Core Curriculum for MOT-Education

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Japan Association of Professional Graduate Schools
of Technology Management

Preface

The professional graduate school system which was inaugurated in fiscal year 2003 has been leveraged in wide variety of education fields. Professional graduate schools specifically concentrate on cultivating professionals with highly specialized skills rather than producing academic researchers. More than 180 professional graduate schools have been established to date and as a whole the schools are now recognized as a centerpiece of the recurrent education system in Japan. Standardization of the contents to be learned in tandem with strict accreditation system is crucial for endorsing the quality of education at professional graduate schools and eventually increasing the visibility of the professional graduate schools further.

Management of Technology (MOT) professional graduate schools were established in response to the social recognition that producing professionals who can think business both from technological and managerial perspective and successfully manage innovation process is essential for preserving the competitiveness of industries in the global marketplace. In this sense, MOT schools are particularly expected to give applicable knowledge and skills in practice among professional graduate schools. However, innovation management requires a lot of capabilities and focal point may differ widely across firms and industries. Moreover, like MBA program, MOT education is not designed for certification exam purpose so that convergence of the educational program is challenging.

Ten member universities of the Japan Association of Professional Graduate Schools of Technology Management had seriously discussed this issue for several years and decide to develop "core curriculum" and to communicate it to the public in order to embrace the social mandate for improvements in the quality of MOT education. We repeatedly heard from leading businesspeople and other influential experts about the content during the development process. We believe the core curriculum largely reflects their comments and shows the "musts" to MOT students.

Standardization in Japan is not the goal of our endeavor. Is it appropriate to consider MOT education in domestic context when firms operate globally? Imagine a MOT graduate can study further at foreign graduate school based on the common knowledge building blocks when he or she is sent oversea. I think truly effective recurrent MOT education system in this globalization era should reflect extended mobility of human resources. Cross border cooperation and convergence in education content among MOT schools in different countries is the key to get into the next stage.

Finally but not least, I would like to express my appreciation to the members of the core curriculum develop committee of the Association for their dedicative efforts to finalize the curriculum and others who gave helpful comments. My sincere acknowledgement also goes to the officials from Ministry of Education, Culture, Sports, Science and Technology and Ministry of Economy, Trade and Industry who warmly supported the project and attended the meetings every time. I hope this curriculum is helpful for all the people involved in MOT across countries.

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Contents

Core Curriculum for MOT-Education -- Background and Concepts

The management of technology (hereinafter referred to as "MOT") entails the effective exploitation of technology. Along with advances in science and technology in recent years, the exploitation of masterfulness has extensively and significantly affected the success of companies and other organizations as well as society as a whole. While facilitating innovations in product development and production methods based on new technologies is important but part of MOT, the impact that information and communications technologies (ICT) has on the entire value-chains of firms also enters into the scope. To promote creative management in companies and other organizations and ensure contributions to be made to society under these circumstances, the importance of understanding the roles of technologies and harnessing them is becoming notably greater alongside research and development efforts that are giving rise to innovative technologies. In other words, it is not enough for companies and other organizations to simply pursue technological frontiers; management skills which are underpinned by deep understanding of the roles of technologies and help to take advantage of them have become essential. MOT education is offered with the aim of cultivating such management skills.

Ten professional graduate schools that are specialized in cultivating advanced-level professionals have been established since 2003 in response to rising demand from society for MOT. The aim of these MOT professional graduate schools is the cultivation of human resources capable of generating creative results when grappling with various issues in society, companies, and other organizations from synthetic perspectives on technology and management. While these human resource professionals are required to solve particular issues in companies and organizations with their expertise and skills, they are also expected to occupy managerial or leadership positions in companies and other organizations at some point in time. They will then be able to play their roles in facilitating to plan, formulate, and implement comprehensive measures characterized by integrity in terms of a global and societal outlook (to survey all relevant aspects informed by synthetic perspectives on technology and management), foresight, logicality, and effectiveness in their companies and organizations. The cultivation of such human resources is essential for industries to attain sustainable development and retain international competitiveness.

