

A TEMPLATE FOR GRADUATE PROGRAMS IN MANAGEMENT OF TECHNOLOGY (MOT)

Report to the Education Committee
International Association for Management of Technology
(IAMOT)

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EXECUTIVE SUMMARY

The note has been prepared in response to a request from the *Education Committee* of the *International Association for Management of Technology (IAMOT)*.

A number of steps are being considered to improve the professional standing of management of technology (MOT). Among these is the certification and registration of MOT qualifications and professionals.

As a precursor to such an endeavor, it is necessary to agree to a *body of knowledge* that constitutes the intellectual foundation of MOT. This note addresses a possible template for graduate programs in MOT that would reflect the required body of knowledge.

In view of the great diversity in the MOT area, and the interdisciplinary nature of the field, it is not advisable to suggest a single, rigid, template. A *flexible* template is proposed that delineates the *scope* of the field, but allows for diversity in the *internal structure* of individual programs.

The template covers four categories.

1. Technology-centered subjects
2. Technology related management procedures
3. Corporate functions
4. Supporting disciplines

In addition to these categories different programs will also include special assignments

The note provides a rationale for this template and gives examples of courses that could be included in each category.

While the note is closely aligned with the deliberations of the Education Committee of IAMOT, it is being made available to a broader readership in the spirit of open debate and deliberation.

Contents

Executive summary	1
1. Introduction	3
2. Scope of MOT	5
3. Suggested template	7
4. Using the template	10
5. Concluding comments	11
References	12

INTRODUCTION

Background

The note has been prepared in response to a request from the *Education Committee* of the *International Association for Management of Technology (IAMOT)*.

A number of organizations are considering steps to enhance the professional standing of management of technology (MOT). These organizations include; (i) The International Association for the Management of Technology (IAMOT), (ii) Technology Management Education Association (TMEDA), (iii) Portland International Center for the Management of Engineering and Technology (PICMET), (iv) Engineering and Technology Managers Education and Research Council (ETMERC), (v) European Institute for Technology and Innovation Management (EITIM), (vi) MOT Consortium in Japan, (vii) International Forum for Technology Management (IFTM).

Among the steps being considered are the certification and registration of MOT programs and professionals.

As a precursor for this step, the MOT community has to identify;

- A body of knowledge
- A community of peers

This note addresses the *body of knowledge* that constitutes the intellectual foundation of MOT.

Academic setting

Management of Technology (MOT) is a highly diversified activity. A recent survey identified about 270 academic programs. (Kocaoglu, et al, 2003). Details are available on 148 of these. The survey finds that:

- Different types of schools and centers offer MOT programs. Three examples are; business schools, schools of science and engineering, and dedicated centers.
- Titles of academic programs vary. Examples include: Management of Technology (or Technology Management); Engineering Management, Engineering and Technology Management; MBA Management of Technology; Systems Engineering Management; and others.
- Program contents vary significantly, and are made up from a variety of courses. More than thirty courses were identified.
- Professional affiliations of faculty vary. About twenty associations were cited.
- In addition to dedicated programs, aspects of MOT are taught as individual courses in other programs as well.

With this diversity, it is a challenge to agree to an appropriate body of knowledge for MOT. The note proposes a possible template for graduate programs in MOT.

The note should be seen as suggestive rather than exhaustive. While the note is closely aligned to the needs of the Education Committee of IAMOT, it is being made available to a wider readership in the spirit of open debate and deliberation.

Source material

In preparing this note we have drawn from the following resources.

1. A statement by Prof. Tarek Khalil, "A Message from the President: New IAMOT Initiatives" *International Association for Management of Technology (IAMOT)*, April 12, 2004. (<http://www.iamot.org>)
2. A report by the National Research Council, 1987 *Management of Technology: The Hidden Competitive Advantage*. National Academy Press, Washington, DC. This is a key report in the history of MOT, and set the stage for many initiatives.
3. A series of reports sponsored by the National Science Foundation and prepared under the auspices of the International Association for Management of Technology (IAMOT). The latest item is: Khalil, T.M., 1999, *Management of Technology: The Drivers of Technological Changes in the Twenty First Century*, NSF Grant No. SES-0001271, University of Miami.
4. A template devised by the present author while serving as the Director of the Management of Technology Program at the University of Minnesota, 2000. This template was part of an initiative to enhance the Master of Science in the Management of Technology (MS-MOT) degree. It was devised on the basis of a survey among students, alumni, faculty and colleagues, and was disseminated among professional colleagues.
5. Discussions on the positioning of MOT – a topic that was dealt with at various international conferences. Of particular relevance were comparisons between *technology focused* management programs and *generic* management programs. This topic was covered during the *Tenth International Forum on Technology Management (IFTM)*, Austria, Vienna, November 2000, and the *Eleventh International Conference on Management of Technology (IAMOT)*, 2002, Fountainebleau Hotel, Miami.
6. A debate on the MINT network over the period 2001-2003, and exploring the fundamental structure of technology and the development of MOT as a profession. (<http://mint.mcmaster.ca>)
7. A *Credo for MOT*. Formulated by the MOT community in the course of 2000 – 2003, (<http://www.iamot.org>).
8. A survey "Educational Trends in Engineering and Technology Management" by Kocaoglu, et al, 2003, and referred to in the Introduction to this note.
9. Recent writings on MOT in Japan, including (i) *A Guide to MOT in Japan*, 2003, Ministry of Economic Trade and Industry, and (ii) a presentation by Yasser Hosni, giving an IAMOT prospective of MOT in Japan.

