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Design and Implementation of a Doctoral Program of Management in Information Technology

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Abstract

The paper reports on an initiative taken by the Graduate College of Management, Lawrence Technological University to establish a Doctorate of Management in Information Technology (DMIT). The DMIT has a scholar/ practitioner orientation designed for working professionals with high levels of managerial, technical and analytical expertise in the sub-fields of information technology (IT). The goal of the DMIT is to provide students with an advanced learning experience focused on leadership in IT through the integration of IT into business and industrial processes to attain higher levels of efficiencies and quality. The DMIT Program endorses learning outcomes in four categories: theoretical outcomes, informational outcomes, skill-sets and informing of practice. In addition the program addresses six thematic areas of scholarship and practice, namely abstraction and modeling, process, optimization, quality, measurement and manufacturing. A feasibility study determined the knowledge needs of professionals in the field of IT, and was followed by an implementation proposal to stakeholders, university management and accrediting bodies. The rationale of the program, the curriculum, the teaching and learning model, and some lessons learnt thus far in the implementation are described.

Keywords: doctoral program, IT education, IT management, curriculum

1. INTRODUCTION

Advancements in information technology (IT) continue unabated in what has become known as the E-era of innovation (Butler 1999). Organizations have become increasingly dependent on IT systems while striving to add value, streamline business processes and maximize their competitive advantage. In most successful enterprises today business processes are carried out, or

are supported by, IT-based systems interpreted as a combination of hardware and software (including middleware) which implements a solution for one or more business processes of the enterprise (Willcocks et al. 1997; Steenkamp and Roberson 2002; Harmon 2002). IT is regarded by many to be the key enabler for an enterprise to differentiate itself from the competition. The so-called "dot-com" collapse in the latter part of the 1990's has

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caused organizations to reconsider their dependence and utilization of IT, and the skills and competencies of the IT staff whom they recruit.

Denning (2001) and Spooner (2000) have stated the need for educators to focus on the requirements of a changing and advancing IT workplace. There is the realization that students not only should complete the coursework but must demonstrate their acquired knowledge before they are allowed to graduate. This demonstration is intended to assure the student, the university and the prospective employer that the student is prepared to perform at the expected level in the corporate world. In view of these factors educators have been influenced to re-assess their computing programs and curricula (Crum and Landry 2002). They have compared four-year IT degree programs to determine common knowledge content finding that a variety of interpretations exists. While considerable effort over several years has gone into developing a "mature" model curriculum for undergraduate degree programs in information systems (Gorgone et al. 2002), there is no consensus about a similar model in the field of IT (Crum and Landry 2002).

As in the case of undergraduate programs many graduate programs are offered in computer science and information systems and the MSIS 2000 model curriculum has emerged through the collaborative work of a committee representing the three leading computing professional associations, namely ACM, AIS and AITP (Gorgone et al. 2000). Some of these graduate programs include a concentration in IT (Denning 2001; Counterline & Pfeiffer 2000), with fewer programs focusing on IT per se, and the curricula in IT vary considerably. Freeman et al. (2000) has written about the imbalance in the supply and demand of information systems doctorates. They stated their belief that "the temporal nature of the imbalance is structural, persistent and not a short-term anomaly." In general, most people with IT skills "of the moment," whether university educated or vendor certified, find well-paid positions in industry. As a consequence IT professionals are reluctant, or even unwilling, to pursue traditional PhD programs that are theoretical

and research-based, and that usually require full-time attendance.

This paper reports on an initiative taken to establish a Doctorate of Management in IT, or DMIT, with aim to provide working professionals with an advanced learning experience focused on the integration of IT into business and industrial processes. The rationale of the DMIT, the curriculum structure, and the research orientation is described, as well as key aspects of the implementation process.

2. BACKGROUND

The university started exploring the feasibility of offering a scholar/ practitioner oriented doctoral program in IT out of the College of Management in the late 1990's. The idea was conceived based on the considerations mentioned above, and driven by the belief that an opportunity existed to create an innovative doctoral program along with the Doctorate of Engineering in Manufacturing Systems, or DEMS, program. The idea was strengthened due to the fact that the university had experienced a notable growth in the masters' degree programs focused on manufacturing and information technologies in the last decade. In response the university had cultivated the resources, including industrial and business partnerships, necessary to deliver these programs. In its report the NCA/HLC Institutional Self Study Team of the university wrote that "In the last ten years the demand for technologically-based, applied doctoral programs focused on practitioners who understand their professional field in depth and are able to solve complex, cross disciplinary problems in business and industry has grown." The Self Study Team found that applied doctoral programs such as EdD, DBA and DD are recognized and established degree alternatives to the traditional PhD. In these applied programs the dissertation research is problem-oriented to find solutions to complex, interdisciplinary challenges in industrial and/or business settings. In the management field the NCA/HLC Institutional Self Study Report cites Weatherhead School of Management, Case Western Reserve University, the University of Texas, and Cleveland State University who have developed and offer applied programs such

as the Doctor of Management (DM), among other fields.