At the same time, MOT covers a broad spectrum of educational content reflecting a breadth of items that are subject to adaptation. At educational institutions other than the professional graduate schools that were previously mentioned, one can also come across a number of examples of cases in which courses focusing on specific fields of expertise or courses dealing with the handling of technology in conventional categories, which do not include management elements, are presented under the labels of MOT education. If this situation is not addressed, the expectations of industry and society at large of MOT education will diverge from what is really educating, such that a state of confusion could arise in terms of proper evaluations of MOT education and professional graduate schools that offer MOT education. Thus, in order to embrace the social mandate for improvements in the quality of MOT education, we believe that it is necessary to develop and standardize the educational content for MOT professional graduate schools and to communicate this to the public.

Against this backdrop, we scrutinized the education that should be provided by MOT professional graduate schools and prescribed a "core curriculum" for MOT education. The core curriculum was formulated as a foundation for deploying MOT education throughout Japan. The specific content of the curriculum, which we believe all students studying at MOT professional graduate schools should learn while enrolled, is presented as a reference for universities when they are putting together their

curricula. It is hoped that this core curriculum, which reflects feedback from the ten member universities of the Management of Technology (MOT) Association Japan and incorporates the opinions of members from the business community, will be widely used. In the future, greater efforts should be expended to guarantee levels of achievement of graduates from MOT professional graduate schools to embrace this social mandate for improvements to the quality of MOT education. To this end, it will be necessary to establish standards of achievement and objective methods of evaluation and address numerous other issues in addition to developing educational curricula. The core curriculum that we produced shall be the foundation for future initiatives with the aim of guaranteeing the achievement levels of graduates from MOT professional graduate schools.

The core curriculum comprises *knowledge items* that we believe should be acquired by all students and *integrated areas* that will entail creative problem solving based on the use of the knowledge and skills acquired. The knowledge items represent the minimum requirements and the level of achievement that should be attained by students. The integrated areas represent the problem-solving initiatives and the qualitative requirements, which the results of these initiatives are subject to.

MOT education that incorporates societal demands is diverse. Education based on a curriculum individually tailored to individual professional graduate schools is important to totally develop MOT education. Consequently, the fact that unique content provided by individual professional graduate school accounts for a greater portion of the total education provided by institution until student graduate than education that corresponds to the core curriculum does not present a problem. In other words, the stipulation of education targets according to the core curriculum must not compromise the independence or diversity of professional graduate schools.

In addition to corresponding to a broad scope of content, that pertaining to MOT education is diverse in terms of the degree of systemization as a subject. In the future, it will be necessary to reinforce the curriculum on an ongoing basis while taking into consideration societal demands, scientific and technological progress, and other factors. In order to ensure qualitative improvements to MOT education based on ongoing reinforcement of the core curriculum, MOT professional graduate schools will be called upon to not only provide education based on past knowledge but also to promote initiatives with the aim of systemizing information as academic elements from various MOT-related areas and incorporate the results of such initiatives into education.

1. Knowledge items

Knowledge items consist of *basic knowledge* and advanced c*ore knowledge items.* Each of these categories consists in turn of achievement objectives. Based on the content, basic knowledge represents MOT fundamentals, such that the basic information required for understanding MOT is presented; this information is relevant to the cultivation of MOT human resources. The basic knowledge required to solve problems from multiple viewpoints concerning technology and management—ranging from information pertaining to technology within the context of MOT to information pertaining to accounting, corporate finance, marketing, and other matters involving the management of companies and other organizations—is presented. As the name suggests, core knowledge consists of elements comprising the core curriculum of MOT professional education.

While a graduate of an MOT professional graduate school is expected to demonstrate creative problem-solving skills from multiple viewpoints in managing technology in the real world, he/she will in practice be required to collaborate with the relevant sections and personnel in a company or other

organization in order to effectively solve problems. Basic knowledge that pertains to technology and management will be needed to provide shared understanding or a common foundation for smoothly promoting such efforts. Information is presented from this perspective on a minimum-requirement basis in MOT education. As described earlier, there are diverse situations concerning the systemization of information pertaining to MOT. Therefore, the methods by which information is described have not yet been completely standardized. Specific examples of more detailed information should help to facilitate an understanding of certain items in some cases.

