study are examples which could be included in the General Technology Core:
Studies in Trends and Development of Technology
International and Cultural Technological Development
Strategic Planning for Technological Processes
Technological Assessment and Innovation

Cognate Studies (12-18 credits). The cognate area of study may be inclusive of previous graduate work and is designed to provide concentrated study in technology. Recommendations for approval shall be made by the student's program committee.

Topical Areas of Study: The program planning committee will review previous graduate level course work to determine the appropriateness to the objectives of the degree program. If appropriate previous work is not identified, the program planning committee may, working cooperatively with the graduate student, define a cognate area of study. The Doctoral Student Program Planning Committee in reviewing the cognate area should anticipate that the student may have course background in instructional strategies including curriculum design, methodology, evaluation, and delivery systems if he/she is interested in teaching at the post-secondary level. If deficiencies in the instructional strategies area are found, the planning committee may recommend procedures or courses which can be used to remediate the deficiency. It is permissible to have the total number of credits awarded for previous course work plus the number required to rectify deficiencies exceed the 12-18 range in the cognate area. These credits cannot be used to decrease requirements in the other areas of study.

C-3 Degree Awarded

Students meeting all requirements for the PhD in Technology will be recommended for awarding of the degree by the PhD Graduate Program Coordinator to the Dean of the School of Graduate Studies at Indiana State University. The ceremonial presentation of the degree may be made by a consortium member university at the appropriate graduation ceremony. The degree identification shall be a PhD in Technology from Indiana State University with the appropriate recognition of the role of the consortium members identified on the certificate. Records of the progress of the graduate student shall be maintained at Indiana State University and shall be the official documents.

C-4 Catalog Statement and Changes

The proposed degree program is new and no current catalog materials exist. The catalog statement will be:

Doctor of Philosophy in Technology (90 semester hours minimum)

The Doctor of Philosophy in Technology degree program is designed to prepare selected persons for positions of leadership in research, teaching, and service for private and public employment. The program is offered through a consortium of nine universities with Indiana State University being the degree-granting institution. Students have the opportunity to pursue areas of specialization made available by consortium member universities.

The objectives of the program are to: (1) enhance the level of study in selected technologies at the doctoral level, providing opportunities for research in the development, application, and transmission of technological knowledge; (2) prepare specialists who can provide leadership in areas of curriculum design, content development, and instructional design in industrial technology; (3) provide service to the industrial community and society in the use and implementation of technology; and (4) educate individuals for leadership roles in the educational process of higher education, post secondary schools, government agencies, and industries.

Admission requirements include the appropriate degree(s), a (minimum) undergraduate grade index of 3.0 and a (minimum) graduate index of 3.5 (on a 4.0 scale). The Graduate Record Examination is required with scores of not less than 500 in any category. These requirements conform to those listed in the *Indiana Sate University Bulletin, Graduate Catalog.*

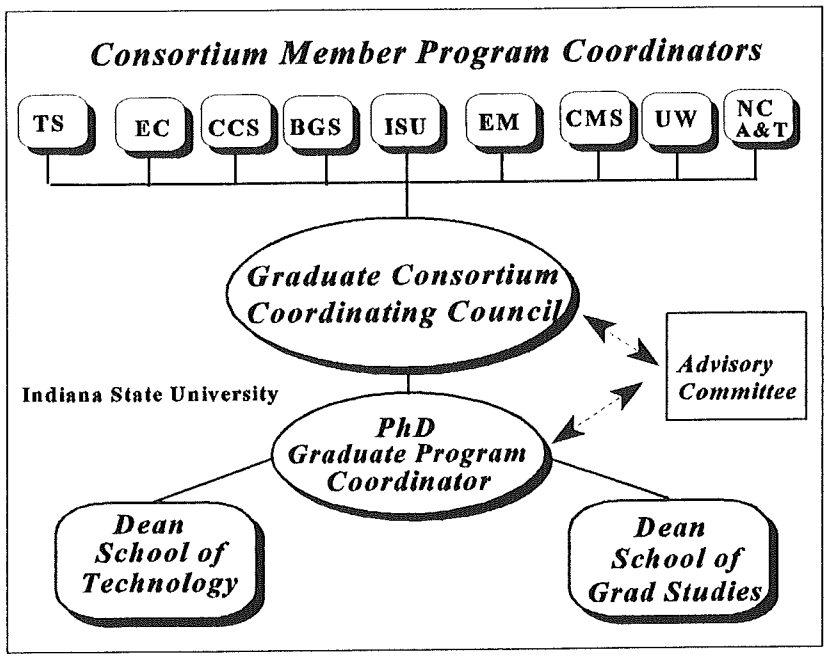

Figure 3. Administrative organization of the Consortium.

D. ADMINISTRATIVE ORGANIZATION AND FACULTY APPROVAL

The organization of the consortium will operate using most of the conventional roles of faculty in governance and decision-making. Primary authority for curriculum and program will reside with the Graduate Consortium Coordinating Council. The program administrator is the PhD Graduate Program Coordinator at Indiana State University working with the Consortium Member Program Coordinators. The interrelationships between the Graduate Consortium Coordinating Council, PhD Graduate Program Coordinator, Consortium Member Program Coordinators, Advisory Committee, Deans of the Schools of Technology and Dean of the School of Graduate Studies at Indiana State University are presented in Figure 3.

