



*The Key Role of Engineering Education
in the Digital Economy Era and
its State-of-the-Art in Japan*

*Conference on Advanced Manufacturing
16-17 November 2005, Leuven Belgium*

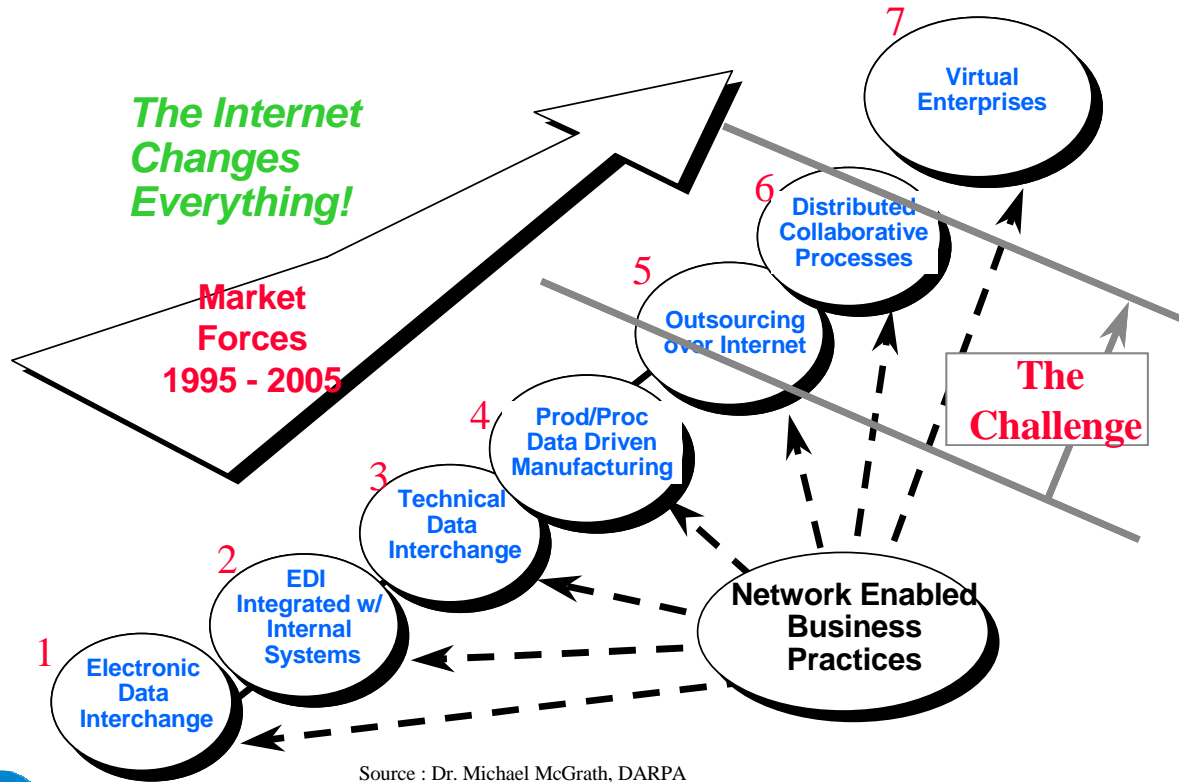
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Trend towards Digital Business