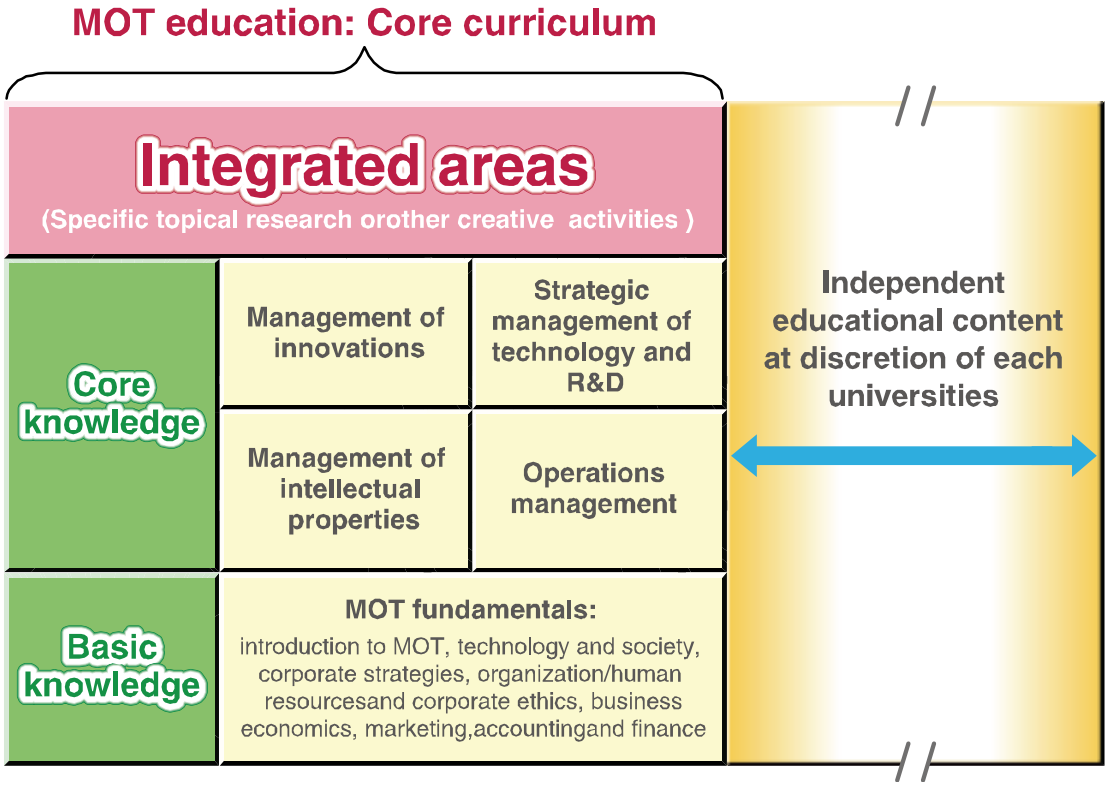
This is because the education currently offered by MOT professional graduate schools is not based on the premise that any kind of certification is obtained through a system of national exams or other such arrangements. For instance, when the term “explain” is used as a means of representing the level of achievement of knowledge in the core curriculum, there is no need to provide explanations equivalent to responses which are expected to be given in national exams. Based on the viewpoint that it is important to use knowledge as a means of solving problems, it is necessary to think flexibly by referencing and presenting the required documentation in practical situations as one aspect of proffering explanations.