The consortium program requires a fulltime PhD Graduate Program Coordinator at Indiana State University. In addition, each member university will appoint a Consortium Member Program

Coordinator. The amount of time assigned to the Consortium Member Program Coordinator position, and how the time allocation is made, will be determined by each consortium university. However, in active member universities, it is anticipated that this will require a 1/4 time allocation at the onset with review after the program becomes operational.

Each participating university must have approved graduate faculty who have met the graduate faculty requirements of their university and those of Indiana State University. The Graduate Consortium Coordinating Council will review and recommend appropriate action for faculty seeking to teach specific courses.

D-1 Graduate Consortium Coordinating Council

A Consortium Coordinating Council will be established that will include one representative from each of the participating universities, including one representative from Indiana State University, plus the PhD Graduate Program Coordinator from Indiana State University. Selection of the representative shall be made by the sending university but must come from the School of Technology, the Industrial Technology Department, or another appropriate department.

The responsibility of the Graduate Consortium Coordinating Council shall be to advise and recommend on the development and operation of the consortium PhD in Technology program. This is inclusive of: (1) curriculum review and approval, (2) faculty evaluation and recommendation, (3) guidelines for the Student Programming Planning Committee, (4) policies on distance education delivery, (5) recommendations pertaining to program administration, (6) review of the consortium budget, (7) recommendation about facilities including laboratories, (8) faculty and student appeals, and (9) program assessment procedures.

The Indiana State University PhD Graduate Program Coordinator shall be responsible for setting agendas and calling and chairing meetings of the Consortium Coordinating Council. Recommendations from the Consortium Coordinating Council shall be to the PhD Graduate Program Coordinator, who will implement or recommend appropriate action.

Advisory Committee. An advisory committee composed of the deans of participating schools, industrial CEOs, and government officials shall be organized. This committee shall be appointed by, and advisory to, the Consortium Coordinating Council and the PhD Graduate Program Coordinator. The chairperson of the advisory committee shall be selected by the committee. The PhD Graduate Program Coordinator shall be responsible for calling and making arrangements for all meetings.

D-2 PhD Graduate Program Coordinator

The PhD Graduate Program Coordinator shall be appointed by the Dean of the School of Technology at Indiana State University. Responsibilities shall pertain to providing leadership and administration of the program within established guidelines. Categorical areas of responsibility will include: (1) admission recommendations, (2) leadership for the Graduate Consortium Coordinating Council, (3) monitoring student progress, (4) organizing and advertising all consortium course schedules, (5) calling meetings and organizing the Advisory Committee to seek guidance for action, and (6) working with the Dean of the School of Graduate Studies at Indiana State University

The PhD Graduate Program Coordinator shall be identified as a full-time position, but the individual may choose to teach courses, serve on Student Program Planning Committees, and chair dissertations.

D-3 Consortium Member Program Coordinators

A Consortium Member Program Coordinator shall be a graduate faculty person appointed by each of the consortium universities to represent and administer consortium relations of that university. The amount of time allocated to the program coordinator role will be a decision of the participating university. The responsibilities of the program coordinator will be to assure program operation, advise students, participate on committees, and serve as the faculty representative to the Graduate Consortium Coordinating Council. The primary responsibilities will be to assure that an open and responsible link of communications is maintained with the PhD Graduate Program Coordinator, Dean of the member university, and students. The Consortium Member Program Coordinator must attend Graduate Consortium Coordinating Council meetings and represent the concerns of his/her university.

D-4 Consortium Graduate Faculty

In order to participate in the Consortium sponsored PhD program, professors and administrators must meet the requirements for graduate faculty status of their university and those of Indiana State University.

Approval Process for Graduate Faculty. The approval process requires that the faculty member submit validation of current graduate faculty status and/or application materials to the PhD Graduate Program Coordinator. Application for graduate faculty status at the home university is the responsibility of the applicant. Application materials for graduate faculty status at Indiana State University shall be submitted to the PhD Graduate Program Coordinator who will send them to the Dean of the School of Graduate Studies at Indiana State University with a recommendation.

Approval of a faculty member for graduate faculty status will be based on existing criteria and procedures of both the participating university and Indiana State University. Faculty seeking to participate in the consortium must meet the graduate faculty requirements of the university at which the individual is employed, graduate faculty status at Indiana State University, and approval of the Consortium Coordinating Council in order to become a graduate faculty member of the consortium.

Load Measures for Graduate Faculty. The proposed guidelines for load assignments of graduate faculty are delineated in Table 1. Generally, load assignments will take into consideration teaching load, advising, committee responsibility, and other activities required to participate in the consortium. Additional options such as reduced load or additional pay can be negotiated by each consortium university to comply with local policies.

Teaching Credit-Hours	Student Advisement	Committees	Other
6 hrs of 600 level courses	20 students if all are 600 level	Chair 2 dissertations and serve as a member of 5 dissertation committees	Participate in consortium Participate in research activity
9 hrs mixed instruction (at least one 600 level course)	40 students if mixed (1 course @ 600)	Same as above	Participate in consortium Participate in research activity
12 hrs with no 600 level courses	60 students with no doctoral	Serve as a member of 5 dissertation committees	Participate in consortium Participate in research

Note: The table is read by row , across the 4 columns, with all activities in each cell defining the combination of responsibilities for a suggested equivalent faculty load.