With this background the university began the planning of several professional doctoral programs, including the DMIT, which is the topic of this paper. While seeking NCA/HLC endorsement for the initiative the university stressed its capability to develop an effective participatory internal process for generating, planning and implementing the doctoral programs. In addition the report emphasized that the implementation of the DMIT program promises to enhance the quality of faculty scholarship in the Graduate College of Management, and offer an advanced learning opportunity for MSIS graduates and alumni.

3. RATIONALE OF DMIT

The DMIT is a professional program designed for working professionals with high levels of managerial, technical and analytical expertise in the sub-fields of IT. The goal is to provide advanced learning experiences focused on leadership through the integration of IT into business and industrial processes to attain higher levels of efficiencies and quality. The field of IT is viewed as encompassing all the software, hardware and infrastructure resources forming part of an IT system, which has the aim of adding value to the business processes of the organization. The body of knowledge represented in IT is evolving continuously as new research ideas are transferred into business and industrial processes aimed at optimizing the functioning of the enterprise at all levels. Organizations now proactively seek to gain competitive advantage by means of IT as the enabler. New business strategies and initiatives are formulated based on emerging trends and technologies, including ITs that are anticipated to yield greater efficiencies and higher quality products and services. As new ITs emerge managerial and technical challenges are ever present, since the existing IT infrastructure must be enhanced and aligned with redesigned processes that it seeks to enable. Due to the large capital investment in the IT infrastructure it is essential that existing resources are managed, and IT life cycle processes performed and managed effectively and efficiently.

The role of IT Management is depicted in Figure 1 as a central function, performed by IT people, utilizing IT resources by means of IT processes, in support of the business processes of a contemporary computer-based enterprise.

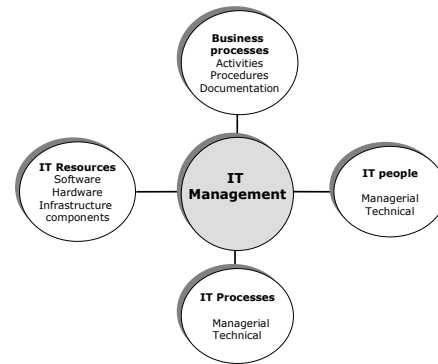


Figure 1. Context of IT Management

4. CURRICULUM

With this context in mind the DMIT curriculum was designed to consist of two parts: coursework in state-of-the-art knowledge in key subfields of IT, as well as comprehensive coverage of quantitative methods and supporting disciplines; and research focused on developing innovative solutions to real-world problems.

The program endorses learning outcomes in four categories:

- 1) Theoretical outcomes – define the concepts and principles in the field of IT Management that a student should master.
- 2) Informational outcomes – interpreted to mean the leading-edge trends in IT that a student should be aware of.
- 3) Skill-sets – the competencies that students should have upon completing the program.
- 4) Informing of practice – knowledge and awareness of best practices as found in business and industry in the field of IT Management.

In addition the program addresses six thematic areas of scholarship and practice, namely:

- 1) Abstraction and modeling – understanding/ representing of problem space
- 2) Process – corresponding to knowledge of real-world best practices
- 3) Optimization – improvement of IT and software processes, activities and tasks
- 4) Quality – IT and software product and process assurance
- 5) Measurement – management of process and product by means of metrics
- 6) Manufacture – software construction focusing on reuse

Coursework

The coursework builds on a foundation in database technology, software development methodologies and technologies, systems architectures, data communication and network infrastructure. In addition a foundation in project management and business are prerequisite stepping stones leading into DMIT studies. Courses are taught on-ground on weekends following a multi-faceted approach. This approach involves faculty lecture sessions, guest lectures, student presentations, discussion forums, and project work involving field visits. All courses are supported with the Blackboard Learning System which facilitates faculty-student, and student-student collaboration, as well as a comprehensive set of international standards in the sub-fields of IT.