The knowledge category and achievement objectives are listed here to simplify the identification and understanding of information that should be learned. There is no need for the knowledge category and achievement objectives to be consistent with the names of courses. A single knowledge category or achievement objectives can be attained through multiple courses. The order in which the knowledge category and achievement objectives are presented does not indicate the order in which education should be provided. There is also no need to limit the format for implementation to lectures where knowledge is imparted, i.e., exercises, reading in turns, seminars, practical training, and other formats may also be applied. Since students enrolling in MOT professional graduate schools represent a diverse range of backgrounds; it is consequently conceivable that some of them will already be familiar, when they enroll with certain knowledge in the core curriculum. As described earlier, the knowledge items in the core curriculum define the level of achievement that should be attained by the student. Thus, a student deemed to have already attained a given level of achievement should not be compelled to take a required course and should be dealt with flexibly depending on the situation.

2. Integrated areas

The aim of MOT education in professional graduate schools is not simply to facilitate the acquisition of knowledge; it is also offered to provide students with chances of obtaining the capabilities for creative problem solving in the real world. Creative problem solving requires the integration of learned knowledge and skills. It is important for students to engage directly in such efforts as part of their education; this part of their learning is presented under the heading of integrated areas. Initiatives corresponding to these areas are referred to by a variety of different headings, such as specific topical research, by different universities. Because topics vary in integrated areas, subjects are prescribed in the core curriculum in terms of the initiatives and the qualitative conditions that apply and relevant details are specified.

The framework of the core curriculum is outlined in the chart below:



A. Basic knowledge

Knowledge category

1. MOT fundamentals

The information that should be acquired given status as MOT fundamentals is categorized under the following headings -- introduction to MOT, technology and society, corporate strategies, organization/human resources and corporate ethics, business economics, marketing, and accounting and finance. The achievement objectives that comprise each of these categories have been presented. Sections denoted by an asterisk in the explanations of intermediate-level objectives below are points to be borne in mind.

General goal:

Systematically understands and explains key points concerning technology, management of companies, ethics required for operations, and knowledge pertaining to the framework from diverse perspectives on technology and management.

Introduction to MOT

Achievement objectives:

(1) What is MOT?

Describes MOT by giving a definition and objectives, and the reasons for the necessity of MOT, Defines “technology” and “management”, and other relevant points.

(2) MOT background

Explains the origins and the history of MOT as well as current global and Japanese situations and trends concerning MOT.

(3) Areas subject to application of MOT

Explains information that is characteristic of MOT as it corresponds to each applicable area of MOT that includes corporate management, science and technology policies, topics of research in universities and elsewhere, and other areas as well as commonalities.

*Differences between MOT and an MBA or PSM (Professional Science Master), interactions among information handled under high-level core MOT knowledge or basic knowledge, differences between MOT and areas such as techno-economics and techno-metrology, and other examples may be addressed under this item.

Technology and society

MOT encompasses management within organizational structures underpinned by technology. MOT professionals discern the relationship between management and issues inherent to technology that are not simply reduced to economic calculations and, given the necessity for applying such in-

sight to management, provide relevant knowledge to accomplish this purpose. Intermediate-level objectives consisting of the ethics of engineers, science/technology and society, technology and risks, and technology and standardization are indicated under “technology and society” as problem areas inherent to technology.

In the area of technology and society, the terms in brackets in the explanations are only illustrative and should not be construed as encompassing all the examples there. On the whole, it would be ideal to cover corresponding intermediate-level objectives. Illustrations by example have been presented to help ascertain and ensure common understanding of the information.

Achievement objectives:

(4) Ethics of engineers

Explains the impact and effect of technology on society and nature as well as the responsibility of engineers toward society.

(5) Science, technology, and society

Understands the various connections between science/technology and society and explains issues (such as societal acceptance of science/technology, science/technology and the environment, science/technology and public policy, and science/technology and international relations) that must be addressed in the application to the process of innovation.

(6) Technology and risks

Analyzes, assesses, and understands the risks attributed to technology and explains issues (such as risk analysis, risk assessment, risk management, and quality control) that must be addressed in the application of the process of innovation.

(7) Technology and standardization

Explains basic issues (such as the significance of standardization, the stakeholders in standardization, and the process of standardization) pertaining to technology and standardization.

Corporate strategies

Achievement objectives:

(8) Management philosophy (mission)

Understands and explains the roles and importance of elements in the management philosophy (mission) that affect corporate strategies.