Table 1. Maximum load assignment considerations for doctoral faculty.

Graduate Faculty Potential. The consortium model has the potential to provide a large and extremely well qualified faculty that is not available in any single university. The total number of

faculty in departments/colleges/schools of technology is 358 with 228 (63%) holding doctoral degrees. The percentage of technology faculty having terminal degrees, by member university, is from 79% to 50%, with an average of 63%.

E. PROGRAM RATIONALE AND RESOURCES

Indiana State University has an established record of providing doctoral programs in various disciplines. However, in times of improved communication technology, it becomes logical to review existing structures, administrative policies, programs and resources, while seeking a more effective and efficient means for providing a PhD program. It is with this sense of innovation that the model of a consortium of universities delivering a PhD in Technology is proposed.

E-1 Learning Resources

The consortium concept provides resources beyond those of any single university. Technology resources are essential and must include an adequate library, laboratories with the appropriate modern equipment, communications equipment, and community resources. In addition, the proposed consortium will use alternative delivery strategies permitting access by students to some of the most outstanding faculty in technology and related studies. The collaborative efforts of the consortium universities are critical to assuring that quality, uniqueness, and innovation are present.

As a part of the consortium, Eastern Carolina University recently submitted a National Science Foundation concept paper. This pre-proposal for *The Design and Implementation of a Problem-Solving Consortium Utilizing Internet On-Line Strategies, Faculty Specialists, and Expert Field Reviewers to Team Teach Graduate and Undergraduate Courses in Technology at Nine Universities* included a budget of $392,785 that would be used to assist in the further development of a delivery model for the Ph.D. in Technology program. (Approval pending)

The potential for accessing additional funding to support the program is improved through the collaborative efforts of the consortium. It is anticipated that funds will need to come from: (1) internal reallocation, (2) new appropriations from state governments, and (3) external funding sources. The proposed program presents a model which uses new organizational structures and communications technology to accomplish the goals. The consortium includes two universities which are historically minority universities. The characteristics of the consortium are commonly

identified as criteria in many funding agency briefs.

E-2 Program Strengths

The proposed program for earning a PhD in Technology is unique. There is no similar program in the United States. The uniqueness of the proposed program is in the use of a consortium of selected universities. The collaborative effort of these universities brings together a combination of both faculty and facility resources which cannot be matched by any other single university. The innovative restructuring of administration, use of resources, and alternative communication systems using cutting edge technology will permit a larger number of students to pursue an advanced degree. In return, this collaborative effort will require fewer new resources and more effectively utilize current resources than any other model. The impact on Indiana's industrial competitiveness, and on that of other consortium states, will be through increased economic participation in the global market and additional technological leadership.

The profession, promoting studies in technology, has matured to the status of needing persons with both specialized technical and conceptual knowledge about technology.

The consortium-based PhD in Technology has these advantages:

> The consortium of nine universities provides considerable resources in both technical laboratories and faculty expertise which would not be provided by any single institution.

> The use of advanced communication technology will provide flexibility and opportunity for students to experience a broader spectrum of concepts and ideas from faculty.

> The program requires students to develop expertise in research while pursuing a specialization. The General Technology Core will provide broad-based study in technology.

E-3 Institutional Factors

Indiana State University is frequently defined as unique, having quality programs while remaining focused on the academic needs of the individual. President John Moore, in addressing faculty on our accomplishments as a university for 1995-96 said, *"Let us take a look at our*

accomplishments . . . for these accomplishments are examples of how ISU is becoming a stronger, better university." (Moore, President's Letter, October, 1996) In listing accomplishments, the 15,306 students who received benefit of the university were paramount. Undergraduate degrees were earned by 1,643 students, 503 students earned graduate degrees, and 33 students earned doctorate degrees. These were only a few accomplishments; with attention also being given to initiatives that are forging new partnerships, improved scholarship, funded research, recognition for public service, recognized athletic programs, and cultural diversity. Each of these accomplishments is integral to the goals established in the Indiana State University's strategic plan.

In focusing towards new programs, Dr. Moore recognized the accomplishments of the School of Technology. Specifically, he mentioned the delivery of the General Aviation Technology over the Indiana Higher Education Telecommunication System. He also drew attention to the current development of the PhD in Technology with an anticipated implementation date being fall semester of 1997.

Graduate study at Indiana State University has a long history of providing the doctoral degree to practitioners in the professions. The first cooperative venture in delivering a program was started in 1948 between the School of Education at Indiana State University and Indiana University. This collaborative effort led to a doctorate in Education. Currently, Indiana State University offers six doctoral programs through the School of Education and the College of Arts and Sciences. The School of Education's doctorate in Curriculum, Instruction, and Media Technology provides for various specializations in collaboration with other schools on campus.