Student performance evaluation is performed in accordance with faculty preference and in general is based on course participation, and complete and unambiguous deliverables by means of evaluation instruments such as:

- Individual assignment deliverables
- Blackboard participation
- Class participation
- Team project participation
- Presentations
- Examinations
- Peer-based performance evaluation.

Coursework falls into three tracks namely the IT major, research methods and minor courses as follows:

IT major track: The courses in this track form the core dealing with key subjects in IT Management.

Advanced Data Management. The focus is on the theory and practice of object-orientation, data warehouses, data mining, and on-line-analytical processing. Organizations have a substantial investment in legacy and database systems that must be integrated with new data requirements of the enterprise. New approaches of creating and accessing the integrated data repository, such as using an Internet-based enterprise portal, are explored in an applied context.

IT Life Cycle Processes are concerned with the processes by which IT resources are acquired, maintained, supported, managed and aligned with the business processes of the enterprise. IT processes involve people, methods, techniques, procedures and computer-based tools, and the IT resources themselves. Enterprises have varying capabilities to perform IT processes, and to integrate these processes into the core value chains. Frameworks, standards and reference models structuring enterprise and IT architectures are explored here and used in a project-based environment to align the IT assets with new business initiatives.

IT Systems Architecture is concerned with the software, hardware and infrastructure components of IT systems. Due to the complexity of these system several perspectives and views are required including data, application and supporting technology infrastructure. Each of the views is best modeled following established methodologies, techniques and notations. A range of computer-based tools are used by students to develop and document the models. At hand is also a catalog of international standards reflecting best practices to which students are exposed.

IT Leadership and Management. Here the focus is on the skills needed to lead and manage today's IT-based organization in a changing world. Organizations, whether private, public, profit or non-profit, conduct business in national and global contexts requiring the ability to exchange information, provide and use services, and communicate through state-of-the-art ITs. Managers at all levels must be aware and versed with the potential of existing and emerging ITs to provide leadership and manage the affairs of the enterprise. Key skills required fall into the areas of strategic

and tactical planning, budgeting and finance, IT management, and human resources. Key issues include the alignment of IT initiatives with business goals and objectives, simultaneous management of operational and development environments, and the determination of the impact of new business organization models on IT infrastructure and services.

Advanced Topics in IT. This type of course allows the program to focus on emerging ITs that represent leading edge opportunities for an enterprise, on ITs that have become a trend, or on best practices in the field. An offering of this type of course explores one topic in depth. Typical course topics are:

- The new Internet technologies, dealing with web-based application architectures, the implementation of such architectures, web-services, middleware and distributed database systems.
- Re-usable component software technologies, based on the object-oriented architecture, dealing with reference models, frameworks, patterns, process models, methodologies and notations for agile application development.
- IT Metrics and ROI, dealing with issues concerning predicting, documenting and evaluating the return on IT investments. Returns on IT investment can fall into several categories, including reduced operating costs, increased productivity, and improved competitive position. IT leaders are also required to rigorously document the performance of their organizations in delivering high quality, cost effective services to the organization, as mandated by models such as CMMI and Six Sigma.
- Sourcing IT Services. In the contemporary business climate IT management is increasingly responsible for managing external service relationships. These outsourcing relationships comprise an important part of the IT manager's responsibility portfolio, and require a different set of skills than those used to manage in-house IT organizations. Important issues include the assessment of the potential for outsourcing, preparing the IT organization for an outsourcing

project, developing outsourcing agreements, managing the implementation of outsourcing contracts, and integrating outsourcing solutions with in-house services.

- IT Security Management. Leaders in IT agree that the security of all assets of the contemporary organization must be assured through an IT Security Management System (ITMS) as authorized by a strategic decision. The organization should develop, implement, maintain and continually improve a documented ITMS within the context of the organization's overall business risks. In the Internet era of business and computing enterprises are increasingly vulnerable to breaches in security and unauthorized use of organizational assets. In addition the malicious damage and destruction of the IT electronic and physical infrastructure have become real threats. Organizational assets include information assets, software assets, physical assets and services. Students in the field of IT Management must be versed with the key issues and considerations of creation and management of an IT security infrastructure. This course is intended to provide a managerial perspective of the field of IT security based on the international ISO/IEC standards.
- Knowledge Management, dealing with the management of corporate knowledge assets. It is widely acknowledged that, in order to harness knowledge of an enterprise, a KM system is needed, i.e. a system which creates, preserves and utilizes the intellectual assets. Due to the diversity of knowledge assets and the challenges of utilizing them in support of the strategic goals of an enterprise, an enterprise knowledge framework is needed. Within such a framework a KM system may be built using a KM process architecture, a process/IT alignment matrix, a KM methodology, and a KM system architecture.