Courtesy by Dr. Michael McGrath

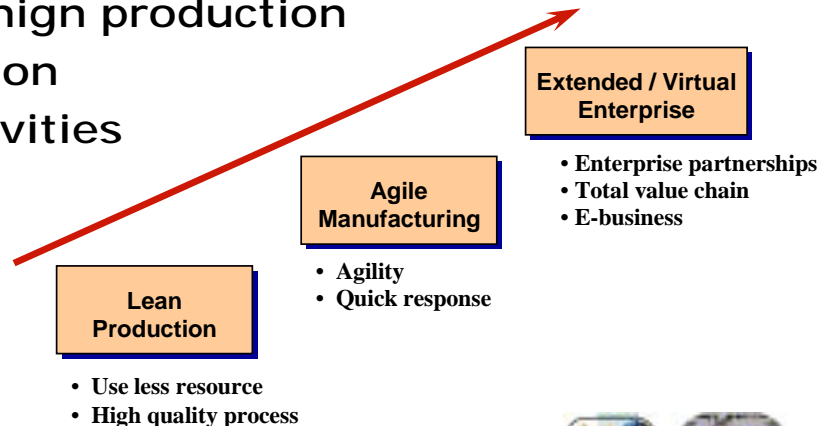
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Modern Manufacturing Systems

- Time based competition
- Customer order driven
- Customisation of products and processes
- Environmentally benign production
- Continuous innovation
- Globalisation of activities
- Digital Business