In defining the institutional mission (Graduate Bulletin, 1995-97) for graduate education, Indiana State University is clearly dedicated to advanced scholarly endeavors:

> *Graduate education is viewed as being at the heart of those efforts designed to preserve and enhance the quality of life. The concentrated, in-depth study which characterizes this level of experience provides the trained manpower for addressing and solving society's needs. Indiana State University has long recognized that research, scholarship, and creative activity are essential parts of its mission.*

The School of Technology has five Master of Science Degree programs and a specialization program agreement with the Department of Curriculum, Instruction, and Media Technology for its PhD in Curriculum and Instruction. Graduate studies have a long history of being emphasized in the School of Technology. Prior to the reorganization in 1979, graduate programs in Industrial

Arts and Vocational Education were offered for teachers. In the Strategic Plan for the School of Technology, the PhD in Technology is identified as a program consistent with the mission of the School.

An Advanced Technology Center is currently under construction. This nearly $19 million facility is scheduled to open in the fall of 1997. This is only one of several initiatives of the School. The School is recognized for its leadership in the use of satellite delivered distance education. Both the undergraduate and graduate Human Resource Development (HRD) programs and the General Aviation Courses make extensive use of this alternative delivery system. Articulation programs with the Ivy Tech State College system and Vincennes University are being expanded. The employment of a specialist promoting program articulation with secondary schools in the School to Work program is unique among universities in Indiana. Career exploratory programs such as the new high school mentoring experience, *"Hands-on-High Tech"*, and a proposed Academy for Technologists are all critical to the linking of university education with secondary education, other post-secondary institutions, and the adult workforce of Indiana.

E-4 Planning Process

At Indiana State University, the School of Technology has actively pursued the development and approval of a PhD in Technology program. In 1991 a PhD in Technology proposal was submitted, approved by the School of Technology, but was not supported for further approval because of changes at the President and Provost levels. The School's Strategic Plan for 1994-95 included the PhD in Technology as one of the new program goals.

This proposal is new, using a consortium of universities during the planning process and the same universities as being essential to program delivery, to provide the necessary resources. A series of meetings including Deans and selected faculty from each of the participating institutions has resulted in this proposal document. A listing of the Consortium Members and Planning Team Participants is included below:

Consortium Members and Planning Team Participants

Indiana State University — School of Technology

Dr. Clois Kicklighter, Dean
Dr. Lowell D. Anderson, Consortium Coordinator
Dr. David P. Beach, Professor
Dr. Roy A. Buckingham, Professor
Dr. Gerald W. Cockrell, Professor

Texas Southern University— School of Technology
Dr. Joshua Hill, Dean
Dr. Boma T. Afiesimama

East Carolina University — School of Industry and Technology
Dr. Darryl Davis, Dean
Dr. J. Barry DuVall

Central Connecticut State University — School of Technology
Dr. John R. Wright, Dean
Dr. James A. DeLaura, Professor

Bowling Green State University — College of Technology
Dr. Thomas L. Erekson, Dean
Dr. David V. Gedeon, Professor

Eastern Michigan University — College of Technology
Dr. Thomas K. Harden, Dean
Dr. Paul D. Kuwik, Department Head
Dr. Thomas McDole

Central Missouri State University — College of Applied Sciences and Technology
Dr. A. J. Rosser, Dean
Dr. John R. Sutton, Chair

University of Wisconsin-Stout — College of Technology, Engineering, and Management
Dr. Bruce E. Siebold, Dean
Dr. Leonard Sterry, Director of Graduate Program

North Carolina A & T State University — School of Technology
Dr. Earl G. Yarbrough, Dean
Dr. Abhay V. Trivedi, Chair

E-5 Student Demand and Employment Factors

Finding qualified persons with advanced technology degrees for employment in universities having programs in industrial technology is critical. Many of the faculty currently teaching technology are approaching retirement. This will place considerable demand on the limited supply. The number of qualified technology professors and instructors has been declining for nearly a

decade. At the same time, qualifications have risen with the expectation that faculty must hold a doctorate and be able to teach in a laboratory based technology program. In addition to the academic demand, industry and government agencies are increasingly employing persons with research and administrative capabilities who are well versed in technology.

In a survey to determine supply and demand for university technology faculty (Erekson, 1996), the conclusion was: *"It appears there will be a significant demand for new technology faculty holding the doctorate currently and in the future."* The survey instrument was sent to 230 departments having technology and technology-related programs. Of the initial sample, 117 (50.8%) of the department chairs responded. It is important to note that the survey did not include the two-year post-secondary institutions or make any estimate of the industrial and government job demand.

In the study, age was considered a critical variable for predicting staffing needs. The mean age of technology faculty teaching in universities is 48.97 years with an age range of 22 to 73 years. In the sample, over 14% of the faculty were over 60 and almost one third (32.3%) were 55 years or older. The factor of age, when added to the current shortage of new faculty, intensifies the demand for competent technology professionals.

In addition to age, background was also determined to be an important criterion used by universities when selecting professionals to staff these positions. On a 10 point scale, with 1 being the highest, the need for a doctorate (for technology faculty teaching in universities) was given a mean rating of 2.34. Industrial experience was rated at 4.39.

The department chairs who had conducted a faculty search in the past five years were asked how difficult it was to employ qualified tenure track faculty. The mean response was 3.92 on a ten point scale with 1 being very difficulty and 10 being very easy to employ qualified faculty. This suggests that chairs have been experiencing difficulty in employing qualified technology and technology related faculty in the past five years.

