Establish a Post-Baccalaureate Certificate in Technology Management (PCC ID #682)

PRESENTED BY	Valérie K. Orlando, Chair, Senate Programs, Curricula, and Courses Committee
REVIEW DATES	SEC – October 20, 2020	SENATE – November 10, 2020
VOTING METHOD	In a single vote
RELEVANT POLICY/DOCUMENT	N/A
NECESSARY APPROVALS	Senate, President, University System of Maryland Chancellor, and Maryland Higher Education Commission

ISSUE

The Post-Baccalaureate Certificate in Technology Management will provide professional managers with additional training in managing technological resources and enterprises. Students will learn how to identify, transition, and leverage emergent technology within their own organizations and into markets. Faculty in the Robert H. Smith School of Business have learned from multiple public and private sector executives that there is an unmet demand for graduate-level programs that integrate business and technology education for mid-career professionals from diverse academic backgrounds. A variety of organizations, including Federal, state, and local governments, small and large private enterprises, non-profit organizations, and private corporations are in critical need of leaders and program executives skilled not only in the traditional disciplines of business management, but also in managing the conceptualization, maturation, commercialization or government adoption, employment, and impact of emergent technologies.

The program is 14 credits, consisting of five core courses and five credits of special topics courses. Courses are delivered in partnership with the A. James Clark School Engineering to facilitate cross-disciplinary instruction on research and development strategy, science and technology project valuation, technology entrepreneurship and commercialization, technical systems design, marketing emergent technology, and planning for technology resilience.

Core coursework includes Marketing Emergent Technology (1 credit), Science and Technology Project Valuation (2 credits), Research and Development Strategy and Process (2 credits), Technology Entrepreneurship, Innovation and Commercialization (2 credits), and a Technology Management Capstone course (2 credits).

This proposal was approved by the Senate Programs, Curricula, and Courses committee on October 2, 2020.

RECOMMENDATION(S)

The Senate Committee on Programs, Curricula, and Courses recommends that the Senate approve this degree program.

COMMITTEE WORK

The committee considered this proposal at its meeting on October 2, 2020. Joe Bailey, Associate Research Professor of Decision, Operations and Information Technologies, Frank Goertner, Program Director of Military and Veteran Affairs, and Mike Marcellino, Assistant Dean for the Robert H. Smith School of Business, presented the proposal. The proposal was unanimously approved by the committee.

ALTERNATIVES

The Senate could decline to approve this new degree program.

RISKS

If the Senate declines to approve this degree program, the university will lose an opportunity to provide specialized training in managing technological resources and enterprises for students in a growing technological industry.

FINANCIAL IMPLICATIONS

There are no significant financial implications with this proposal for campus as the courses and administrative resources already exist in the Robert H. Smith School of Business.

682: TECHNOLOGY MANAGEMENT

In Workflow

1. BMGT PCC Chair (bhorick@umd.edu; mmarcell@umd.edu)
2. BMGT Dean (ragar@umd.edu)
3. Academic Affairs Curriculum Manager (mcolson@umd.edu)
4. Graduate School Curriculum Manager (aambrosi@umd.edu)
5. Graduate PCC Chair (aambrosi@umd.edu)
6. Dean of the Graduate School (sfetter@umd.edu; aambrosi@umd.edu)
7. Senate PCC Chair (mcolson@umd.edu; vorlando@umd.edu)
8. University Senate Chair (mcolson@umd.edu)
9. President (mcolson@umd.edu)
10. Chancellor (mcolson@umd.edu)
11. MHEC (mcolson@umd.edu)
12. Provost Office (mcolson@umd.edu)
13. Graduate Catalog Manager (aambrosi@umd.edu)

Approval Path

1. Mon, 06 Apr 2020 18:09:26 GMT
Michael Marcellino (mmarcell): Approved for BMGT PCC Chair
2. Mon, 13 Apr 2020 21:07:56 GMT
Ritu Agarwal (ragar): Approved for BMGT Dean
3. Fri, 18 Sep 2020 15:33:33 GMT
Michael Colson (mcolson): Approved for Academic Affairs Curriculum Manager
4. Wed, 30 Sep 2020 14:15:57 GMT
Angela Ambrosi (aambrosi): Approved for Graduate School Curriculum Manager
5. Wed, 30 Sep 2020 14:30:55 GMT
Angela Ambrosi (aambrosi): Approved for Graduate PCC Chair
6. Thu, 01 Oct 2020 12:34:20 GMT
Steve Fetter (sfetter): Approved for Dean of the Graduate School
7. Fri, 02 Oct 2020 14:41:17 GMT
Valerie Orlando (vorlando): Approved for Senate PCC Chair

New Program Proposal

Date Submitted: Mon, 06 Apr 2020 18:06:40 GMT

Viewing: 682 : Technology Management
Last edit: Wed, 07 Oct 2020 13:34:23 GMT

Changes proposed by: Michael Marcellino (mmarcell)

Program Name

Technology Management

Program Status

Proposed

Effective Term

Fall 2021

Catalog Year

2021-2022

Program Level

Graduate Program

Program Type

Post-Baccalaureate Certificate

Delivery Method

Off Campus

Does an approved version of this program already exist?

No

Departments

Department
The Robert H. Smith School of Business

Colleges

College
The Robert H. Smith School of Business

Degree(s) Awarded

Degree Awarded
Certificate, Post-Baccalaureate

Proposal Contact

Frank Goertner; 240-581-4405; fgoertne@umd.edu

Proposal Summary

The proposal is to offer an academic certificate in technology management that prepares public and private sector leaders in how to identify, transition, and leverage emergent technology into and across their organizations and markets. Course material will be delivered to admitted cohorts in weekend residencies at existing facilities in the Ronald Reagan Building and Internal Trade Center in Washington, DC with intent to consider eventual export of class sessions or web-stream delivery to the Crystal City, VA suite once available and approved.

Program and Catalog Information

Provide the catalog description of the proposed program. As part of the description, please indicate any areas of concentration or specializations that will be offered.

The Post-Baccalaureate Certificate in Technology Management prepares public or private sector managers of technology-dependent enterprises to effectively identify, transition, and leverage emergent technology across their organizations or markets. Courses are delivered in partnership with the A. James Clark School Engineering to facilitate cross-disciplinary instruction on research and development strategy, science and technology project valuation, technology entrepreneurship and commercialization, technical systems design, marketing emergent technology, and planning for technology resilience.

Catalog Program Requirements:

Course	Title	Credits
Core Courses		
BUSI781	Course BUSI781 Not Found (Marketing Emergent Technology)	1
BUSI782	Course BUSI782 Not Found (Science and Technology Project Valuation)	2
BUSI786	Course BUSI786 Not Found (Technology Management Capstone)	2
BUSI791	Management of High Technology, Research and Development	2
BUSI793	Course BUSI793 Not Found (Technology Entrepreneurship, Innovation and Commercialization)	2
Special Topics Courses		
BUSI784	Course BUSI784 Not Found (Systems Design, Development, Test and Evaluation)	2
BUSI758	Special Topics in Business	1
BUSI758	Special Topics in Business	1
BUSI758	Special Topics in Business	1
Total Credits		14

Sample plan. Provide a term by term sample plan that shows how a hypothetical student would progress through the program to completion. It should be clear the length of time it will take for a typical student to graduate. For undergraduate programs, this should be the four-year plan.