(9) Domain

Explains the significance of domains as they relate to the development of business activities.

(10) Analysis of external environment

Explains the framework for the analysis of opportunities and threats to a company as external conditions.

(11) Analysis of internal environment

Explains the framework for the analysis of strengths and weaknesses of a company as internal conditions.

(12) Formulation of strategies

Explains the formulation of strategies based on the utilization of a framework of strategic theories.

Organization/human resources and corporate ethics

Achievement objectives:

(13) Corporate ethics

Explains ethics as conditions which members of companies and organizations are subject to in executing their duties.

(14) Organizational management

Explains methods of striking an appropriate balance between organizational efficiency and creativity.

(15) Motivation

Explains the elements of the framework for motivation management (including the personnel system) that are designed to ensure that organizational members act toward accomplishing organizational goals.

(16) Leadership

Explains the role of leadership in achieving organizational goals and effective practical methods of demonstrating such leadership.

(17) Compliance

Explains the significance of main statutes and regulations and internal codes of conduct as they relate to the conduct of one's own company and proposes individual and organizational initiatives to ensure compliance.

(18) Corporate social responsibility (CSR)

Explains the concept of CSR and the positioning and importance of CSR for business activities.

(19) Risk management

Enumerates the main risk factors surrounding one's own company and their potential impact and explains the process of organizationally managing these factors.

Business economics

Achievement objectives:

(20) Consumer behavior

Explains, from the perspective of microeconomics, basic ways in which changes in prices or income affect consumer demand.

(21) Corporate behavior

Explains, from the perspective of microeconomics, basic ways in which a company should engage in production activities according to the market structure to maximize profits.

(22) Market mechanisms

Explains, from the perspective of microeconomics, market demand, market supply, and market price that result from the interplay between corporate behavior toward profit maximization and consumer behavior in maximizing their utility.

(23) Statistics

Analyzes data as well as tests statistical hypotheses and explains the statistical meanings of estimates.

Marketing

Explains key items required for formulating and implementing marketing strategies.

Achievement objectives:

(24) Discovering market opportunities

Focuses on customer needs, company seeds, and changes in the environment surrounding a business operation and explains methods of discovering market opportunities.

(25) Segmentation and targeting

Explains marketing research processes, methods of market segmentation, and methods of selecting target markets.

(26) Market positioning

Explains the uniqueness of the products offered by his/her own company (differentiates them from competitors' products) and methods by which the market positions of the prod-

ucts have been configured.

(27) Marketing mix

Provides outlines of the strategy for each product, pricing, distribution, nd communication.

(28) Brands

Explains the importance of brands and branding according to circumstances.

(29) Customer satisfaction (CS)

Explains the characteristics of customer satisfaction and measures for enhancing client satisfaction.

(30) Industrial marketing

Explains marketing for industrial goods while taking into account differences between industrial marketing and consumer marketing, such as that n terms of the characteristics of purchasing behavior.

Accounting and finance

<Aims of accounting and finance>

- Understands the significance and structure of financial statements,
- Compares and evaluates other companies based on financial analysis,
- Understands methods of assessing enterprise value, and;
- Understands methods of assessing investment profitability.

Achievement objectives:

(31) Double-entry bookkeeping

Understands the significance of recording all business activities on a dual-ledger basis in a company's accounting system and engages in simple journalizing.

(32) Financial statements

Understands the significance and methods of producing income statements, balance sheets, and cash-flow statements and explains their relationships to one another.

(33) Cost accounting

Explains the basic structure and role of cost accounting.

(34) Variable costing and absorption costing (managerial accounting concepts)

Classifies costs into variable and fixed costs and understands that costs will differ unless fixed costs are allocated to inventory.

(35) CVP (cost/volume/profit) analysis and break-even point

Explains methods of calculating break-even sales based on a breakdown of variable and fixed costs.

(36) Assessing enterprise value

Explains the concept of enterprise value and the main methods by which enterprise value is assessed.

(37) Cost and profit analysis of investments

Explains different ways of assessing the profitability of investment projects.

