

Master of Science Degree Program in Portfolio and Program Management

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A number of industry practitioner members of the Education Board of the Association for Advancement of Cost Engineering—International (AACE) sought a curriculum for a master's degree program to replace previous studies that AACE endorsed in its Recommended Practice 12R-89, Model Master's Degree Program with Emphasis in Cost Engineering. Their practical experience convinced them that a graduate degree teaching program management skills would be very useful. Construction program management is more cognitively complex than project management, so a different array of courses is necessary when moving instruction beyond the project management level. Cost engineering competencies were culled of those that seem to clearly be more elemental, at the bachelor's level. The remaining competencies can generally be reconciled against the AACE Total Cost Management framework to comprise the proposed master's degree program content. The resulting proposal of a programmed array of master's-level courses would help prepare construction program managers for the increased level of responsibility that they usually encounter upon promotion from project to program-level concerns.

Key Words: Construction Master's Degree; Portfolio and Program Management

Introduction

AACE International Recommended Practice No. 12R-89, *Model Master's Degree Program with Emphasis in Cost Engineering*, dated November 1990, was the initial AACE prescription of appropriate graduate studies for those wishing to become especially well-educated cost engineers. Cost engineering spans a wide array of technical and managerial knowledge and skills with significant application in the construction industry. Some circumstances affecting those prescriptions have changed. Construction-related baccalaureate degree programs accredited by the American Council of Construction Education (ACCE) have grown in popularity and rigor during the intervening years.

ACCE's standards and criteria have guided the development of construction baccalaureate curricula, which have been taught to tens of thousands of current industry practitioners. The many such curricula the author has reviewed or with which he has been personally associated during the past 13 years include RP 12R-89 subjects. Many of those subjects are developed as thoroughly as indicated by RP 12R-89, if not more so, in accredited engineering or business baccalaureate programs. Because the array of baccalaureate program graduates with previous 12R-89 skills has increased, the Recommended Practice lost some of its relevance as a guide for cost professionals aspiring to earn master's degrees. The practitioners determined that an updated model master's program would be useful. The Education Board directed the author to closely examine the content and structure of the Master of Science in Transportation Management degree offered by the Mineta Transportation Institute as a possible template for what AACE would prescribe (Mineta Transportation Institute, 2007).

The Education Board recognized that the prescribed course descriptions and learning objectives of the model master's degree program would probably not be adopted by any institution without modifications. The board did not certainly know that there is much demand for the model program, but their collective judgment is that there should be significant demand for such studies from those who wish to better prepare for higher-level management responsibilities. Construction graduate educators might be encouraged to review what they now teach, in order to bring their curricula into closer alignment with what the practitioners have learned to be useful to them in their program management activities.

Development of General Content of the Program of Instruction

The proposed model master's degree focuses on program management, which is a level of responsibility above project management and is more cognitively complex than management of projects (Zaccarro, 2002). Increased cognitive complexity derives from the expanded time frames and broader scopes of work that typify programs. The recommended program of study offers a logical progression in formal education. Many bachelor's degree programs offer study of project management, so the next level of education, the master's degree, appropriately offers study of management at a level above that of projects. The personal experience of industry managers convinces them that program management merits study unto itself, since it requires different and more challenging skill sets from project management.

The Master of Science in Portfolio and Program Management (MS2PM) recommendation was developed from an array of competencies that a cost engineer should exhibit. Members of the AACE Education Board required that the program be developed from cost engineering competencies that they compiled (Hannon, 2006). The competencies that seem suitably taught by ACCE-accredited baccalaureate programs are culled from the list. The spreadsheet displaying the competencies decreased from 857 to 610 lines--almost a 30 percent reduction.

Whether before or after the elimination of more elementary subject matter, competencies are broadly organized per AACE as follows (Hollman, 2006):

1. Supporting skills and knowledge.
 - Elements of cost.
 - Elements of analysis.
 - Enabling knowledge.
2. Process and functional skills and knowledge.
 - Total Cost Management (TCM).
 - Planning.
 - Implementation.
 - Performance measurement.
 - Performance assessment.

Those unfamiliar with the detailed competencies of cost engineering, which means different things to many, might have an expectation of restricted subject matter. Although it is not obvious, these competencies comprise far more than skills and knowledge related only to cost calculation and optimization or the project controls disciplines of estimating, scheduling, and cost control. They more broadly include, among other subjects, enterprise and project management processes such as strategy development and contracting. Construction educators can find much of the ACCE-accredited program subject matter in the competencies, except purely technical subject matter, such as construction methods and materials.