Fall Semester

·   BUSI791: Research and Development Strategy and Process (2 credits)*

·   BUSI793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)*

·   BUSI781: Marketing Emergent Technology (1 credit)*

Winter Semester

·   BUSI758: Mastery on Corporate Structures and Law for Technology Managers (1 credit)

Spring Semester

·   BUSI782: Science and Technology Project Valuation (2 credits)*

·   BUSI784: Systems Design, Development, Test and Evaluation (2 credits)

·   BUSI758: Mastery on Cyber/Enterprise Risk and Resilience Modeling (1 credit)

Summer Semester

·   BUSI758: Mastery on Leadership and Technology (1 credit)

·   BUSI786: Technology Management Capstone (2 credits)*

denotes core course

List the intended student learning outcomes. In an attachment, provide the plan for assessing these outcomes.

Learning Outcomes

Learning Outcome 1: The Fundamentals of Technology Management
• Understand how public and private sector account for technology in strategic planning;
• Model best practices in developing and leading research and development programs;
• Comprehend the challenges associated with technology development, commercialization and transition, maturation and regulation, and how each is approached by public and private sector enterprises.

Learning Outcome 2: Executing Technology Management
• Develop skillsets to evaluate and cultivate emergent technology from concept to operational;
Understand systems engineering precepts and design thinking through real-world case-studies and simulations involving design, development, test and evaluation of new technologies;
• Apply design methodologies for integrated human-machine systems design and risk management;
• Model, valuate and plan for the financial implications of investment in science and technology;
• Develop skills to assess and plan marketing strategies for emergent technologies and future applications;
• Understand implications of corporate structure, mergers and acquisitions on technology development in the private sector.

Learning Outcome 3: Leading and Practicing Technology Management
• Understand C-Suite perspective on enterprise-level risks from cyber activities and model techniques for enhancing cyber resilience;
• Develop skills for decision making in technology-dependent organization and leadership of integrated human-machine teams and activities;
• Collaborate with others on developing an innovative analysis, project or solution, by incorporating technology management principles, innovation practices, and stake-holder input.

New Program Information

Mission and Purpose

Describe the program and explain how it fits the institutional mission statement and planning priorities.

The Technology Management Certificate aligns with several goals of the University of Maryland, the Clark School, and the Smith School. These goals include the students, the organizations they work for, the faculty that teach in the program, scholarship, and the public.

The first goal is in the growth and development of the students in this program. These students are looking for professional development to help them in their current roles and for future career success. Many of them are unable to find offerings at the University of Maryland or other regional schools. Although some universities provide similar programs, the location of these programs prevents the students from participating or the distance-learning design prevents the networking opportunities from face-to-face interactions. The University of Maryland is uniquely positioned by location and expertise to help bridge the divide between technology and management. In doing so, the students will learn more about themselves and set them up for future career success.

The second goal is for the organizations for which the students work. Since these students are actively employed as professionals in public and private sector technology enterprises, we hope that students will apply what they've learned as they are going through the program.

The third goal is to help faculty and scholarship in general. Many of the challenges faced by prospective Technology Management Certificate students are on the vanguard of developments in the industries and markets we aim to better serve and understand. Accordingly, faculty teaching in this program will have the opportunity to be more innovative with their course content and may even lead to research opportunities. The research may require funding, which the students in the program can help facilitate. Hopefully, this will lead to innovative curriculum and an increased number of scholarly publications.

The final goal is to help the public at large. Whether we are looking at the State of Maryland, the Baltimore-Washington region, or the country, we hope that by educating these students and helping them better execute on the mission of their organizations, they can better serve the public at large.

Program Characteristics

What are the educational objectives of the program?

The Technology Management Certificate is intended to prepare future public and private sector leaders with critical reasoning and academic skills to identify, transition and leverage emergent technology into and across their organizations and markets. The goal is a student experience that affords experiential, integrated, and relevant learning such that each cohort member can leverage what they learn from instructors and each other in their varied professional roles as they learn it.

The certificate will be structured to meet the requirements of a specialty elective track in the second year of Smith MBA studies that facilitates interdisciplinary exploration of topics relevant to managers of technology-dependent enterprises. It can also be completed as a stand-alone credit-bearing academic certificate for professionals not pursuing a degree or stackable credential for any graduate programs at the University.

Describe any selective admissions policy or special criteria for students interested in this program.

Applicants to the Technology Management Certificate program must have completed all of the requirements for a baccalaureate degree prior to their acceptance into the program with a minimum GPA of 3.0. A complete online application form that includes a written essay articulating qualifications and motivation for pursuing advanced education, one letter of recommendation from supervisors or from professors competent to judge the applicant's probability of success in graduate school will also be required.

An admissions interview may be required. After initial screening, the Admissions Office may select candidates for interviews which may be done in person or by telephone. Proof of English language proficiency (TOEFL or IELTS official scores) is also required unless the applicant has received an undergraduate or graduate degree from a select list of countries. For international students needing an F1 visa, a completed certification of finance form and supporting financial documentation are required.

In addition to Graduate School requirements, admission decisions for the Technology Management Certificate program will be based on the quality of previous undergraduate and graduate coursework (if applicable), the relevance of prior work and research experience, and the congruence of professional goals with those of the program. Students should submit application materials at least 30 days prior to the start date of the program.

Summarize the factors that were considered in developing the proposed curriculum (such as recommendations of advisory or other groups, articulated workforce needs, standards set by disciplinary associations or specialized-accrediting groups, etc.).

Deans, faculty and staff at the Robert H. Smith School of Business have received recommendations from multiple public and private sector executives that the national capital region lacks academic programs that blend business and engineering higher education to enhance technology management skill sets for the region's working professionals.

Unmet demand for programs integrating business and technology education for mid-career professionals from diverse academic backgrounds has been exposed by corporate partners of the Robert H. Smith School of Business as well as public sector agencies headquartered in the national capital region. These employers have expressed need for their next generation managers to be upskilled in how to identify and transition emergent technology into or across organizations.

UMCP, with top ranked schools of business and engineering, is ideally situated to deliver solutions for this demand. This would be the first such offering by a business school in the National Capital Region tailored to working professional cohorts.

The Technology Management certificate will require completion of 14 credits distributed across nine credits of core courses and five credits of special topic courses:

Core Courses (9 Credits)
· BUSI 791: Research and Development Strategy and Process (2 credits)
· BUSI 793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)
· BUSI 758: Science and Technology Project Valuation (2 credits)
· BUSI 758: Marketing Emergent Technology (1 credit)
· BUSI 758: Technology Management Capstone (2 credits)

Special Topic Courses (5 Credits)
· BUSI 758: Systems Design, Development, Test and Evaluation (2 credits)
· BUSI 758: Mastery Elective (1 credit)
· BUSI 758: Mastery Elective (1 credit)
· BUSI 758: Mastery Elective (1 credit)

Special topic courses are differentiated from core courses in order to update the curriculum over time with topical instruction most relevant to the enrolled cohorts. Initial mastery electives are projected to focus on the following topics:
· Corporate Structures and Law for Technology Managers
· Cyber/Enterprise Risk and Resilience Modeling
· Leadership and Technology

NOTE: All courses are being submitted for permanent number assignment.