Based on this survey, 259 positions are predicted to become available during the next five years. In addition to retirement, the chairs anticipated an additional 92 new positions. It was estimated that 50 positions will be lost over this period of time. Based on these data, it would appear that the profession will need, approximately, 300 new faculty at a rate of 60 faculty per year over the next five years. This number of graduates would be needed to meet the faculty

demand of the 117 universities responding to the survey. It does not include other universities, post secondary colleges, industry, or government agencies.

The total number of terminal degrees (PhD, EdS, DIT) awarded in the professions related to technology and occupational education listed in the Industrial Teacher Education Directory for 1995-96 was 86 (Industrial Teacher Education Directory, 1996). The areas of concentrated study in these programs were: 10 in industrial technology, 52 in vocational education and industrial technology teacher education, and 24 in human resource development and adult occupational education. The 10 degrees awarded in industrial technology were all technology teacher education degrees (two PhD, eight DIT).

In higher education in the United States, not considering foreign countries, government agencies, post secondary institutions and industries, these 86 graduates are the total new supply of faculty for 232 universities having 2,361 faculty in technology and occupational based degree programs.

E-6 Transferability

The concept of a consortium-based doctorate in technology alleviates the issue of transfer between universities. The program guidelines will be established through the recommendations of the Graduate Consortium Coordinating Council. The Graduate Consortium Coordinating Council has responsibility for course approval and program planning procedures. Courses taken at a participating consortium member institution that have prior approval by the Coordinating Council are not considered as transfer courses and are not subjected to review for transfer purposes. Courses which have been taken at universities outside of the consortium will be subject to the transfer regulations of Indiana State University.

Records will be maintained at Indiana State University, Records Office, for purposes of establishing an official transcript and a recording progress in completion of the program requirements. The awarding of the degree will be based upon the recommendation of the School of Graduate Studies of Indiana State University.

E-7 Consortium Member Resource Estimate

Each member university of the consortium is obligated to provide the necessary resources from their budget to support the program. The following budget (see Table 2.) is an estimate of the annual cost.

Table 2. Consortium Member Annual Budget Estimate

a.) Administrative and Secretarial Support			
	Program Coordinator	.25 FTE x $ 60,000	
		+ .30 Benefit	= $ 19,500
	Secretary	.25 FTE x $ 25,000	
		+ .22 Benefit	= $ 7,625
b.) Graduate Faculty			
	In-Kind Cost	.25 FTE x $ 50,000	
		+ .30 Benefit	= $ 16,250
c.) Fellowship/Scholarship Support			
	2 x $ 11,000 per year		= $ 22,000
	Tuition Waivers		
	22 cr. per calendar yr. x $ 150 per cr. hr. (est)		= $ 3,300
d.) Supplies and Operating Costs			
	Office Supplies	$ 1200	
	Telephone/Fax	$ 1200	
	Travel	$ 2500	
	Internet	$ 1000	= $ 5,900
	Total Estimated Cost		**= $74,575**

F. PROGRAM IMPLEMENTATION AND EVALUATION

The logistics for implementation of a program involving the complexities of a consortium are both interesting and challenging. It is anticipated that it will take a year or two to phase in all components of the program. In addition to the planning, it is very important that outside funding from various agencies be obtained. In implementing a program of this magnitude, it is essential that the Indiana Commission for Higher Education give critical attention to additional funding as specified in the attached budget sheets.

External funding is needed, in addition to existing resources, to purchase necessary support equipment, provide in-service programs for faculty development, and award additional release time for planning and establishing an effective delivery system.

F-1 Time Line of Events

The consortium concept evolved at the Dean's Breakout Session at the Annual National Convention of the National Association of Industrial Technology. The deans in attendance became the nucleus for the planning and organization for the PhD in Technology.

The following dates are/were critical to the planning process:

(1)	Meeting of Consortium Members	April 1996
(2)	NSF Pre-Proposal Planning Grant	May 1996
(3)	Proposal review by Teleconference	June 1996
(4)	Proposal rewrite and submit to SOT Faculty Council	Sept 1996
(5)	Proposal rewrite and submit to Graduate Council	Nov 1996
(6)	Consortium Meeting on program and implementation planning	Dec 1996

(7)	Indiana State University Approval	March 1997
(8)	Consortium Member Visitation	
	NC A&T, ECU	February 1997
	EMU	March 1997
	ISU	June 1997
(9)	Indiana Commission for Higher Education	June 1997
(10)	Program Admission Process	August 1997
(11)	First Course Offering	Fall 1997

F-2 Program Evaluation

The program will be reviewed as a part of the North Central Association of Colleges and Schools accreditation process. The concept of assessment, as currently being implemented at Indiana State University, is critical to the process of self-evaluation and self-improvement.

The Student Outcomes Assessment Plan submitted to the North Central Association of Colleges and Schools by Indiana State University in June of 1995 will serve as an assessment guide in the evaluative process. In this plan, five evaluative questions serve to guide the process. These are:

> How is the plan linked to the mission, goals, and objectives of the institution?