These are examples of competencies deemed to be of baccalaureate level, which were eliminated for the MS2PM:

- Define or explain general cost concepts in relation to each other and to assets or activities.
- Describe and differentiate the cost characteristics and types that make up product and project costs.
- Describe and differentiate the cost perspectives of an owner from those of a contractor or supplier.
- Explain the general differences among the ways costs are classified for various cost management purposes.

These are examples of competencies adjudged to be more useful for portfolio and program management, which were retained for the MS2PM:

- Describe the Balanced Scorecard and Key Performance Indicators for measuring and assessing asset management performance.
- Describe how the project control planning concepts (e.g., estimating, scheduling) are applied in the context of work in progress, performance assessment findings, change management, and corrective actions.

- Describe how forensic assessment differs from typical project control performance assessment.
- Describe the purpose and mechanics of a benchmarking study.

Professionals in commerce or academia will probably perceive a difference between the eliminated and retained competencies in terms of their complexity and difficulty. Judgment is inevitably applied both to select the more basic, deleted competencies and to group competencies into MS2PM courses. However, the latter process is well-guided by the Total Cost Management (TCM) Framework, a product of many seasoned practitioners and some educators that was more than 10 years in the making.

To a substantial degree, a number of the MS2PM courses adhere to the TCM Framework content and sequence. The TCM Framework affords a comprehensive blueprint for effective asset management and application of the related and fairly comprehensive cost engineering functions to management activities (Hollman, 2006). Drawing from the TCM Framework, the MS2PM includes strategic asset portfolio management instruction with that of program management. They can describe the same level of management, but portfolio management concepts, analysis, and imperatives can also encompass higher management concerns. Those managing programs should understand imperatives and concerns, which often attend portfolio management.

Details of the Program of Instruction

The Master of Science in Portfolio and Program Management (MS2PM) compels study and application of knowledge, skills, and abilities that empower the management of portfolio and program processes and activities, to link projects to enterprise success (Rapp, 2007). The degree program should consist of 33 units and be housed in a duly accredited institution. The 33 units require completion of seven required courses, three electives, and the culminating experience of the Capstone Course, MS2PM 500. The Mineta master's program, referenced before, requires 30 units, and that number is not uncommon for other professional master's degree programs in the U.S. An additional three units is then included for the Capstone Course. Naturally, this number might be modified as necessary by those who adopt the program concept.

By program completion, to earn the MS2PM diploma, the student shall also earn an industry-related certification, the relevance of which is accepted or not by concurrence of the program faculty. Certification shall be one that has at least 500 certificants, has existed for at least three years, and requires at least an all-day written examination. These criteria help ensure that the certification has reasonable credibility in the professional community and will be sustained into the future. Leadership by force of personal example, whereby the professional passes an all-day examination of the knowledge and skills, which they should possess and apply, is a worthy discriminator. It also confirms by an outside party that the student has mastered relevant material.

Experiential Prerequisites

The program applicant should have at least four years of professional experience, which begins after earning a relevant baccalaureate degree. Four years of documented professional experience has long been prescribed for professional engineering licensure and for some certifications, so that duration seems reasonable in this case. At least one of those years must be in a professional-level position with a project or program and with written confirmation by the immediate supervisor that the applicant has performed competently and ethically. Many of the construction higher education community strongly endorse responsible industry experience as a criterion for earning a bachelor's degree. An increased level of relevant professional experience is justified for students wishing to earn a graduate degree. Higher-level management activities in many public or private organizations key on fiscal year events, so requiring at least one year of professional management experience with a project or program is sensible. Also, it is common knowledge that students with professional experience to share can enhance the quality of student exchanges in a management-oriented graduate program.

Baccalaureate-level Prerequisites

Prerequisite course work ensures that students share common knowledge and skills, so that all students can successfully address progressively more advanced studies, and so the instruction can proceed at an acceptable rate.

To move beyond the knowledge and skills often imparted in project management studies, these courses are appropriate prerequisites for the prescribed master's program:

1. Probability and statistics.
2. Construction, contract, or business law.
3. Calculus.
4. Cost estimating.
5. Cost control or business accounting.
6. Project scheduling, including a commercial software package.
7. Engineering economy or business finance.
8. Project management.