Select the academic calendar type for this program (calendar types with dates can be found on the Academic Calendar **(**https://www.provost.umd.edu/calendar/**) page)**

Traditional Semester

Identify specific actions and strategies that will be utilized to recruit and retain a diverse student body.

The Robert H. Smith School of Business community is multifaceted at every level – students, staff and faculty represent a diverse blend of backgrounds, nationalities, ethnicities and experiences. About a dozen Smith School and student clubs are focused on bringing members together who have similar interests in gender, nationality, religion, and sexual orientation.

To attract the most diverse population possible for the proposed Technology Management certificate program, Smith School recruiting staff will focus on domestic efforts. These efforts will be targeted at recruiting U.S. minorities and American women of all ethnicities.

Current efforts include:
• Representing Masters programs in U.S. MBA and Masters Fairs and Tours
• Representing Masters programs in International MBA and Masters Fairs and Tours
• Online Chats
• U.S. College Visits
• International College Visits
• GMASS-based Mailings
• GRE-based Mailings
• Direct Mail
• Email Campaigns
• Outreach to College and Campus Organizations and Clubs
• Participating in Career/Graduate Study Panels or Workshops
• Presentations at Professional Conferences
• Creation of "Leap Your Career Forward" for Current UMD Students Looking At MBA and Masters Study Post-Undergraduate Studies (An Annual Event)
• Advertising in UMD Campus Newspapers
• Masters Only Education Fairs (Fall And Spring) Throughout the U.S.
• Participation in a Masters-focused Business School Alliance
• Participant in Graduate Business Education Events Targeted for Underrepresented Populations, Particularly U.S. Minorities and Women
• Including Master's Level Programming in Marketing Content Targeted to U.S. Military/Veterans
• Outreach to College Organizations in the Washington, D.C. Area
• Enhancement of Website for All Masters Programs
• Inclusion of Spotlight and Vignettes of Masters Alumni and Current Students who Reflect Diversity
• Participation in Events Targeted for Women Seeking Graduate Study (General and Non-MBA Based Events)
• Social Media and Online Advertising within U.S. Markets

Off Campus

Indicate the location for this off-campus program.

University of Maryland, Robert H Smith School of Business Suite; Ronald Reagan Building and International Trade Center, 1300 Pennsylvania Ave NW, Washington, DC 20004.
*Note: Upon approval, eventual export of program administration, class sessions, web-stream delivery, or student support to the Crystal City suite may also be considered.

Describe the suitability of the site for the off-campus programs.

The site is suitable as is with no need for facility improvement.

Describe the method of instructional delivery, including online delivery, on-site faculty, and the mix of full-time and part-time instructors (according to MHEC 13B.02.03.20.D(2), "At least # of the classes offered in an off-campus program shall be taught by full-time faculty of the parent institution").

To accommodate working professional students from across the national capital region, instruction will be in a cohort setting on-site with some content delivered online as suitable. On-site classes will be initially offered at our DC suite in the Ronald Reagan Building and International Trade Center with the desire to consider eventual export of class sessions or web-stream delivery to the Crystal City suite once available and approved.

Classes will be held during the day on weekends (Friday, Saturday, and/or Sunday) to accommodate schedules of working professional students and deconflict with Part Time and Online MBA course schedules.

Discuss the resources available for supporting faculty at the location. In an attachment, please indicate the faculty involved in the program. Include their titles, credentials, and courses they may teach for the program.

Key faculty have been identified and slated for all core certificate courses, along with an Academic Director, and Faculty Sponsors for the Schools of Engineering and Public Policy.

See attachment: Faculty Resources for Technology Management Program.docx.

Discuss how students will have reasonable and adequate access to the range of student support services (library materials, teacher interaction, advising, counseling, accessibility, disability support, and financial aid) needed to support their learning activities.

Enrolled certificate students will have access to the full range of services provided to existing Part Time MBA students as managed by the Masters Programs Office, Office of Career Services, and other relevant staff of the Robert H. Smith School of Business and UMCP.

Discuss how the off-campus program will be comparable to the existing program in terms of academic rigor. What are the learning outcomes for the online offering? Do they differ from the existing on-site program?

The rigor of the certificate will be identical to the rigor of elective courses taught in existing Masters programs at the University of Maryland. Although most of the certificate content will be instructed in person, content within each course deemed suitable for learning outside of classroom-based cohort settings may be offered online. This online content will be comparable in rigor and presentation to that of online content found in the Smith School's existing Online MBA program. Both the learning objectives and the assessment standards thereof will be the same as those for content delivered on-site for each course.

Describe the quality control and evaluation of the off-campus program's effectiveness. How will the program be evaluated?

Program success will be regularly measured and assessed by a program steering group comprised of key program faculty and staff. This will include an assessment of grades students earn within each of the classes, course evaluation data, and enrollment trends. Furthermore, program staff and faculty will meet regularly with students to learn more about student satisfaction and their learning. Finally, program staff and faculty will meet several times a year to share their perceptions of program success and student learning and plan for continuous program improvement.

Relationship to Other Units or Institutions

If a required or recommended course is o#ered by another department, discuss how the additional students will not unduly burden that department's faculty and resources. Discuss any other potential impacts on another department, such as academic content that may significantly overlap with existing programs. Use space below for any comments. Otherwise, attach supporting correspondence.

Externally-sourced instructional support for courses on "Systems Design, Development, Test & Evaluation," and "Cyber/Enterprise Risk & Resilience Modeling" is coordinated with A. James Clark School of Engineering and the School of Public Policy via the following faculty members of the Technology Management program development steering-group:

George Syrmos, PhD; Assistant Dean for Continuing Education; University of Maryland
A. James Clark School of Engineering; syrmos@umd.edu

Charles Harry, PhD; Associate Research Professor; School of Public Policy; charry@umd.edu

Accreditation and Licensure. Will the program need to be accredited? If so, indicate the accrediting agency. Also, indicate if students will expect to be licensed or certified in order to engage in or be successful in the program's target occupation.

N/A

Describe any cooperative arrangements with other institutions or organizations that will be important for the success of this program.

N/A

Faculty and Organization

Who will provide academic direction and oversight for the program? In an attachment, please indicate the faculty involved in the program. Include their titles, credentials, and courses they may teach for the program.

Academic direction and oversight will be managed by the Decision, Operations and Information Technologies Department of the Robert H. Smith School of Business and supported by key faculty listed in addendum (a) with the support of associated department chairs and school deans.

Indicate who will provide the administrative coordination for the program

Administrative coordination of the program will be provided by the Masters Programs Office of the Robert H. Smith School of Business.

Resource Needs and Sources

Each new program is required to have a library assessment prepared by the University Libraries in order to determine any new library resources that may be required. This assessment must be done by the University Libraries. Add as an attachment.

A library assessment has been completed.
See Attachment: Collection_Assessment_PBC_Tech_Mgt.docx

Discuss the adequacy of physical facilities, infrastructure and instructional equipment.