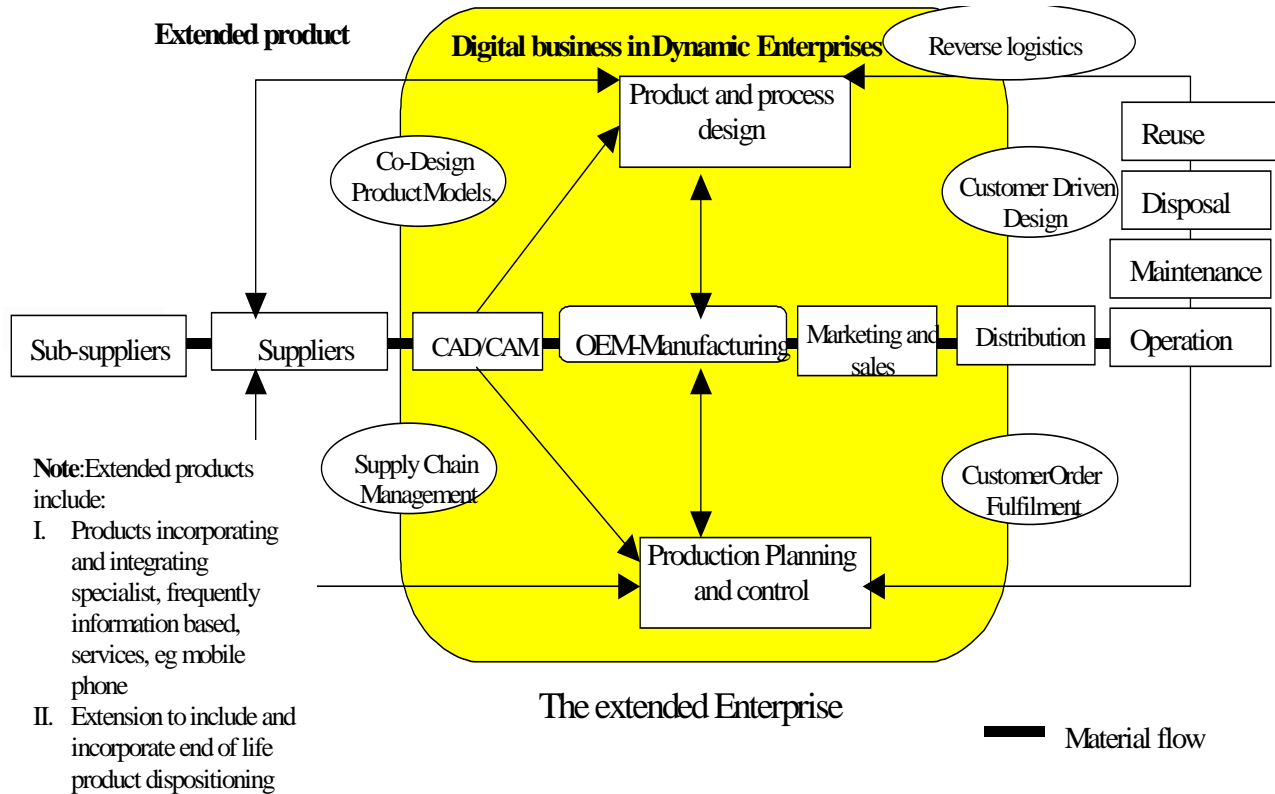
GEM-EUROPE



Courtesy by Prof. Gim Browne



Digital Business -Extended Products by GEM





Professional Graduate School in Japan

- **Strong demands to educate practical professions in,
Law, Management, Accounting,
Management Of Technology (MOT), etc.**
- **Law school:74**
- **Management and Accounting :20?**
- **Management Of Technology: 7 schools**
 - Private=Shibaura Inst., Tokyo Sci. Univ.,
Nihon Eng. Coll., Waseda Univ.**
 - National =Tokyo Inst. Tech., Yamaguchi Univ.
Tokyo Univ. Agr. Tech.**



Why MOT Required in Japan ?

**Death valley :R&D
results collapse at
practice stage**

**Un-connected to business
creation**

**Necessity to
overcome death
valley**

**To manage to convert R&D
results to economic value**

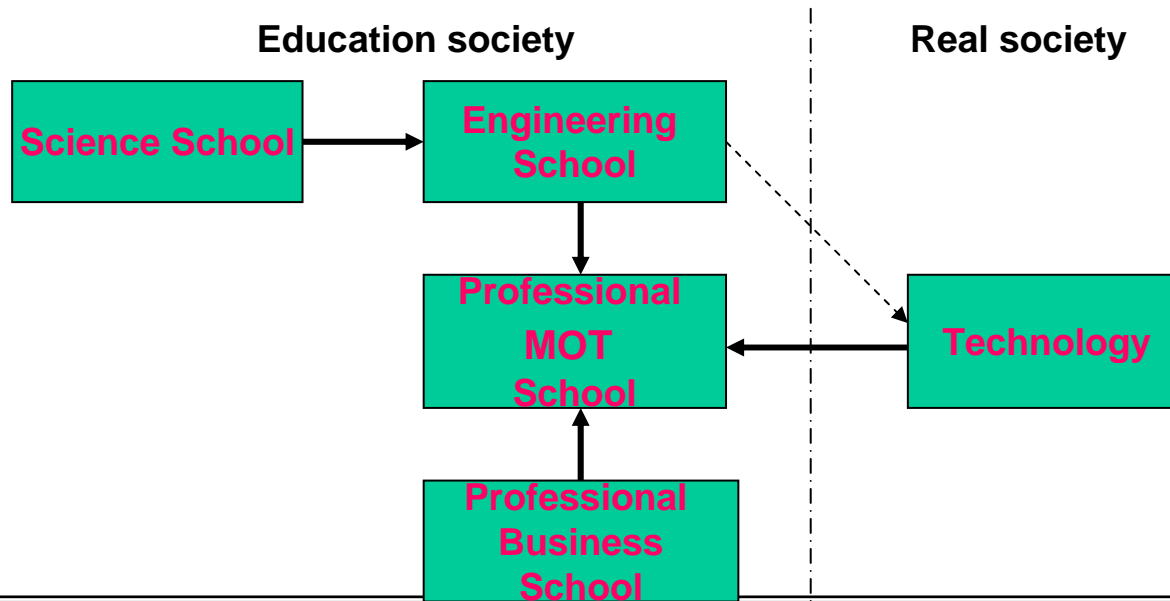
**Rapid innovation
Brings increase of
risks to enterprises**

Expectation to MOT



MEXT (Ministry of Education, Culture, Sports, Science and Technology) Official Requirements for the Establishment of Professional Graduate Schools

- *1948:Official Requirements for the Establishment of Colleges and Graduate Schools in Japan*
- *2003: 1948:Official Requirements for the Establishment of Professional Graduate Schools*