Construction educators recognize these as common subject matter in ACCE-accredited baccalaureate degree programs. No master's program need repeat much of baccalaureate instruction. Indeed, the knowledge and skills of these prerequisites characterize many of the competencies removed from the original AACE list to create the MS2PM curriculum.

Required Courses. The student passes all courses with a grade of B or better to earn the diploma, whether required or elective. Students may retake a course one time to earn the passing grade. These restrictions help ensure that student performance is suitable, and that they advance at an acceptable rate through their studies.

MS2PM 101: Inferential Statistics and Optimization for Portfolio and Program Managers

Description. Application of inferential statistics and optimization in portfolio and program management decision-making. Statistical distributions, multivariate statistical analysis, experimental design, and stochastic optimization techniques adapted to program and portfolio analysis.

1. Learning objective: correctly model problems in portfolio management with appropriate statistical distributions.
2. Learning objective: correctly apply multivariate analysis techniques to problems in portfolio management.
3. Learning objective: correctly apply experimental design to problems in portfolio management.
4. Learning objective: correctly apply optimization techniques to problems in portfolio management.

MS2PM 102: Impact of the Enterprise on People and Society

Description. Economic and social impacts of commercial enterprises on individuals and society in general. Interaction among firm governance, portfolio management, and common stakeholders. Role of leadership. Ethics, profit generation, and other social goods, including the organizational structures that enable their attainment by control and delivery of multiple programs and projects. Decision-making for operational efficiency and effectiveness to ethically achieve economic and other social goods.

1. Learning objective: correctly describe characteristics of individual and organizational psychology and their impact on the performance of a commercial enterprise.
2. Learning objective: correctly explain the nature of leadership in enterprises, and how it must adapt to internal and external circumstances in order to be most effective.
3. Learning objective: correctly relate ethical imperatives to specific activities that enterprise managers should, generally, perform or avoid.
4. Learning objective: correctly explain typical economic costs and benefits created by commercial enterprises.
5. Learning objective: correctly explain typical non-economic, social costs and benefits created by commercial enterprises.
6. Learning objective: correctly explain basic organizational structures, and how they might be applied to effectively charter and organize a program management office (PMO).
7. Learning objective: correctly describe the development and application of effective decision policy for commercial enterprises.

MS2PM 201: Economic and Financial Analysis for Portfolio and Program Managers

Description. Financial statement analysis, statement relation to law and business policy, cost of capital, project economic analysis and selection, and investment portfolio analysis.

1. Learning objective: correctly calculate and relate common financial statement values and ratios to the financial health of a business and the viability of its competitive strategy.
2. Learning objective: correctly explain and calculate the cost of capital, and apply it to typical financial decision-making.
3. Learning objective: correctly explain how monetary value can be assigned to non-cash values, costs, and benefits.
4. Learning objective: correctly forecast the financial returns and risk of a portfolio of business assets.
5. Learning objective: correctly determine the necessary characteristics of a new asset in order to improve the financial performance of a current portfolio.

MS2PM 202: The Total Cost Management (TCM) Process

Description. Introduction to and general overview of the structure and content of the Total Cost Management framework and its applications to 2PM. Emphasis on application of TCM processes to particular industries and assets.

1. Learning objective: correctly sketch and explain principal interrelationships of activities and requirements of the TCM Framework in the context of the Plan-Do-Check-Assess process, PDCA, as reiterated through time.
2. Learning objective: correctly clarify the application of the schematic details of the TCM Framework to program and strategic asset portfolio management.
3. Learning objective: correctly explain relevant applications of earned value and other project control processes for effective program and portfolio management.

MS2PM 301: Management of Processes Supporting TCM

Description. Characteristics and development of typical programs that support the Total Cost Management process. Development and integration of MIS; TQM; health, safety, environment, and security (HSES); and other supporting systems and perspectives to help ensure effective portfolio and program management.

1. Learning objective: correctly list necessary parameters, describe development, and explain requirements for program-wide integration of an effective management information system.
2. Learning objective: correctly list necessary parameters, describe development, and explain requirements for program-wide integration of an effective total quality management program.
3. Learning objective: correctly list necessary parameters, describe development, and explain requirements for program-wide integration of effective health, safety, environment, and security programs.

MS2PM 302: Planning Processes

Description. Typical requirements and techniques for determining and supporting a sequence of activities necessary to effectively invest resources to achieve programmatic goals and objectives. Study of the Plan stage of the PDCA cycle. Role of estimating and scheduling for sound program planning. Includes risk, value, and contract management.