> What is the institution's evidence that faculty have participated in the development of the institution's plan and that the plan is institution-wide in conceptualization and scope?

> How does the plan demonstrate the likelihood that the assessment program will lead to institutional improvement when it is implemented?

> Is the time line for the assessment program appropriate? Realistic?

> What is the evidence that the plan provides for appropriate administration of the

assessment program?

The consortium model presents a number of unique challenges to the evaluative process. Currently all participants have North Central Association of Colleges and Schools accreditation or that of an equivalent organization. Each university will be obligated to maintain this accreditation standard to participate in the consortium.

The National Association of Industrial Technology is currently the organization most representative of the profession. It is anticipated that this association may wish to review the program in the future.

In the process of operating the program, quantitative data will be tabulated to provide accurate indices on admission, qualifications of admitted students, rejected applications, graduation rates, faculty, and other materials which can be used to evaluate the program. It is anticipated that a cost ratio figure will need to be generated which defines the contribution of each consortium member.

Qualitative information will need to be obtained on specializations, new technology for communications, effectiveness of alternative strategies, residency, intern programs, and technology core courses. The program must be reviewed annually with the awareness that this is a new, experimental venture in graduate education. Student follow-up and employer assessment are critical to the qualitative process.

Summative information on the program shall be maintained by Indiana State University using reporting standards comparable to the statistical information required for other programs. Each consortium member will be responsible for maintaining and reporting statistical data on courses and specializations at their institutions.

Budget Table

INDIANA STATE UNIVERSITY

TABLE 1: PROGRAM ENROLLMENTS AND COMPLETIONS
Annual Totals by Fiscal Year (Use SIS Definitions)

Campus: Indiana State University
Program: PhD Technology
Date: March 1997

	Total Year 1 FY98	Total Year 2 FY99	Total Year 3 FY00	Total Year 4 FY01	Total Year 5 FY02
A. PROGRAM CREDIT HOURS GENERATED					
1. Existing Courses	101	201	513	624	312
2. New Courses	301	603	513	624	936
Total	402	804	1,026	1,248	1,248
B. FULL-TIME EQUIVALENTS (FTEs)					
1. FTEs Generated by Full-Time Students	13.00	26.00	33.00	40.00	40.00
2. FTEs Generated by Part-Time Students	4.00	8.00	10.00	12.00	12.00
Total	17.00	34.00	43.00	52.00	52.00
3. On-Campus Transfer FTEs	0.00	0.00	0.00	0.00	0.00
4. New to Campus FTEs	17.00	34.00	43.00	52.00	52.00
C. PROGRAM MAJORS (HEADCOUNT)					
1. Full-Time Students	13	26	33	40	40
2. Part-Time Students	5	10	13	16	16
* Total	18	36	46	56	56
3. On-Campus Transfers	0	0	0	0	0
4. New to Campus Majors	18	18	10	10	10
5. In-State	5	10	15	20	25
6. Out of State	13	26	31	36	31
D. PROGRAM COMPLETIONS	0	0	0	10	15

If necessary, specify additional years up to the point at which the program is projected to achieve steady state.

* 5 headcount at ISU, remaining students by distance education, all students are admitted as consortium participants.

Budget Table

INDIANA STATE UNIVERSITY

TABLE 2A: TOTAL DIRECT PROGRAM COSTS AND SOURCES OF PROGRAM REVENUES

Campus: Indiana State University
Program: PhD Technology
Date: March 1997

	Total Year 1 FY 1998		Total Year 2 FY 1999		Total Year 3 FY 2000		Total Year 4 FY 2001		Total Year 5 FY 2002	
	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost
A. TOTAL DIRECT PROGRAM COSTS										
1. Existing Departmental Faculty Resources	2.7	$175,500	4.1	$266,500	4.9	$318,500	5.6	$364,000	5.6	$364,000
2. Other Existing Resources		$57,420		$57,420		$57,420		$57,420		$57,420
3. Incremental Resources		$129,893		$55,744		$50,580		$53,900		$59,520
Total		$362,813		$379,664		$426,500		$475,320		$480,940

	Total Year 1 FY 1998	Total Year 2 FY 1999	Total Year 3 FY 2000	Total Year 4 FY 2001	Total Year 5 FY 2002
B. Sources of Program Revenues					
1. Reallocation	$159,347	$122,732	$140,042	$159,336	$164,956
2. New-to-Campus Student Fees	$53,466	$106,932	$136,458	$165,984	$165,984
3. Other (Non-State)	$0	$0	$0	$0	$0
4. New State Appropriations					
a. Enrollment Change Funding	$0	$0	$0	$0	$0
b. Other State Funds	$150,000	$150,000	$150,000	$150,000	$150,000
Total	$362,813	$379,664	$426,500	$475,320	$480,940

* If necessary, specify additional years up to the point at which the program is projected to achieve steady state.