Research Methods track: The courses in this track focus on quantitative and qualitative methods relevant to the IT life cycle processes, and are mandatory. . *IT Research Methodology* studies scientific methods of research including empirical and

Table 1. DMIT Coursework in IT Sub-fields

	Inventory	Principles	Models	Standards
IT Life Cycle Processes		Major 1	Major 1	Major 1
Data Architecture	Major 2 Major 4	Major 2	Major 2 Major 4	Major 2 Major 4
Application Architecture	Major 4 Major 5	Major 5	Major 5	Major 4 Major 5
Technology Infrastructure	Major 4 Major 5	Major 4 Major 5	Major 4 Major 5	Major 4 Major 5
Organization Architecture	Major 5	Major 5	Major 5	Major 5
Human Resources	Major 3	Major 3	Major 3	

qualitative approaches, modeling approaches and taxonomies. Aspects such as proposal formulation, methods of investigation, demonstration of concept, approaches to research validation, and documenting research results including writing of technical papers and the dissertation are addressed.

Quantitative Methods I deals with statistical techniques used in managing, manipulating and interpreting data and information in the IT field.

Quantitative Methods II studies deterministic and stochastic analytical techniques and tools that can be used to optimize decision-making in the pursuit of meeting organizational goals, such as cost efficiency, service delivery and profitability.

Modeling and Simulation develops and enhances problem-solving and decision-making capabilities in an IT and enterprise environment by means of modeling and simulation approaches. This includes studying the behavior of complex systems using techniques of simulation and supporting computer-based tools. Complex IT systems require various types of models to depict static structure and dynamic behavior. Operational and executable specifications allow these models to be executed and used to prototype alternative solution options.

Minor track. Courses in this track are electives serving to complement a student's knowledge in the area designated for

dissertation research. The field of IT has inter-disciplinary relationships with many other fields of business, management, science and engineering. The nine credit hours of coursework in this track should address a coherent body of knowledge interfacing with the selected research field.

Dissertation Research

In accordance with the LTU mission and the goal of the DMIT the research part of the curriculum requires applied research towards an innovative solution using state-of-the-art bodies of knowledge. The intent is to afford the doctoral student the opportunity to seek out a problem situated in a real-world environment, with the potential for an innovative IT-based solution. To this end partnerships are sought with enterprises to engage in projects suited to doctoral research. Research projects are conducted based on a proposal which outlines the problem to be investigated, the scope of the project, research approach to be followed, method of investigation and estimated project schedule. The proposal should also explore the literature dealing with other approaches to the problem in the domain of discourse. Where possible applied research topics are drawn from problems in practice, and research is undertaken in partnership with the sponsoring enterprise in accordance with an agreement of collaboration. Research supervision is performed by a supervisor supported by a supervisory committee, which includes one or more key stakeholders in the sponsoring enterprise.

In the E-era of today, with a maturing Internet, companies are aiming to streamline internal business processes as well as those processes involving external business partners and public bodies. There is the prospect of the real-time enterprise which relies on real-time connectivity and Internet technologies to enable real-time data integration. Real-time process management, where processes within the enterprise and those interacting with external partners are managed proactively in real-time, is being sought. This contrasts with the ability to simply monitor key data in real-time.

Most business process redesign initiatives have so far revolved around the integration of IT into the business processes. Further challenges exist to also integrate IT into the strategic process. In what is now known as the E-economy other new applications include the web-enabling of operations, meaning to transform the way transactions are done and how businesses interact. Digitizing the business has made the availability of information throughout the business a reality.

New technologies are emerging that present prospects of innovative applications, such as text-to-speech and voice-enabled applications, or the diversification of choice of interaction and learning, to name a few. Prospects such as the wireless enterprise through WIFI technologies, E-simulation through 3D-web technologies, and E-enabled content management, disease control and assisted living are being researched. However, several applications of wireless technologies such as mobile-commerce (m-Commerce), mobile-electronic transaction (mET) have so far not achieved the predicted successes and must be refined further.