(38) Financing and capital costs

Understands the fundamentals of capital sources and the concept of capital costs based on debt costs and equity costs and explains appropriate methods of financing.

(39) Tax advantages

Explains the types of taxes levied within the context of corporate management and the differences between accounting profit and taxable income.

B. Core knowledge

Knowledge category

1. Management of innovations

Overall objective:

Understands the concept of innovation and obtains knowledge pertaining to its theoretical foundation to achieve innovation according to a high probability rate. In other words, to learn the basic concepts that are required when thinking about how to attain innovation.

<Educational points to bear in mind>

It is not simple to generalize and share more practical techniques and viewpoints that depend on the types of businesses, eras, regions, politics, and other elements of the external environment or on corporate culture and other elements of the internal environment. For this reason, it is hoped that practical techniques and viewpoints can be learned according to the needs of students and other factors.

Achievement objectives:

(1) What is innovation?

Explains the concept denoted by the term "innovation," which includes Schumpeter's new combinations.

*It is preferable for explanations to be based on an understanding of the following. In other words, "innovation" is a concept associated with the creation of economic value; technological change is not an essential condition. The term is an after-the-fact concept and its accomplishment cannot be reliably controlled on a before-the-fact basis. Innovation should be handled with efforts to raise the probability of attainment treated as a key point of management.

(2) Corporate management and innovation

Discusses why growth by Japanese companies based on innovation is presently required, the necessity for a paradigm shift (why improvements are insufficient where a company evolves incrementally within the limits of conventional growth--track projections), and other such topics.

*A student should ideally be able to discuss the necessity for innovation based on an understanding of the facts that the source of profits in modern society is due to differentiation, that the state of differentiation is never permanent, and that the creation of a state of differentiation is dependent on innovation.

(3) Opportunities for innovation

Presents illustrative cases of innovation that are strongly linked to (1) and (2) above.

*For example, the impact of advances in the area of information and communications technology should ideally be considered when explaining the references to railroads examined by Schumpeter or the seven (plus one) sources of innovative opportunities outlined by Drucker.

(4) Open innovation

Explains the significance of business models and the concept of open innovation.

*It is hoped that the act of studying the significance of open innovation as it applies to differentiation that gives rise to profit will promote a constructive understanding of research and development, product planning, marketing, and other such functions.

(5) Business architecture

Explains the concept of product and process architecture and the significance of business architecture within the context of innovation.

Knowledge category

2. Management of intellectual properties

General goal:

To possess basic knowledge pertaining to intellectual property rights and obtain management capabilities for precisely securing and utilizing patents and other such intellectual assets required to promote business in collaboration with sections that are in charge of intellectual assets.

Achievement objectives:

(1) What are intellectual property rights?

Understands the outlines of entire systems of intellectual property rights that are in place in Japan and other countries.

(2) Securing rights

Understands important practical procedures and laws for explicitly securing research and development results as intellectual property rights.

(3) Management within context of collaboration with external parties

Understands important practical procedures and laws for explicitly engaging in the management of intellectual property rights within the context of collaboration with external parties, such as those in terms of the assignment of intellectual property rights within and outside the company and the allocation of intellectual property rights arising from joint research.

(4) Intellectual asset portfolios

Understands important analytical methods for ascertaining and strategically obtaining an intellectual asset portfolio that is required for commercialization and for building impenetrable barriers to entry.

(5) Standardization and intellectual property rights

Understands systems and laws for formulating technology strategies to facilitate appropriate exercise of rights while striking a balance between intellectual--property rights and standardization.

(6) Assessing value of intellectual assets

Understands the significance and methods of assessing the value of intellectual assets.

Knowledge category

3. Strategic management of technology and R&D (research and development)

General goal:

Explains key matters required to formulate technology strategies linked to and integrated with corporate and business strategies. Explains key matters required to manage R&D as measures for execution contained in technology strategies.

Achievement objectives:

(1) Technology

Explains the differences between technology and science/engineering in terms such as motivation, behavior, and attributes (assessment viewpoints).