Launching this certificate in association with the existing Part Time MBA program will allow the Robert H. Smith School of Business to utilize its physical facilities, infrastructure and instructional equipment available in the off-site locations of the Ronald Reagan Building campus in Washington, D.C. and, eventually, new University of Maryland facilities in Crystal City. All courses will be offered at our DC campus on weekends when current Part Time MBA courses are not in session.

Discuss the instructional resources (faculty, staff, and teaching assistants) that will be needed to cover new courses or needed additional sections of existing courses to be taught. Indicate the source of resources for covering these costs.

Faculty who teach core courses in this program shall be drawn from existing faculty of the Robert H. Smith School of Business with faculty for specialty topic courses drawn from the Robert H. Smith School of Business, A. James Clark School of Engineering, and School of Public Policy.

Discuss the administrative and advising resources that will be needed for the program. Indicate the source of resources for covering these costs.

At steady-state, annual program support and administrative resources will include:
• Marketing & Recruiting
• Academic Director Administrative Increment
• Cohort Director Administrative Increment
• Full Time Staff Program Manager Salary

Use the Maryland Higher Education Commission (MHEC) commission financial tables to describe the program's financial plan for the next five years. See help bubble for financial table template. Use space below for any additional comments on program funding.

See Attachment: PCC New Program Budget Sheets - 682 Tech Management Cert.xlsx

Implications for the State (Additional Information Required by MHEC and the Board of Regents)

Explain how there is a compelling regional or statewide need for the program. Argument for need may be based on the need for the advancement of knowledge and/or societal needs, including the need for "expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education." Also, explain how need is consistent with the Maryland State Plan for Postsecondary Education (https://mhec.state.md.us/About/Documents/2017.2021%20Maryland%20State%20Plan%20for%20Higher%20Education.pdf)**.**

The national capital and greater Maryland region is among the most dynamic and fastest growing technology hubs in the United States. Federal, state, and local governments; small and large private enterprises; non-profit organizations; and the business communities that support each are in critical need of leaders and program executives skilled in the traditional disciplines of business management but also educated on how to manage the conceptualization, maturation, commercialization or government adoption, employment, and impact of emergent technologies. This demands instruction for business managers that extends beyond single course explorations of the disruptive phenomena of new technology or exposure to best practices in design thinking and innovation. Nor is it adequate to amend existing curricula for engineering students to include isolated objectives for business and organizational management. It requires integrated interdisciplinary curricula that attract technology-savvy business and government professionals to study alongside market and mission-oriented technology professionals learning to navigate the array unique challenges they each face leading human-machine teams.

We have received direct input on the demand for such education from government contacts in the U.S. Departments of Defense, Homeland Security, Veterans Affairs, Office of Personnel Management, and National Institutes and Standards and Technology. We also assess the program would have relevance for the Departments of Transportation, Energy, Commerce as well Maryland State agencies. Further, corporate contacts in public and private

sector consulting, defense and intelligence contracting, technology and strategic design, data analytics, finance, and logistics have expressed interest in such a program.

The most prominent U.S. business schools currently offering programs that blend business and technology education for technology managers in tailored programs are based in technology hubs outside of the national capital region: Boston, New York, Philadelphia, Washington State, Texas, and California. The list of current programs not only underserves national demand, its growth is constrained by the need for a university to have the unique advantage of collocated reputable business and engineering schools in proximity to a U.S. technology hub.

We see relevance to workforces across the region, to include those employed in Anne Arundel, Frederick, Harford, Montgomery, Prince Georges, and St Mary's Counties in Maryland; Alexandria, Arlington, Fairfax, King George, and Prince William County in Virginia; and the District of Columbia.

Beyond workforce demand, however, there is also a greater societal need for this type of interdisciplinary education for managers of business and technology. According to national polling by Pew Research Center in 2018, nearly 3 in 4 (74%) of Americans say major technology companies and their products and services positively impact their personal lives. But a solid majority (65%) of Americans feel technology enterprises fail to anticipate how their products and services will impact society, with less than 1 in 3 (28%) expressing trust in most of their decisions and roughly half (51%) supporting more regulation of them. The technology industry is not just growing, it is likely on the cusp of significant reforms. Public and private sector technology managers will need the skills to lead it.

Is the proposed Post-Baccalaureate Certificate derived entirely from the core requirements of an existing master's degree program?

No

Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program. Possible sources of information include industry or disciplinary studies on job market, the USBLS Occupational Outlook Handbook **(**https://www.bls.gov/ooh/**), or Maryland state** Occupational and Industry Projections **(**http://www.dllr.state.md.us/lmi/iandoproj/**) over the next five years. Also, provide information on the existing supply of graduates in similar programs in the state (use MHEC's Office of Research and Policy Analysis** webpage **(**http://mhec.maryland.gov/publications/Pages/research/**) for Annual Reports on Enrollment by Program) and discuss how future demand for graduates will exceed the existing supply. As part of this analysis, indicate the anticipated number of students your program will graduate per year at steady state.**

The program is designed to serve the fastest growing sectors and occupations in the U.S. and Maryland.

From 2018-2028, USBLS projects U.S. employment growth of:
• 7 percent in management occupations, resulting in 706,900 new jobs;
• 12 percent in computer and information technology occupations, adding 546,200 new jobs with well above average demand in cloud computing, the collection and storage of big data, and information security.
• 4 percent in architecture and engineering occupations, adding 113,300 new jobs.
Long term projections for Maryland by the Department of Labor for 2016-2026 are similar:
• 22.1% growth in heavy and civil engineering construction;
• 8.0 growth in management of electronic equipment, appliances, and computers;
• 7.9% growth in management of computer and electronics manufacturing;
• 7.9% growth in telecommunications.
While there is no existing program in the State of Maryland comparable to this certificate, MHEC statistics evidence that graduate admissions in technical and technology branded independent schools in the state grew from 2018-2019:
• 22% growth in graduate student admission to Sand Technical Institute
• 7.1% growth in part time graduate student admission to Capitol Tech
• 3.5% growth in part time graduate student admission to Johns Hopkins University
At steady state, the program is anticipated to enroll and certify approximately 20-30 students annually.

Identify similar programs in the state. Discuss any di#erences between the proposed program and existing programs. Explain how your program will not result in an unreasonable duplica on of an existing program (you can base this argument on program di#erences or market demand for graduates). The MHEC website can be used to find academic programs operatinng in the state: http://mhec.maryland.gov/institutions_training/pages/HEPrograms.aspx

There is no similar program known to be offered in the state. The University of Maryland College Park does currently offer an Online Master of Professional Studies in Technology Entrepreneurship, however this program is substantially different in curriculum design, instructional format, learning objectives, and industry positioning.
• The MPS in Technology Entrepreneurship is designed to deliver skills to create, launch and lead start-up companies or innovation projects. The Certificate in Technology Management is focused on working professionals responsible for managing technology and the people envisioning, developing, acquiring or managing it. While entrepreneurs and start-up founders may be attracted to it, they are not the primary professional demographic it will serve.
• MPS in Technology Entrepreneurship's instruction is fully online with predominately asynchronous content delivery, catering to geographically distributed enrollment. The Certificate in Technology Management's instruction is predominantly in-person to managed cohorts.
• Credits earned in the Certificate in Technology Management are explicitly designed to be creditable as electives in BMGT's existing MBA degree programs.