1. Learning objective: correctly explain the process and cost concepts by which to determine program requirements.
2. Learning objective: correctly describe the process and components of effective scope determination.
3. Learning objective: correctly describe the application of common planning tools and techniques.
4. Learning objective: correctly describe the formulation of contractual terms and conditions that best effect the plan of action.

5. Learning objective: correctly describe how an execution strategy can be developed to minimize risk and maximize value.

MS2PM 303: Implementation, Performance Measurement, and Assessment Processes

Description. Typical requirements and techniques for communicating and executing program plans and measuring, correcting, mitigating, and improving program performance. Includes concepts in earned value, forecasting, and program change management. Study of the Do-Check-Assess stages of the PDCA cycle.

1. Learning objective: correctly describe how a program execution strategy should be implemented under various internal and external conditions.
2. Learning objective: correctly explain the advantages and disadvantages of metrics and methods, their bases and practice, to compare performance along typical dimensions of portfolio and program activity.
3. Learning objective: correctly explain how timely and accurate assessment of portfolio and program effectiveness can be accomplished.
4. Learning objective: correctly describe how the results of assessments can best be leveraged to improve program performance.

MS2PM 500: Capstone Course

This could be an elaboration of the current plans for an AACSB-sponsored inter-collegiate program management competitive problem, which might also integrate relevant portfolio management challenges.

Description. A scenario-driven array of typical, sequential program development problems that compels student integration of core program management knowledge, skills, and abilities by role play. Common portfolio management problems and principles for their solution are included. Capstone deliverables are team products and include multiple formal presentations and peer performance evaluations.

1. Learning objective: Successfully integrate relevant knowledge, skills, and abilities to conceive, coordinate, and present viable solutions to successive, scenario-driven program management problems.
2. Learning objective: Earn a satisfactory peer evaluation for collaborative effort and contributions to group program management problem solutions.

Possible Elective Courses

Other elective course subjects suggested to the author by various program practitioners follow. The list is far from exhaustive, but it indicates the direction that some construction program managers prefer to see a master's curriculum tack. Other elective courses would be akin to those offered in many Master's of Business Administration (MBA) degree programs but with a bias to construction industry specifics and applications.

Business Strategy and Policy

This could be one of eight core courses; thus, learning objectives are provided as with the required courses.

Description. Formulation and implementation processes for competitive and collaborative business strategies. Role of disciplined policy development and implementation to attain strategic success. Analysis of technological, economic, social, demographic, and political trends to determine their implications for business strategies and policies.

1. Learning objective: correctly explain the development of policy for effective business strategy implementation in a commercial enterprise.
2. Learning objective: correctly describe the impact of typical technological factors on policy development for a commercial enterprise.
3. Learning objective: correctly describe the impact of typical economic factors on policy development for a commercial enterprise.

4. Learning objective: correctly describe the impact of typical social factors on policy development for a commercial enterprise.
5. Learning objective: correctly describe the impact of typical demographic factors on policy development for a commercial enterprise.
6. Learning objective: correctly describe the impact of typical political factors on policy development for a commercial enterprise.

Environmental Law and Policy

Description. Current status and trends for environmental laws and government policies and their economic impact on commercial portfolios and programs. Provides limited history of the development of conservation and environmental protection law and policy, primarily in the US but also internationally.

Real Property Finance and Management

Description. Fundamentals of real property management and associated financial instruments and procedures. Tenant-management relationship, property maintenance, leases, real property insurance, commercial property, industrial property, and marketing; sources of financing, mortgages, liens, foreclosures, principles of value, and insurance.

Labor Relations

Description. Introduction to U.S. labor law and the development of public and private sector unions: right to organize, management rights, arbitration, and grievances. Includes contract negotiation and work management under a union contract. Students simulate negotiation.

Conclusion

As with any proposal of this sort, the model curriculum may not be ideal “as is” for many universities. It is almost inevitable that faculty members’ and students’ prior education and professional experience, as well as their plans for the future, will strongly influence their opinions of how much of the proposed MS2PM content is useful for their needs. Some institutions of higher construction education, which seek to offer graduate programs that help prepare project-level professionals for the next level of management, would likely find the Master of Science in Portfolio and Program Management degree program a useful basis for further refinement and incorporation into their curricula. If so, the objective of the AACE International Education Board is attained.

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