SCOPE OF MOT

Definition

The notion of MOT is evolving all the time. A 1987 description states that: “Management of technology links engineering, science and management disciplines to plan, develop, and implement *technological* capabilities to shape and accomplish the strategic and operational objectives of an organization” (Task Force on the Management of Technology, 1987: p. 9). This description characterizes MOT as a *unique combination* of many constituent elements and emphasizes the multi-disciplinary nature of the field. Over the years the concept has been explored further, leading to new insights and understanding, (e.g., Khalil, 1999).

One aspect that is being brought to the fore is the *compelling need* for technologically informed management. This compelling need follows directly from a significant gap in traditional management theory.

Traditional theory is based on the so-called *functional concept* - a very powerful concept conceived in about 1917. In terms of this concept, management can be viewed in terms of a number of standardized functions. These include marketing, finance, operations, HR, administration and overall leadership. The functional concept is a most resilient notion. Today virtually every business is organized in terms of the functional concept. Most business schools use it to structure their core courses. And most professional societies define their interests in terms of functional fields.

However, the functional concept does not adequately deal with the phenomenon of technology. As the business world evolves, and as technology becomes a greater presence with a larger impact than before, the traditional management model is less able to reflect the new realities. Traditional management thought cannot picture the changing technological landscape. And traditional management thought does not tell us how to harness opportunities arising from advances in science and technology. For this a new management framework is required – hence MOT.

To reflect this compelling role of MOT, a sharper definition of MOT is beginning to emerge. Moving beyond the notion of MOT as a multidisciplinary area, the field is increasingly being defined in terms of an elegant, central theme. For instance: MOT is “the art of maintaining the mature, nurturing the new and forecasting the future of technology” (Hosni, 2003). Or “MOT is a branch of management that assesses the potential of individual technologies and uses this potential to the benefit of the organization”.

A template for an academic program has to take account of this evolving definition.

Academic setting

As mentioned before, MOT programs are hosted in a number of very different academic environments. These include business schools with a traditionally “soft” culture, schools

of science and engineering, with a traditionally “hard” culture, and dedicated centers. Each has a valuable contributory influence.

The different schools already have experience of different certification and accrediting agencies. The MOT community therefore faces the challenge of formulating a body of knowledge that will be acceptable to this widely diversified audience.

The template for a graduate program will have to accommodate this diversity.

SUGGESTED TEMPLATE

Criteria

Given the multi-disciplinary roots of MOT and its different academic settings, it does not seem feasible to suggest a single and rigid template that could apply to all programs. A pliable format is needed.

Such a format would have to meet three requirements. It has to be: (i) *Focused* enough to emphasize the unique features of technology. (ii) *Broad* enough to encompass the entire scope of the MOT field. (iii) *Flexible* enough to allow for creative diversity and the special competencies of host organizations.

In keeping with these requirements we propose a template that is made up of four categories.

1. Technology-centered subjects
2. Technology related management procedures
3. Corporate functions
4. Supporting disciplines

In addition to the four categories, there is a need for special assignments. These will be discussed below.

At this stage the template is not concerned with the length of individual programs, i.e., total credit values, or the distribution of credit values among the various categories. These matters can be explored later. The characteristics of the four categories are the most important features here.

Academic content of each category

Category one: Technology-centered subjects

This part of the template covers the true “technology” heart of MOT. It deals with the theory of technology, the structure of the technological landscape, and detailed knowledge of individual technologies. Examples of courses include:

- Technology: A core theory
- Emerging technologies
- Technology foresight
- Specialty fields

Course materials are very specialized and contents are known within a small circle of specialists only. Curricula vary significantly. Much scope exists for creativity and refinement.

Category two: Technology related management procedures

This part of the template covers specialized management procedures that are normally, but not exclusively, associated with technology intensive settings. Materials in this part of

the template normally; (i) have a high technical component, (ii) have a high level of innovation, (iii) frequently use metrics other than cash.

Courses in this area include:

- Technology forecasting
- R&D Management
- Innovation management
- New product management
- Project management
- Intellectual property management

Academic materials are generally well developed. Some have achieved a respected level of professional standing, for example project management that has its own book of knowledge.