MOT Education Systems in Japan

- **MOT** (Management Of Technology)
vs **MBA** (Management of Business & Administration)
- **Non-degree MOT-like Courses**
- **2003**: Established **New Law on Professional Graduate School** by Ministry of Education
- **2003**: 1st MOT, Shibaura Institute
- **2004**: 2nd MOT, Tokyo Scie. Univ.
- **2005**: MOTs by National Univ.s such as **TUAT, TIT**, etc



**MOT Professional
Graduate School(8)**

**MOT Courses in
General Engineering
Colleges and Privates
(70)**

**MOT Schooling at
Enterprises**

MOT Info. In Enterprise and society



Target to Educate Professions at Professional MOT

Based on technological knowledge,

To educate CEO, CTO, CIO,

through the whole process of

Business Strategy (Market Driven)-

Development-

Design-

Manufacturing-

Application-

Disposal



Japanese MOT Education Contents

Technological Core + Business Admin.

Educate Capability to Create
New Businesses

High Value Added Prod.

**MEMS, Info, Bio, Nano, Environment &
their Manufacturing**



Educational Practice of Professional Grad. School

Schooling and Exercise

+ Verification of Knowledge

by Case study

Acquisition of Empirical Knowledge

thru. Internship

Practice of Knowledge

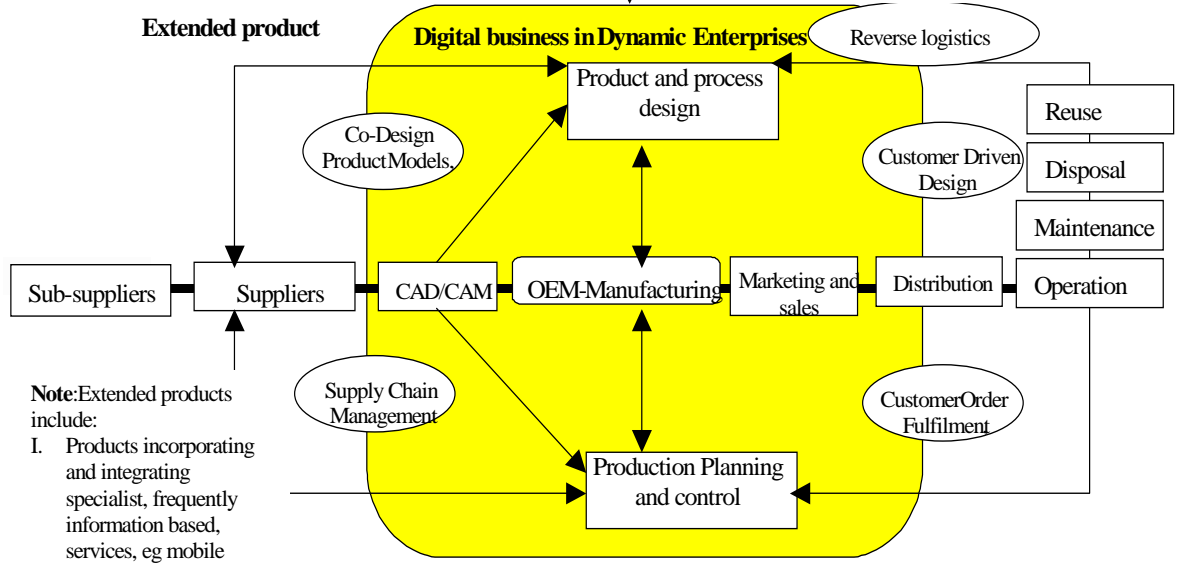
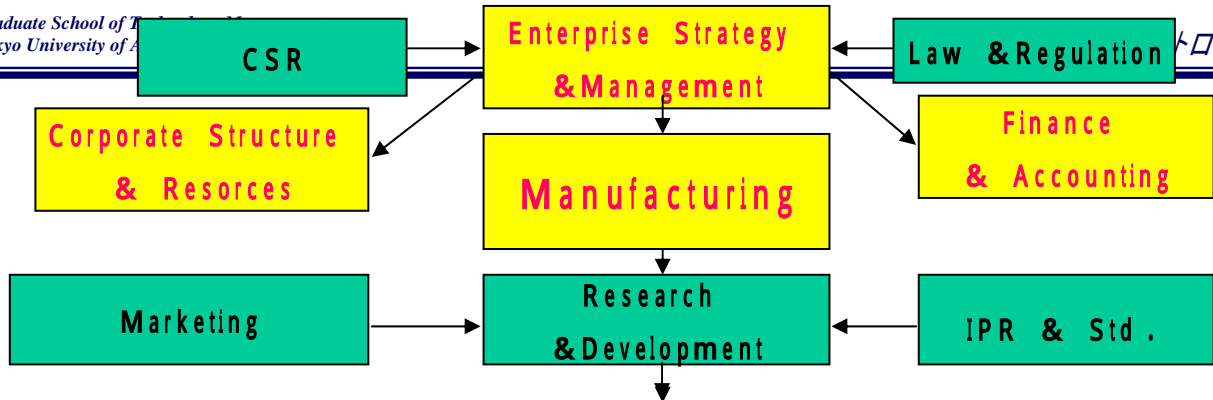
by Business Plan Project