(2) Relationship between technology strategies and corporate and business strategies

Explains the relationship between technology strategies and corporate and business strategies.

(3) Analysis of technology trends

Explains the characteristics, utility, and limits of key matters pertaining to the analyses and predictions of technology trends (e.g., degree of technological maturation (S-curve), and Delphi, extrapolation, and correlation-modeling methods).

(4) Analysis of proprietary technologies (internal resources)

Provides an outline of typical methods used by a company or other organization for analyses of internal resources pertaining to technologies. While elemental technology portfolios, product and technology matrices, technology maps, and other methods are known, there is no need to cover all these methods. The aim of this objective is to have students acquire knowledge on methods of systemizing a company's own technologies and of categorizing and surveying such technologies based on multiple variables informed by viewpoints according to objectives.

(5) Technology knowledge management

Provides an outline of the roles of the management of technical knowledge within the context of technology strategies and the management of R&D.

(6) Evaluation of technology

Provides an outline of methods of evaluating technologies from diverse perspectives, such as using techniques learned through analyzing the cost and profit of investments using accounting and finance.

(7) Technology acquisitions

Explains the characteristics of in-house development, collaborations, and collaborations between industry and academia as they apply to technology acquisitions within the context of technology strategies.

(8) Technology road-mapping and technology roadmaps

Provides an outline of the positioning and roles of technology roadmaps within the context of technology strategies and the management of R&D. Explains the elements of technology roadmaps using examples of leading-edge technologies.

(9) Roles of R&D (functions)

Is aware that the content of R&D is diverse and that there are also different management viewpoints with respect to “research” and “development” given differences in terms of objectives and content. Explains the roles of research and development in a company and the differences between them. Provides, as examples, explanations of research, product development, process development, technical services (specific to producer goods), and other functions.

(10) Management of R&D

Provides an outline of key matters required to manage R&D in companies.

Using examples and from a perspective that focuses on individual R&D themes (projects), he/she explains the importance of evaluating the R&D themes of a company or organization according to a process that extends from the origination of these R&D themes to their implementation and completion as well as the viewpoints from which such evaluations are conducted.

Using examples and from a perspective that focuses on R&D activities carried out by a company or organization, he/she explains the importance of ascertaining the status of resource allocation (according to R&D portfolios and other measures), the importance of evaluating the results and productivity of R&D activities, and the viewpoints from which such evaluations are conducted; this explanation should include references to the characteristics of and problems associated with the methods of evaluation that are used.

Knowledge category

4. Operations management

General goal:

Explains the totality of operations pertaining to corporate activities from the perspectives of product development, production planning, materials procurement, operation management, logistics management, and project management.

Achievement objectives:

(1) Product development and process

Explains the process of product development and the methods by which this process is managed.

(2) Management of productivity

Explains the relationship between manufacturing systems and productivity improvements.

(3) Industrial engineering (IE)

Explains the relationship between manufacturing systems and productivity improvements based on process, work, and operation analyses, including other types of studies as well as methods of achieving productivity improvements.

(4) Delivery time and process controls

Explains the necessity for delivery time and process controls.

(5) Materials procurement

Explains order-placement procedures in materials procurement systems and the mechanisms for inventory accrual.

(6) Cost management

Explains the necessity for cost management based on the knowledge of cost accounting learned from accounting/finance courses and methods by which management is implemented.

(7) Quality control

Explains the TCQ concept and the control methods used.

(8) Supply-chain management

Explains the basic mechanisms for SCM.

(9) Project management

Explains the role and the body of knowledge that have been accumulated with respect to project management within the context of corporate activities (PM framework).

C. Integrated areas

Objective and definition of integrated areas:

Education is offered by MOT professional graduate schools with the aim of cultivating students who will be capable of solving the various issues confronting companies and other organizations that involve diverse perspectives on technology and management. To achieve this, it is not sufficient to learn specialized knowledge and skills on an individual basis. Since experience is necessary to utilize knowledge and skills on a selective and integrated basis in light of the attributes of issues that should be resolved to identify and creatively resolve issues on one's own, integrated areas are configured within the core curriculum to facilitate the use of integrated knowledge and skills. Integrated areas are intended to guarantee, through results, the acquisition of methods of addressing various practical issues, which students could conceivably face in the future, in a way that will lead to creative solutions.