Budget Table

INDIANA STATE UNIVERSITY

TABLE 2B: DETAIL ON INCREMENTAL OR OUT-OF-POCKET DIRECT PROGRAM COSTS

Campus: Indiana State University
Program: PhD Technology
Date: March 1997

	Total Year 1 FY 1998		Total Year 2 FY 1999		Total Year 3 FY 2000		Total Year 4 FY 2001		Total Year 5 FY 2002	
	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost
1 Personal Services										
* a. Faculty	2.7	$175,500	4.1	$266,500	4.9	$318,500	5.6	$364,000	5.6	$364,000
b. Support Staff	0.5	$13,420	0.5	$13,420	0.5	$13,420	0.5	$13,420	0.5	$13,420
** c. Graduate Teaching Ass'ts	2.0	$44,000	2.0	$44,000	2.0	$44,000	2.0	$44,000	2.0	$44,000
Total Personal Services	5.2	$232,920	6.6	$323,920	7.4	$375,920	8.1	$421,420	8.1	$421,420
2 Supplies and Expenses										
a. General Supplies/Expenses		$5,000		$5,500		$5,600		$5,800		$5,800
b. Recruiting		$3,500		$3,500		$3,700		$3,700		$3,900
c. Travel		$5,600		$5,600		$5,800		$6,000		$6,000
d. Library Acquisitions		$20,000		$17,000		$14,000		$14,000		$14,000
Total Supplies and Expenses		$34,100		$31,600		$29,100		$29,500		$29,700
3 Equipment										
a. New Equipment Necessary for Pgm.		$88,485		$12,000		$10,000		$10,000		$14,000
b. Routine Replacement		$0		$4,500		$3,500		$6,000		$7,000
Total Equipment		$88,485		$16,500		$13,500		$16,000		$21,000
4 Facilities		$0		$0		$0		$0		$0
5 Student Assistance										
a. Graduate Fee Scholarships		$7,308		$7,644		$7,980		$8,400		$8,820
b. Fellowships		$0		$0		$0		$0		$0
Total Student Assistance		$7,308		$7,644		$7,980		$8,400		$8,820
Sum of All Incremental Direct Costs		$362,813		$379,664		$426,500		$475,320		$480,940

If necessary, specify additional years up to the point at which the program is projected to achieve steady state.

* Faculty FTE is composite - 1.4 teaching, 1.0 Consortium Coordinator, .25 Graduate Coordinating Council.

** Graduate Teaching Assistants held constant at 4 @ .5 time.

Budget Table

INDIANA STATE UNIVERSITY

TABLE 3: NEW ACADEMIC DEGREE PROGRAM PROPOSAL SUMMARY

Campus: Indiana State University
Program: PhD Technology
Date: March1997

	Year 1 FY98	Year 2 FY99	Year 3 FY00	Year 4 FY01	Year 5 FY02
I. Prepared by Institution					
Enrollment Projections (Headcount)	18	36	46	56	56
Enrollment Projections (FTE)	17	34	33	52	52
Degree Completion Projection	0	0	0	10	15
New State Funds Requested (Actual)	$0	$0	$0	$0	$0
New State Funds Requested (Increases)	$150,000	$150,000	$150,000	$150,000	$150,000
II. Prepared by CHE					
New State Funds to be Considered for Recommendation (Actual)					
New State Funds to be Considered for Recommendation (Increases)					

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APPENDIX A

EXAMPLES OF PROGRAM SPECIALIZATIONS

CONSTRUCTION TECHNOLOGY & SITE MANAGEMENT

Central Missouri State University
College of Applied Sciences and Technology
Warrensburg, MO 64093

Indiana State University
School of Technology
Terre Haute, IN 47809

East Carolina University
School of Industry and Technology
Greensville, NC 27858

University of Wisconsin - Stout
School of Industry and Technology
Menomonie, WI 54751-0790

Objectives:

The objectives of this specialization are to:

1. Enhance management skills used during the construction phases of a structure.
2. Investigate alternative construction techniques and materials which are environmentally friendly.
3. Enhance information gathering skills and the application of research techniques to the construction management process.
4. Provide site based experiences for the application of contemporary project management techniques.

Study Concentrations:

1. Management techniques and their impact on productivity.
2. Data gathering, transmission, and communication procedures.
3. Legal aspects of the construction process.
4. Site logistics.
5. Inspection and quality control processes.
6. Computer applications in estimating, scheduling, and cost control.
7. International trends in construction.
8. Risk management and hazard control.
9. Environmental management.

Industrial applications.

Graduates of the construction management specialization will be able to provide leadership in the continued development of the study of:

1. The application of statistical procedures to the construction process.
2. Enhancement of the profitability of construction projects.
3. The development and compliance to governmental regulations.
4. The integration of advanced technologies by the construction industry.
5. Procedures used to enhance construction project productivity.

COMPUTER INTEGRATED MANUFACTURING

Central Connecticut State University
School of Technology
New Britain, Conn

Central Missouri State University
College of Applied Sciences & Technology
Warrensburg, MO 64093

North Carolina A&T State University
School of Technology
Greensboro, NC 27411

University of Wisconsin-Stout
School of Industry and Technology
Menomonie, WI 54751

Objectives:

Advanced systems of automated control have been applied to the manufacturing processes. The close interrelationship between design and production with application of sophisticated quality control is critical in manufacturing. Objectives of this specialization include:

1. Design production systems for production flow and efficiency of product transmission.
2. Use critical path methodology in planning and analyzing production.
3. Apply principles of quality decision making in product development.
4. Integrate materials selection with product manufacturing.
5. Calculate and integrate tooling specifications into material removal.