Value Added of Graduates

In advanced technology,

- **Practical Solution Ability** for Technological Problems
- **Wide Knowledge** to be Competitive Technology Manager
- **Business Planning Ability** in Advanced Technology Area



Note: Extended products include:

- I. Products incorporating and integrating specialist, frequently information based, services, eg mobile phone
- II. Extension to include and incorporate end of life product dispositioning

— Material flow



Core Curricula of GEM/MOT School

Manufacturing sectors

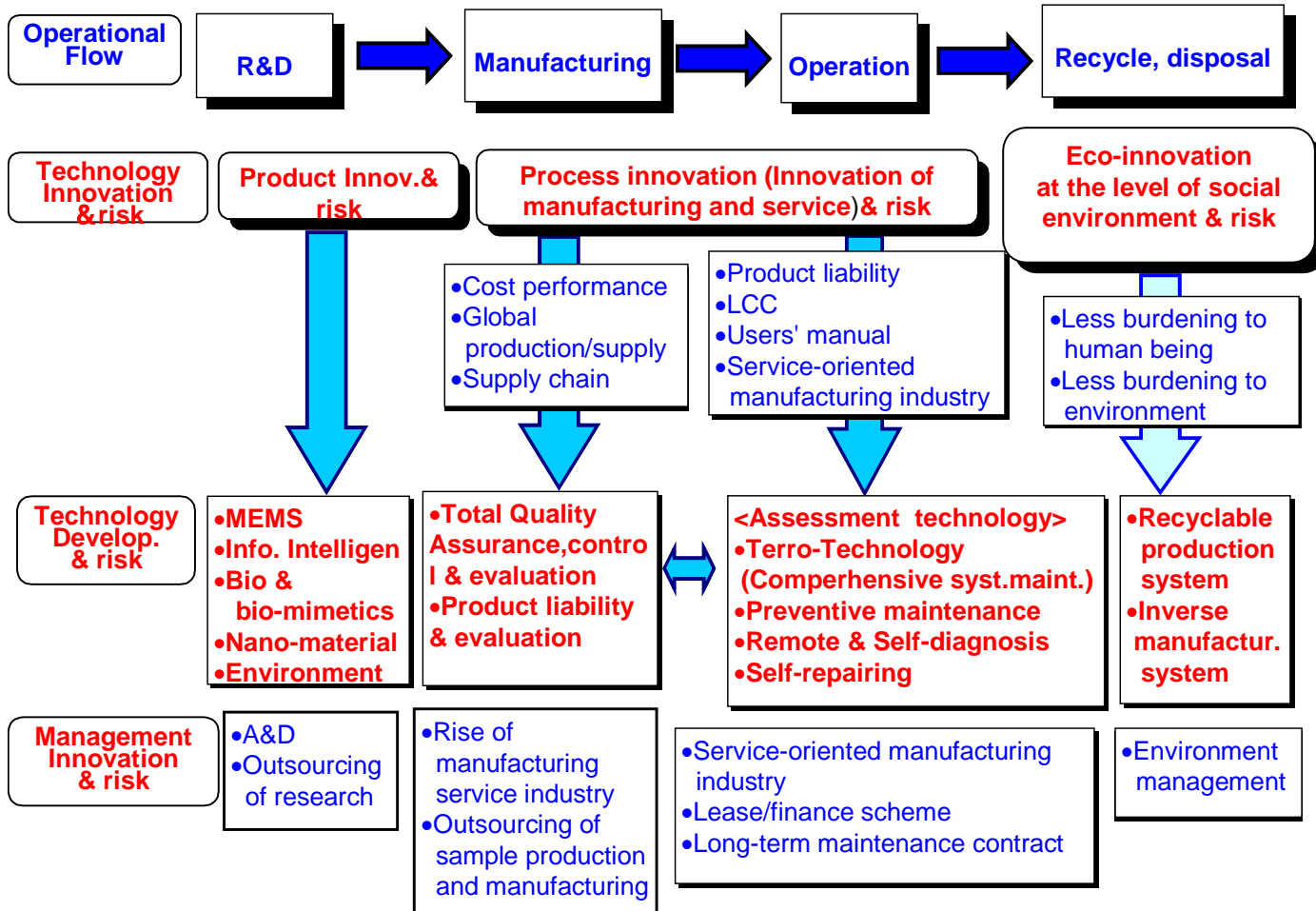
Machinery, automobiles
Electrics and electronics
Information tech.
Chemistry and materials
Life science