Discuss the possible impact on Historically Black Institutions (HBIs) in the state. Will the program affect any existing programs at Maryland HBIs? Will the program impact the uniqueness or identity of a Maryland HBI?

No.

Supporting Documents

Attachments

PCC New Program Budget Sheets - 682 Tech Management Cert.xlsx
Faculty Resources for Technology Management Program.docx
Collection_Assessment_PBC_Tech_Mgt.docx
Learning Outcomes Assessment.docx

Key: 682

TABLE 1: RESOURCES

Resources Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1.Reallocated Funds	$ 59,135	$ -	$ -	$ -	$ -
2. Tuition/Fee Revenue (c+g below)	$ 235,480	$ 291,053	$ 349,749	$ 411,705	$ 530,070
a. #FT Students	NONE				
b. Annual Tuition/Fee Rate					
c. Annual FT Revenue (a x b)					
d. # PT Students	10	12	14	16	20
e. Credit Hour Rate	$ 1,682.00	$ 1,732.46	$ 1,784.43	$ 1,837.97	$ 1,893.11
f. Annual Credit Hours	14	14	14	14	14
g. Total Part Time Revenue (d x e x f)	$ 235,480	$ 291,053	$ 349,749	$ 411,705	$ 530,070
3. Grants, Contracts, & Other External Sources	$ -	$ -	$ -	$ -	$ -
4. Other Sources	$ -	$ -	$ -	$ -	$ -
TOTAL (Add 1 - 4)	$294,615	$291,053	$349,749	$411,705	$530,070

Graduate

(FY2019)	annual	per credit hour	inflation
resident		$ 1,682.00	1.03
non-resident		$ 1,682.00	

TABLE 2: EXPENDITURES

Expenditure Categories	Year 1	Year 2	Year 3	Year 4	Year 5
1. Faculty (b+c below)	$33,915	$46,577	$47,974	$49,413	$50,896
a. #FTE	0.2	0.2	0.2	0.2	0.2
b. Total Salary	$25,500	$35,020	$36,071	$37,153	$38,267
c. Total Benefits	$8,415	$11,557	$11,903	$12,260	$12,628
2. Admin. Staff (b+c below)	$33,250	$34,248	$35,275	$36,333	$37,423
a. #FTE	0.2	0.2	0.2	0.2	0.2
b. Total Salary	$25,000	$25,750	$26,523	$27,318	$28,138
c. Total Benefits	$8,250	$8,498	$8,752	$9,015	$9,285
3. Total Support Staff (b+c below)	$86,450	$89,044	$91,715	$94,466	$97,300
a. #FTE	1.0	1.0	1.0	1.0	1.0
b. Total Salary	$65,000	$66,950	$68,959	$71,027	$73,158
c. Total Benefits	$21,450	$22,094	$22,756	$23,439	$24,142
4. Graduate Assistants (b+c)					
a. #FTE	0.0	0.0	0.0	0.0	0.0
b. Stipend					
c. Tuition Remission					
d. Benefits					
5. Equipment					
5. Library					
6. New or Renovated Space					
7. Other Expenses: Operational Expenses	$141,000	$105,450	$105,914	$106,391	$106,883
a. Course Development	$42,000	$6,000	$6,000	$6,000	$6,000
b. Teaching / Overload	$84,000	$84,000	$84,000	$84,000	$84,000
c. Advertising / Recrutiment	$15,000	$15,450	$15,914	$16,391	$16,883
TOTAL (Add 1 - 8)	$294,615	$275,318	$280,877	$286,603	$292,502
resources - expenditures	$0	$15,736	$68,872	$125,101	$237,568

These budget estimates are resources and expenditures to the University overall, and not to the program or unit. Do not include revenue-sharing agreements between units, between unit and college, or with the university (e.g., for entrepreneurial programs) as an expenditure.

benefits	0.33
inflation	1.03

Other expenses might include   Space rental (if offsite), advertising/recruitment, course development, travel. Please specify in a footnote.

If new or renovated space is required beyond what is currently allocated to the College, this should be negotiated with the Office of the Provost prior to proposal submission.

FACULTY RESOURCES: TECHNOLOGY MANAGEMENT PROGRAM

Faculty	Courses	Program Role
Wendy Moe, PhD Associate Dean of Master's Programs and Dean's Professor of Marketing, Robert H. Smith School of Business		Dean/Faculty Sponsor
Joseph Bailey, PhD Associate Research Professor, Department of Decision, Operations and Information Technologies, Robert H. Smith School of Business	*Research and Development Strategy and Process*	Academic Director & Faculty
George Syrmos, PhD Assistant Dean for Continuing Education, A. James Clark School of Engineering	*Systems Design, Development, Test & Evaluation*	Engineering Faculty Sponsor
Timothy Eveleigh, PhD, ESEP Institute for Systems Research (ISR), A. James Clark School of Engineering	*Systems Design, Development, Test & Evaluation*	Faculty
Yogesh Joshi, PhD Associate Professor and Academic Director, MS in Business & Management Program, Robert H. Smith School of Business	*Marketing Emergent Technologies*	Faculty
HENRY C. BOYD III, PhD Clinical Professor and Academic Director, Marketing, Robert H. Smith School of Business	*Marketing Emergent Technologies*	Faculty
Bren Goldfarb, PhD Associate Professor and Academic Director, Dingman Center for Entrepreneurship, Robert H. Smith School of Business	*Technology Entrepreneurship, Innovation & Commercialization; Technology Management Capstone*	Faculty
Even Starr, PhD Associate Professor of Management and Operations, Robert H. Smith School of Business	*Technology Entrepreneurship, Innovation & Commercialization; Technology Management Capstone*	Faculty
David Waguespack, PhD Associate Professor of Management and Operations, Robert H. Smith School of Business	*Technology Entrepreneurship, Innovation & Commercialization; Technology Management Capstone*	Faculty

Oliver Schlake, PhD Clinical Professor of Management and Operations, Robert H. Smith School of Business	*Technology Entrepreneurship, Innovation & Commercialization; Technology Management Capstone*	Faculty
Liu Yang, PhD Associate Professor of Finance and Academic Director, Master of Finance & Master of Quantitative Finance Programs, Robert H. Smith School of Business	*Science and Technology Project Valuation*	Faculty
David Kass, PhD Clinical Professor of Finance, Robert H. Smith School of Business	*Science and Technology Project Valuation*	Faculty
Sarah Kronke, MBA Senior Lecturer of Finance, Robert H. Smith School of Business	*Science and Technology Project Valuation*	Faculty
Judy Frels, PhD Clinical Professor, Marketing, Robert H. Smith School of Business	*Leadership and Technology*	Faculty
Martine Dresner, PhD Professor, Logistics, Business & Public Policy, Robert H. Smith School of Business	*Corporate Structures and Law for Technology Managers*	Faculty
Sandor Boyson, PhD Professor, Logistics, Business & Public Policy, Robert H. Smith School of Business	*Research and Development Strategy and Process* *Corporate Structures and Law for Technology Managers*	Faculty
JUSTÍN MARCOS REYNA, JD Lecturer, Logistics, Business & Public Policy, Robert H. Smith School of Business	*Corporate Structures and Law for Technology Managers*	Faculty
Charles Harry, PhD Associate Research Professor, School of Public Policy	*Cyber/Enterprise Risk & Resilience Modeling*	Public Policy Faculty Sponsor