Category three: Corporate functions

This category covers the classic business functions. It is the most standardized of all four categories. About six functions reflect the internal working of business organizations. The identification of these functions has been attributed to Fayol and dates back to 1917. Since then these functions have constituted the basic format for all management education. While the descriptions and emphases of the business functions have evolved over the years, their basic structures have remained remarkably stable.

Attempts are underway to reconfigure the functional classification. In due course a new classification could emerge that will reflect the reality of the business world better than the 1917 formulation. However the inertia inherent in the present system will probably ensure that the evolutionary process is a gradual one.

Examples of courses include:

- Strategy
- Marketing
- Finance
- Operations
- MIS
- HR
- Administration

Academic materials in this category are extremely well known and standardized.

Category four: Supporting disciplines

Supporting disciplines provide the broader academic roots of MOT. When MOT is referred to as a multi-disciplinary activity, a wide range of academic disciplines is thought of. These can range all the way from hard disciplines rooted in the natural sciences to soft disciplines from the social sciences and humanities.

Examples of courses include;

- National policy frameworks
- General systems theory
- Futuristics
- Industrial ecology
- Ethics
- Economics
- Human behavior
- Quantitative methods
- Accounting
- Law

This category allows for much diversity and innovation. Programs hosted by business schools would offer different disciplines from programs hosted by engineering schools.

Special assignments

In addition to the basic template, many programs require special assignments. Typical examples include:

- Internships
- Capstone courses and research reports
- Business study missions

Internships increase the practical acumen of the candidate. Capstone courses and research reports may be included to bring the program in line with Master's degree research requirements. Study missions, especially study missions abroad, are included to broaden the world-view of participants and to foster an international outlook.

Much scope remains for creative special assignments.

USING THE TEMPLATE

The template can be used to (i) ensure adequate coverage of requisite themes, (ii) position MOT programs in relation to generic management programs, and (iii) position one MOT program in relation to others.

- To ensure adequate *coverage*, the template can be used as checklist to include courses from each of the four categories differentiated in the template
- To *position* a program, the template can be used to visualize the relative emphasis on different categories. This is illustrated in Figure 1 below. It illustrates the positioning of an MOT program relative to a generic management program (Van Wyk, 2002).

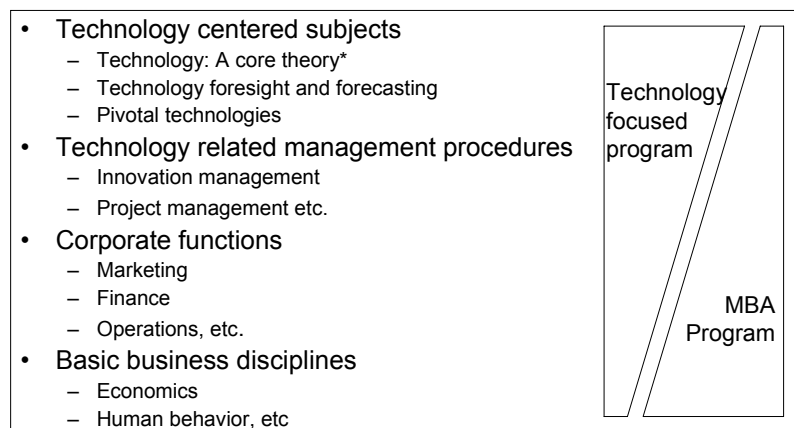


Figure 1: Technology focused management program compared to generic MBA

Technology focused management programs, like the MS-MOT or the MBA in technology management, would place greater emphasis on categories one and two than generic management programs would.

Also technology focused management programs can differentiate among themselves by emphasizing various categories differently. Programs that accentuate techno-centricity, would be more heavily weighted in category one. Programs with a less techno-centric orientation would emphasize categories 2 and 3 more.

CONCLUDING COMMENTS

This note represents an early step in the process of certification and registration of qualifications and professionals in MOT. It addresses the need for agreement on an appropriate body of knowledge by suggesting a structure for graduate programs in MOT.

In evaluating this note it is convenient to address seven key questions:

1. Is the notion of a template for graduate programs in MOT a valid notion?
2. Is the idea of a flexible template an acceptable concept?
3. Does the suggested template adequately reflect the scope of MOT?
4. Is the choice of categories a viable representation of the range of topics that could be included in a MOT program?
5. Are the examples of individual courses fair examples of the types of courses that should be included in each category?
6. What further courses should be added?
7. Which categories are adequately catered for with existing knowledge, and which categories require the development of new materials?

The note has been submitted to and is being considered by the Education Committee of the International Association for Management of Technology (IAMOT) for possible further action. The note is made available to other interested organizations to encourage a coordinated approach to certification and registration of MOT programs and professionals.

Comments will be appreciated.

REFERENCES

1. *A Credo for MOT*. Formulated by the MOT community in the course of 2000 – 2003, (<http://www.iamot.org>).
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