Integrated areas such as those contained in the core curriculum are defined as follows according to this perspective. In other words, creative efforts towards independently resolving set issues in areas pertaining to technology and management from diverse perspectives on technology and management that are based on a fusion of knowledge and skills obtained through lectures, exercises, and discussions of case studies are to be carried out under the guidance of instructors, with the results satisfying the following qualitative conditions, which are to be presented in the form of a report.

Conditions to be satisfied by integrated areas and resulting objectives:

The conditions that are to be satisfied by the results are as follows:

- Educational results are to be accepted. In other words, the knowledge and skills obtained from a professional graduate school are to be used.
- Results represent the development of appropriate, valid logic. In other words, the data subject to investigations and studies have been collected using appropriate methods and their reliability has been ensured. Appropriate methods of analysis have been selected and properly applied. Ingenuity is evident in assertions and recommendations, such that they are not simply a repetition of information that is already known.
- Satisfies at least two of the following:

  Utility: Does not refer simply to an enumeration of individual impressions and survey results. Encompasses a projection of contributions to society, industry, the company or other organizations, and other stakeholders,

  Feasibility: Assertions and recommendations demonstrate feasibility,

  Academic value: Information has academic value in terms of objectivity, stringency, novelty, originality, and other qualities.

Because the activities pertaining to integrated areas are diverse depending on the backgrounds and interests of individual students due to the nature of different professional graduate schools, the integrated areas constituting the core curriculum are prescribed on the basis of the qualitative conditions described above.

Such qualitative conditions are designed to have students appropriately survey and analyze issues that they have configured independently and procure for these students the experience of creative problem solving. Students are expected to demonstrate creative problem-solving capabilities based on diverse perspectives on technology and management with respect to issues that they may face in practice after graduation according to approaches to arriving at solutions that they have conceived through this experience. Therefore, they must explore and select the optimal knowledge and skills for solving problems and, where necessary, learn new knowledge and skills to satisfy the qualitative conditions that apply in integrated areas.

Relationship between integrated areas and knowledge items:

The evaluation of results obtained through efforts aimed at creative problem solving from diverse perspectives on technology and management in practice is not always consistent with academic evaluations. In contrast to autonomous activities in academic research, issues to be resolved are not always configured by oneself in practice; it is conceivable that many cases will arise where the issues have been defined by managerial, operational, or occupational necessities. Therefore, the required creative problem-solving capabilities should not be applied to limited areas. It is also insufficient to merely have students at MOT professional graduate schools only learn advanced knowledge and skills pertaining to specific issues to be handled in integrated areas.

To demonstrate effective problem solving in practice, a graduate will be required to collaborate with various relevant sections and personnel within company or other organizations. Basic knowledge pertaining to technology and management will be needed as a common element or a common foundation for smoothly promoting such efforts. In other words, failure to acquire basic knowledge will make it difficult to raise the possibility of successful problem solving in practice while exploiting the experience obtained during the course of studying integrated areas. As a result, education on the processes presented as knowledge items in the core curriculum of MOT education is essential, such that integrated areas are meaningful when underpinned by a solid foundation of fundamentals so that creative problem solving can be implemented on an ongoing basis based on synthetic perspectives on technology and management.

Opportunities for exploiting acquired knowledge and skills are not necessarily restricted to integrated-area activities. During the process of proceeding from learning the knowledge items to working on integrated areas with this knowledge, or alongside these studies, it is preferable to provide proactive and practical study opportunities such as surveys on technology and market trends in specific business areas and examinations of solutions to issues raised by active cooperate executives. As such, a wide variety of content is recommended to be provided at the discretion of separate universities given their distinctive qualities, just as graduates have been inculcated with more opportunities of properly engaging in practical efforts at solving individual problems and utilizing knowledge and skills

MOT education core curriculum development committee

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