DATE: February 17, 2020

TO: Frank T. Goertner

             The Robert H. Smith School of Business

FROM: On behalf of the University of Maryland Libraries:

             Zaida M. Diaz, Business and Economics Librarian

             Maggie Saponaro, Director of Collection Development Strategies

             Daniel Mack, Associate Dean, Collection Strategies & Services

RE: Library Collection Assessment- Post-Baccalaureate Certificate in Technology
             Management

We are providing this assessment in response to a proposal by the Technology Management Program in The Robert H. Smith School of Business to offer a Post-Baccalaureate Certificate in Technology Management. The Technology Management Program asked that we at the University of Maryland Libraries assess our collection resources to determine how well the Libraries support the curriculum of this proposed new program.

Serial Publications

Since the course material is expected to be delivered to admitted students during weekend residencies at the Ronald Reagan Building and Internal Trade Center in Washington, DC, it is likely that course assignments will rely heavily upon online journals. The University of Maryland Libraries currently subscribe to a large number of scholarly journals—almost all in online format—that focus on business, technology entrepreneurship and commercialization and cybersecurity, among other related subject areas.

The University of Maryland Libraries currently subscribe to a large number of scholarly journals—almost all in online format. Many of these are top ranked journals by the *Journal Citation Reports*, in terms of research impact and are widely recognized in the fields of development strategy, science and technology project valuation, technology entrepreneurship and commercialization, technical systems design, marketing emergent technology, cybersecurity, management, organization theory, computation, and other related areas, which would be relevant to the subject or program areas within technology management. Among these are the following scholarly journals published by the highly regarded *Institute for Operations Research and the Management Sciences (INFORMS)* that cover the latest research in a wide range of analytics methods, technology applications, information and computing systems, among many other relevant areas in technology management:

- *INFORMS Transactions on Education* – Open access journal with the mission of advancing O.R., management science, and analytics education at all levels worldwide.
- *Decision Analysis* – Focuses on advancing the theory, application, and teaching of all aspects of decision analysis.

- *Information Systems Research (ISR)* – Covers the latest theory, research, and intellectual development for information systems in organizations, institutions, the economy, and society.
- *INFORMS Journal on Computing* – Contains topical and informative papers on the broad intersection of O.R. and computing.
- *Management Science* – Scientifically addresses the problems, interests, and concerns of managers while promoting the science of managing private and public sector enterprises.
- *Operations Research* – Presents high-quality papers that represent the true breadth of the methodologies and applications that define O.R.
- *Manufacturing & Service Operations Management (M&SOM)* – Presents state-of-the-art research of interest to both academic and industry researchers and practitioners working at the interface of research and implementation.
- *Marketing Science* – Addresses current questions in marketing and introduces cutting-edge research as well as new insights and approaches to current marketing-related problems.
- *Mathematics of Operations Research* – Publishes excellent foundational studies with significant mathematical content and relevance to OR/MS.
- *Organization Science* – Covers groundbreaking research about organizations, including their processes, structures, technologies, identities, capabilities, forms, and performance.
- *Transportation Science* – Features comprehensive timely articles and surveys that cover all modes of transportation, present and prospective, and researches planning and design issues.

In cases in which the Libraries do not subscribe to highly ranked journals, for example: *Journal on Optimization* and *Strategy Science*, both also published by the INFORMS, or any other articles in journals that we do not own, they likely will be available through our Interlibrary Loan/Document Delivery.

*Note: *Journal Citation Reports* is a tool for evaluating scholarly journals. It computes these evaluations from the relative number of citations compiled in the *Science Citation Index* and *Social Sciences Citation Index* database tools.

Databases

The Libraries' *Database Finder* (http://www.lib.umd.edu/dbfinder) and also the Virtual Business Information Center (VBIC) https://www.lib.umd.edu/vbic resource portal offers online access to databases that provide indexing and access to scholarly journal articles and other information sources. Many of these databases cover subject areas that would be relevant to this proposed program. In the case of the VBIC portal, it also provides exclusive access to data sets that the Smith School of Business subscribes to, such as: *Bloomberg*, *Wharton Research Data Services (WRDS)*, *Thomson Reuters Eikon*, and many others. Additional databases that would be useful in the field of technology management are:

- *Business Source Complete* (EBSCO) – Comprehensive database of business sources — includes over 3600 peer reviewed journals, trade publications, magazines, books, case studies, company profiles, SWOT analysis, etc.
- *Science Direct* (Elsevier) – It is an international leading source for scientific, technical, and medical research. It is a peer-reviewed, full text database containing e-books and online journal

titles covering the fields of business, computing, economics, science, technology, health and life sciences.

- *IEEE Xplore* – Provides full-text access to IEEE transactions, journals, magazines and conference proceedings published since 1988 and all current IEEE Standards. Includes access to Bell Labs Technical journal Archive (BLTJA) 1922-2015. Among topics covered are: computer engineering, biomedical technology and telecommunications, electric power, aerospace and consumer electronics, among many others.
- *Mergent Intellect* (Mergent/Dun) – Provides access to private and public U.S. and international business data, among them: company annual reports, industry reports and ratios, news, facts, and figures, and more.
- *IBISWorld* (IBISWorld)– Provides Industry market research reports on U.S., China and Global Industries; U.S. Risk Ratings, and U.S. Business Environment Profiles.
- *Mintel Oxygen* (Mintel Group)– Provides full-text reports on a wide range of market research studies, analyzing market sizes and trends, market segmentation, consumer attitudes and purchasing habits, opportunities, weaknesses and the future of the market.

Also three general/multidisciplinary databases: *Academic Search Ultimate, MasterFILE Premier* and *ProjectMUSE* are good sources of articles relevant to this topic.

In many-and likely in most--cases, these indexes offer full text copies of the relevant journal articles. In those instances in which the journal articles are available only in print format, the Libraries can make copies available to students through either the Libraries' Interlibrary Loan service (https://www.lib.umd.edu/access/ill-article-request). (Note: see below.)

Monographs

The Libraries regularly acquire scholarly monographs in business and engineering, and allied subject disciplines. Monographs not already part of the collection can usually be added upon request.

Even though most library research for this program likely will rely upon online journal articles, students may wish to supplement this research with monographs. Fortunately, more and more monographs are available as individual e-books or through online collection packages, among them:

- *EBSCO eBook Collection* – A collection of e-texts covering topics in computer science, business, international relations, education, environmental science, psychology, and civil rights law and history.
- *IEEE/Wiley eBooks* – The collection of titles includes practical handbooks, introductory and advanced texts, reference works and professional books with an emphasis on leading areas of research, such as Aerospace; Bioengineering; Communication, Networking & Broadcasting; Components, Circuits, Devices & Systems; Computing & Processing (Includes Hardware & Software); Engineered Materials, Dielectrics & Plasmas; Fields, Waves & Electromagnetics; General Topics for Engineers (Math, Science & Engineering); Geoscience; Photonics & Electro-Optics; Power, Energy & Industry Applications; Robotics & Control Systems; Signal Processing and Analysis.