Study Concentrations:

1. Principles of computer aided design in manufacturing.
2. Cost estimating in product design and production.
3. Numerical Control Systems.
4. Robotics.
5. Environmental Standards.
6. Statistical Procedures for Quality Control.

Industrial Applications:

Graduates of the Computer Integrated Manufacturing specialization will be able to provide expertise in the manufacturing process such as:

1. Designing and installing product flow systems in industrial settings.
2. Quality design in the production system.
3. Interrelationships between computer systems and production systems.
4. Applications of robotics in manufacturing.
5. Packaging technology.

DIGITAL COMMUNICATIONS SYSTEMS

East Carolina University
Department of Industrial Technology
Greenville, NC 27858

University of Wisconsin-Stout
School of Industry and Technology
Menomonie, WI 54751

North Carolina A&T State University
School of Technology
Greensboro, NC 27411

Objectives:

The purpose of the specialization in Digital Communications Systems is to provide a program concentration in the use of computers, techniques of computer application, and technical systems supporting communication technology. Study will include the process of transmission, restoration, retrieval, and analysis of both auditory and visual systems. Graduates will be able to:

1. Analyze the process of human and machine communications related to improved efficiency and reduction of noise and entropy of systems.
2. Design and assemble communications systems for transmission purposes.
3. Organize and demonstrate the effective integration of computer and alternative communication technologies to deliver technical presentations and briefings.
4. Develop applications of Internet systems and implement collaborative processes to maximize efficient use of resources.
5. Analyze a variety of contemporary communication systems and design the most economically efficient model.

Study Concentrations:

1. Technology Assessment and Forecasting.
2. Technical Developments in Communications.
3. Integrating Communication Systems into Manufacturing.
4. Electronic Principles in Communications.
5. Project Management.
6. Selection and Application of System and Server Software.

Industrial Applications:

Graduates in Digital Communications Systems will be able to design and analyze systems of communications technology, including:

1. Designing and developing World-Wide-Web sites.
2. Digitizing information for presentation format.
3. Designing and developing satellite based systems for training and development.
4. Designing and developing computer applications and software used in the communication industry.

POLYMER COATING TECHNOLOGY

Eastern Michigan University
Interdisciplinary Technology Department
Ypsilanti, Michigan 48197

Eastern Michigan University has established itself as one of the leading schools in polymer technology. The Interdisciplinary Technology Department has firmly established itself as a teaching research department with a history of funding and application of polymers to the automotive industry.

Objectives:

The objective of the specialization in polymer technology is to provide scientific and technological knowledge permitting advanced graduate students to apply the theory of coatings, adhesives, sealants, lubricants, and ink formation. This will enable the graduate student to:

1. Comprehend and apply the concepts of polymer synthesis and cross-listing.
2. Apply the principles applicable to the physical phenomenon that are descriptive of polymer coatings used in industrial applications.
3. Design formulas and processes to improve the character of polymer methods to approve coatings.
4. Formulate and synthesize new coatings from polymer research and development to applications in use.

Study Concentrations:

1. Advanced Organic Polymer Chemistry.
2. Physical Chemical Characterizations of Polymers.
3. Advanced Polymer Synthesis.
4. Polymer Synthesis Laboratory.
5. Polymer Synthesis Control.

Industrial Applications:

Specialists in Polymer Technology will be able to explain and perform applied research in:

1. Cross-linking chemistry and cross-linking film properties.
2. V.O.C. Emissions.
3. Stabilization and rheology.
4. Scanning probe microscopy of coatings.
5. Adhesion and sealant technology.
6. Surface and interfacial opectroscopy.

QUALITY SPECIALIZATION

Central Connecticut State University
School of Technology
New Britain, Conn

North Carolina A&T State University
School of Technology
Greensboro, NC 27411

Eastern Michigan University
Interdisciplinary Technology Department
Ypsilanti, Michigan 48197

Objectives:

The purpose of this specialization is to prepare persons with research, problem-solving and application skills to improve the processes of manufacturing through the use of the principles of quality control. Specifically, this specialization will prepare candidates to:

1. Interpret process control and capability to identify and reduce or eliminate assignable cause of variation and instability in manufacturing systems.
2. Use empirical data to determine quality standards meeting customer expectations.
3. Optimize design and process variables to improve quality and reliability.
4. Analyze and design quality systems to fit organizational structures and operations.
5. Predict expected life and failure modes of complex products and manufacturing equipment.
6. Understand the relationship of human systems to product design, manufacturing, and quality standards.
7. Establish product and process tolerances which are based on customer requirements for cost and functionality.

Study Concentrations:

1. Statistical process of reliability and validity in process control.
2. Designing quality into the product development process.
3. Performing and using quality audits.
4. Designing quality experiments.
5. Laboratory testing procedures.
6. Standards and measurements in quality design.

Industrial Applications:

Graduates with specialization in quality procedures will be able to design and use quality procedures in industrial settings. They will have expertise in:

1. Designing quality into manufacturing and construction systems.
2. Using Quality audit procedures in support of ISO 9000 standards.
3. Preparing experiments to determine quality standards in materials and production.
4. Performing systems documentation.