The challenge is to understand that changes in technology is inevitable and that the rate of change will only increase in the future. Students in the DMIT must take a futuristic view in two interdependent dimensions, namely:

1. The technical dimension, dealing with the range of technologies, standards and functionalities that are the enabling agents.

Table 2. Implementation Process

DMIT Policies, Processes and Procedures
Applications Process Admissions Process Diagnostic Evaluation Interview Process Orientation Process Coursework Administration Process Advising Process Comprehensive Evaluation Examinations Research Partnerships Research supervision Dissertation
Process Improvement Process
Process assessment Program assessment Course assessment
Program Descriptions
Background Information Catalog Description Flyers and Brochures Program Web Site
Curriculum
Overview Syllabi Detailed Syllabi
Forms
Application Form Admission Recommendation Form List Of DMIT Applications Checklist Of DMIT Applicants Diagnostic Evaluation Interview Record Form Diagnostic Evaluation Interview Schedule Letter Templates Advising Schedule Credit Waiver/ Transfer Form Course Overview Sheet Curriculum Schedule
Letter Templates
Press Releases

2. The management dimension, involving the business rules underpinning the various levels of business processes and the issues of integration and leveraging to provide improvements in process efficiencies and quality of products and services.

5. IMPLEMENTATION PROCESS

The DMIT was implemented as a part-time cohort program offered on weekends beginning in the fall 2002. The implementation, documented in the DMIT Handbook³ followed a planned process that detailed the managerial, administrative and academic processes involved, and was fully

³ DMIT Handbook, 2002.

supported by the university management and the dean of the Graduate College of Management. The implementation involved a team effort of faculty and staff responsible for the respective functions and tasks of each of the processes outlined in Table 2.

The first cohort started coursework in the fall 2002 with all students taking the major course and an elective minor course as advised by the academic advisor assigned to each student. A new cohort is to be admitted each fall term and a continuous process of assessment is performed for each cohort. Program assessments are performed annually. Cohort 1 is due to take the comprehensive examinations in the fall 2004. Upon passing doctoral candidates will start on the research part of the curriculum under direction of an academic supervisor. The first graduates are expected in summer 2006 if the schedule presented in Table 3 is adhered to.

The DMIT program is proving to attract considerable attention with a large number of interested applicants applying for Cohort 2 starting in fall 2003.

6. SUMMARY

The authors acknowledge the work done by Dr. Sumit Sincar, University of Texas at Arlington, on the original proposal⁴ for the DMIT Program, and the input provided by the faculty of the Graduate College of Management at Lawrence Technological University.

The rationale of a professional doctoral program known as the DMIT, designed for the scholar-practitioner, is described. This program is one of the applied doctorates offered by the university and is attracting a substantial number of applications. The paper reviews the factors that have motivated the program, the curriculum, and the implementation process. The collaborative teaching approach, which was adopted in the program, is proving to be very successful since it provides opportunities for all participants to share experiences, thereby complementing the theoretical knowledge acquisition. Coursework is supported by international

standards representing best practices in the field of IT, and complements the knowledge base of the students, many of whom have considerable experience in mature IT processes in business and industry. As assessment data become available the process improvement program will be implemented.

The DMIT Program office would like to express appreciation to the management of the Graduate College of Management and the university for the support and encouragement provided throughout the implementation of this exciting program. To all accounts the program is off to a good start thanks to the enthusiasm, dedication and hard work of faculty, staff, and students alike.

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Table 3. DMIT Cohort 1 Curriculum Schedule

Term	Major	Credit	Minor	Credit	Research Methods	Credit	Total
Cohort 1 Start							
Fall 02	IT Life Cycle Processes	3	Minor 1	3			6
Spring 03	Advanced Data Management	6	Minor 2	6			12
Summer 03					Quantitative Methods I	3	15
Fall 03	IT Leadership & Management	9	Minor 3	9			21
Spring 04	IT Systems Architecture	12			Quantitative Methods II	6	27
Summer 04					Modeling and Simulation	9	30
Fall 04	Advanced Topics in IS	15			Research Methodology	12	36
Comprehensive Examination Cohort 1							
Spring 05	Dissertation proposal	3					39
Summer 05	DIS I DIS II	6					45
Fall 05	DISIII & DISIV	12					51
Spring 06	DISV & DISVI	18					57
Summer 06	DISVII	21					60
Dissertation Defense							
Cohort 1 Earliest Graduation							



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