- *IET eBook Collection* – Contains engineering and technology titles, in a broad range of specialty including: Computing; Control, Robotics & Sensors; Electromagnetic Waves; Energy Engineering; Healthcare Technologies; History of Technology; Management of Technology; Materials, Circuits & Devices; Radar, Sonar & Navigation; Sector Publications; Security; Telecommunications; and Transport.
- *SIAM eBooks* - Titles are written by internationally renowned experts spanning a wide range of topic areas in applied mathematics and computational science. Hosted by the same AIP/Scitation platform as SIAM Journals.
- *SPIE Digital Library* (International Society for Optics and Photonics) – Provides an e-book collection that includes all of the top SPIE Press monographs, reference works, field guides, tutorial texts, and Spotlight eBooks to keep researchers current on the latest science and technology and advancing their own work.
- *World Scientific eBooks* – Titles in the collection span a wide variety of subjects: Mathematics, Physics/Nonlinear Science, Chemistry/Materials Science/Nanotechnology, Computer Science, Engineering, Environmental Science, Medicine and Healthcare, Life Sciences, Business and Economics, General and Popular Science, Social Sciences and Asian Studies.

Even in instances when the books are only available in print, students will be able to request specific chapters for online delivery through the Interlibrary Loan program (https://www.lib.umd.edu/access/ill-article-request).

A search of the University of Maryland Libraries' WorldCat UMD catalog was conducted, using a variety of relevant subject terms, for example: technology management and business or technology and business, yielded a sizable list (78,569) of citations of books that we own, among them:

- *The Aerospace Business: Management and Technology* (e-book) 2020
- *Knowledge Management and Risk Strategies (2018)*
- *Digital Transformation: The Realignment of Information Technology and Business Strategies for Retailers in South Africa (e-book) 2017*
- *Technology Entrepreneurship and Business Incubation: Theory, Practice, Lessons learned (e-book) 2017*
- *Learning Nagios: Learn and Monitor Your Entire IT Infrastructure to Ensure Your Systems, Applications, Services, and Business Function Effectively (e-book) 2016*

A further search using the same search terms, revealed that the Libraries' membership in the Big Ten Academic Alliance (BTAA) dramatically increases these holdings and citations at about 158,814. As with our own materials, students can request that chapters be copied from these BTAA books if the books are not available electronically.

Interlibrary Loan Services

Interlibrary Loan services (https://www.lib.umd.edu/access/ill) provide online delivery of bibliographic materials that otherwise would not be available online. As a result, remote users who take online courses may find these services to be helpful. Interlibrary Loan services are available free of charge.

The article/chapter request service scans and delivers journal articles and book chapters within three business days of the request--provided that the items are available in print on the UM Libraries' shelves or in microform. In the event that the requested article or chapter is not available on campus, the request will be automatically forwarded to the Interlibrary Loan service (ILL). Interlibrary Loan is a service that enables borrowers to obtain online articles and book chapters from materials not held in the University System of Maryland.

Please note that one limitation of these services that might create some challenges for the online student is that the Libraries are not allowed to make online copies of entire books. The only way that a student can get access to a print copy of an entire book is to physically come to the Libraries and check out that book.

Additional Materials and Resources

In addition to serials, monographs and databases available through the University Libraries, students in the proposed program will have access to a wide range of media, datasets, software, and technology. Media in a variety of formats that can be utilized both on-site and via ELMS course media is available at McKeldin Library. GIS Datasets are available through the GIS Data Repository (https://www.lib.umd.edu/gis/data-and-resources) while statistical consulting and additional research support is available through the Research Commons (http://www.lib.umd.edu/rc) and technology support and services are available through the Terrapin Learning Commons (http://www.lib.umd.edu/tlc).

The subject specialist librarians: Zaida Diaz zdiaz@umd.edu and Lily Griner griner@umd.edu, (business and economics) and Sarah Over sover@umd.edu (engineering), also serve as an invaluable resource to programs such as the one proposed. Through departmental partnerships, subject specialists actively develop innovative services and materials that support the University's evolving academic programs and changing research interests. Subject specialists provide one-on-one research assistance online, in-person, or via the phone. They also provide information literacy instruction and can provide answers to questions regarding publishing, copyright and preserving digital works.

Other Research Collections

Because of the University's unique physical location near Washington D.C., Baltimore and Annapolis, University of Maryland students and faculty have access to some of the finest libraries, archives, major trade associations and/or societies, government organizations and research centers in the country vitally important for researchers in business and engineering. Some of them are the: Library of Congress, National Science Foundation [Centers of Research Excellence in Science and Technology (CREST) and HBCU Research Infrastructure for Science and Engineering (HBCU-RISE)], Society for Computing Machinery (ACM), Bureau of Economic and Business Affairs (EB), The Office of Commercial and Business Affairs (CBA), World Bank, to name just a few.

Conclusion

With our substantial journals holdings and index databases, as well as additional support services and resources, the University of Maryland Libraries have resources to support teaching and learning in the area of technology management. These materials are supplemented by a strong monograph collection. Additionally, the Libraries Scan & Deliver and Interlibrary Loan services make materials that otherwise would not be available online, accessible to remote users in online courses. As a result, our assessment is that the University of Maryland Libraries are able to meet the curricular and research needs of the proposed Post- Baccalaureate Certificate in Technology Management.

Learning Outcomes Assessment

Outcomes will be measured through various means depending on the course subject matter and the instructors' syllabi. Examples of measurements and assessments are:

- Performance on individual course summative assessments including exams, papers, and presentations;
- Performance on team assignments including papers and presentations;
- and assessment by faculty, program staff, and external partners of the quality of discourse and dialog among the class participants.

Student learning will be assessed during and at the conclusion of each course. Team and individual student summative assessments will be sampled and reviewed by faculty and external partners to ensure program-level learning outcomes are achieved.

Post-Baccalaureate Certificate in Technology Management

Program learning outcomes have been mapped to course learning outcomes. Evaluation will take place within these courses by the instructor(s). The program team will work with faculty to create and improve rubrics and – when appropriate – standardize the rubrics across courses. In some cases, course deliverables will be evaluated for programmatic learning outcome assessment especially when those learning outcomes demonstrate integration of concepts across courses within the certificate.

In the sections below, we describe how the course learning outcomes will be evaluated to assess programmatic learning outcomes. We map the proposed 6 courses (11 credits in total: 10 credits with from 5 courses at 2 credits each and one 1-credit course) to the program learning outcomes. The additional 3 credits in the program come from the Mastery courses (1 credit each), which are more fluid and are specifically designed to complement and fill in any deficiencies the programmatic learning outcome assessment may reveal.

The following 6 courses are mapped to learning outcomes:
- BUSI 781: Marketing Emergent Technology (1 credit)
- BUSI 782: Science and Technology Project Valuation (2 credits)
- BUSI 784: Systems Design, Development, Test and Evaluation (2 credits)
- BUSI 786: Technology Management Capstone (2 credits)
- BUSI 791: Research and Development Strategy and Process (2 credits)
- BUSI 793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)

	BUSI781	BUSI782	BUSI784	BUSI786	BUSI791	BUSI793
Learning Outcome 1: The Fundamentals of Technology Management						
Understand how public and private sector account for technology in strategic planning		X		X	X	
Model best practices in developing and leading research and development programs					X	X
Comprehend the challenges associated with technology development, commercialization and transition, maturation and regulation, and how each is approached by public and private sector enterprises	X		X		X	X
Learning Outcome 2: Executing Technology Management						
Develop skillsets to evaluate and cultivate emergent technology from concept to operational					X	X
Understand systems engineering precepts and design thinking through real-world case-studies and simulations involving design, development, test and evaluation of new technologies			X	X	X	
Apply design methodologies for integrated human-machine systems design and risk management			X	X		
Model, valuate and plan for the financial implications of investment in science and technology		X		X	X	
Develop skills to assess and plan marketing strategies for emergent technologies and future applications	X			X		
Understand implications of corporate structure, mergers and acquisitions on technology development in the private sector		X				X
Learning Outcome 3: Leading and Practicing Technology Management						
Understand C-Suite perspective on enterprise-level risks from cyber activities and model techniques for enhancing cyber resilience		X		X		
Develop skills for decision making in technology-dependent organization and leadership of integrated human-machine teams and activities				X	X	X
Collaborate with others on developing an innovative analysis, project or solution, by incorporating technology management principles, innovation practices, and stake-holder input				X		

Learning Outcome 1.1. Understand how public and private sector account for technology in strategic planning

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can describe the differences between public and private sector contexts				
Can differentiate among strategic planning techniques based on the technology				
Can articulate how timing and sequence affects strategic planning for technology management				

Assessed in:

- BUSI 782: Science and Technology Project Valuation (2 credits)
- BUSI 786: Technology Management Capstone (2 credits)
- BUSI 791: Research and Development Strategy and Process (2 credits)

Learning Outcome 1.2. Model best practices in developing and leading research and development programs

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can describe how risk affects the R&D process				
Can demonstrate how to assess the value of technology investments				
Can apply the iterative process to help improve technology design				

Addressed in:

- BUSI 791: Research and Development Strategy and Process (2 credits)
- BUSI 793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)

Learning Outcome 1.3. Comprehend the challenges associated with technology development, commercialization and transition, maturation and regulation, and how each is approached by public and private sector enterprises

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can identify challenges for private sector enterprises in technology diffusion				
Can identify challenges for public sector enterprises in technology diffusion				
Can describe how public and private sector enterprises can collaborate on diffusing a new technology				

Addressed in:

- BUSI 781: Marketing Emergent Technology (1 credit)
- BUSI 784: Systems Design, Development, Test and Evaluation (2 credits)
- BUSI 791: Research and Development Strategy and Process (2 credits)
- BUSI 793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)

Learning Outcome 2.1. Develop skillsets to evaluate and cultivate emergent technology from concept to operational

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can develop criteria for emergent technology evaluation				
Can describe how to incentivize innovations				
Can translate the design of a technology, market, and customer to a diffusion plan				

Addressed in:
- BUSI 791: Research and Development Strategy and Process (2 credits)
- BUSI 793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)

Learning Outcome 2.2. Understand systems engineering precepts and design thinking through real-world case-studies and simulations involving design, development, test and evaluation of new technologies

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can describe the design thinking process				
Can apply the design thinking process to real-world case studies				
Can articulate how iteration is used during the design thinking process to improve technical design				

Addressed in:

- BUSI 784: Systems Design, Development, Test and Evaluation (2 credits)
- BUSI 786: Technology Management Capstone (2 credits)
- BUSI 791: Research and Development Strategy and Process (2 credits)

Learning Outcome 2.3. Apply design methodologies for integrated human-machine systems design and risk management

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can describe the interdependencies between humans and machines				
Can identify potential risks associated with system design				
Can eliminate, reduce, or mitigate risks through improved systems design				

Addressed in:

- BUSI 784: Systems Design, Development, Test and Evaluation (2 credits)
- BUSI 786: Technology Management Capstone (2 credits)

Learning Outcome 2.4. Model, valuate and plan for the financial implications of investment in science and technology

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can perform a discounted cash flow analysis				
Can describe how real options are used to help define the value of a new technology				
Can compare a set of science and technology options and allocate funding based on financial projections and portfolio analysis				

Addressed in:
- BUSI 782: Science and Technology Project Valuation (2 credits)
- BUSI 786: Technology Management Capstone (2 credits)
- BUSI 791: Research and Development Strategy and Process (2 credits)

Learning Outcome 2.5. Develop skills to assess and plan marketing strategies for emergent technologies and future applications

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can articulate different marketing strategies for emergent technologies				
Can define a marketing plan for a technology to expand into a new market				
Can objectively assess marketing plans for emergent technologies				

Addressed in:

- BUSI 781: Marketing Emergent Technology (1 credit)
- BUSI 786: Technology Management Capstone (2 credits)

Learning Outcome 2.6. Understand implications of corporate structure, mergers and acquisitions on technology development in the private sector

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can compare and contrast private sector corporate structures for effectiveness of technology development				
Can evaluate how potential collaborations, mergers, or acquisitions may affect technology development				
Can design corporate structures and inter-firm collaborations to help bring a technology to market				

Addressed in:

- BUSI 782: Science and Technology Project Valuation (2 credits)
- BUSI 793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)

Learning Outcome 3.1. Understand C-Suite perspective on enterprise-level risks from cyber activities and model techniques for enhancing cyber resilience

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can define enterprise risks associate with cybersecurity threats				
Can discuss the balance between preventative and prescriptive cybersecurity investments				
Can design risk reduction processes at the enterprise level				

Addressed in:

- BUSI 782: Science and Technology Project Valuation (2 credits)
- BUSI 786: Technology Management Capstone (2 credits)

Learning Outcome 3.2. Develop skills for decision making in technology-dependent organization and leadership of integrated human-machine teams and activities

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can describe how to integrate the perspectives of various stakeholders into a decision model				
Can objectively evaluate a technology decision				
Can define different leadership roles within the organization to help promote good technology management decisions				

Addressed in:

- BUSI 786: Technology Management Capstone (2 credits)
- BUSI 791: Research and Development Strategy and Process (2 credits)
- BUSI 793: Technology Entrepreneurship, Innovation and Commercialization (2 credits)

Learning Outcome 3.3. Collaborate with others on developing an innovative analysis, project or solution, by incorporating technology management principles, innovation practices, and stake-holder input

Rubric:

Criterion	Advanced	Proficient	Beginning	Unacceptable
Can work well in a multidisciplinary team				
Can demonstrate good team collaboration skills within a technology management context				
Can propose a technical design that synthesizes stakeholder input and solves a defined problem				

Addressed in:

- BUSI 786: Technology Management Capstone (2 credits)