Manufacturing company

Management of
· Resource and Organization
· Business
· Technology and production

Digital Technology

Core curricula
Digital Business Management
+
Digital Technology Management





Exploitation at TUAT/MOT

- **Background:** Many business losses caused by technological/technical miss.
- **Necessity:** to forecast and hedge technological /technical risks quantitatively by scientific tools.
- **Strategy:** to renovate manufacturing competency by educating/re-educating such students as holding balanced ability of
“to create new business using leading edge technology as well as paying attention to technological/technical risks”.
- **Method:** to apply concept of GEM and modify its curricula so as to match to our strategy.



Outline of MOT/TUAT

- **Open 2005 April**
- **Master of Management of Technology
(not Master of Manufacturing Strategy)**
- **Schooling 2 yrs(4 semesters)**
- **40 students/year: 50% expected with several yrs. experience in
business**
- **16 professors and another 15 part time professionals**



Mission of TUAT/MOT





CURRICULA of TUAT/MOT

	Subject / Credit
• Basics(B)	
• Risk Basics(BR)	
• Mng. Basics(BM)	3~ / 6~
• Applications(A)	
• Tech. Mng.(AT)	3~ / 6~
• Adv. Ind. Creation(AA)	3~ / 6~
• IPR & Std.(AI)	2~ / 4~
• Mng. Strategy(AM)	2~ / 4~
• Project Research(P)	3~ / 14~



Basics(B) · Risk Basics(BR) · Mng. Basics(BM)

- **Educate basic manage. & admin. ability**
- **Subjects**
 - BR1 : probability & statistics**
 - BR2 : risk assessment**
 - BR3 : human error**

 - BM1 : finance & accounting**
 - BM2 : cost estimation**
 - BM3 : enterprise management**
 - BM4 : business law**



Applications(A) ・Tech. Mng.(AT)

- **Educate risk understanding induced in adv. industrial activities**
- **Subjects**
 - AT1 : technology innovation**
 - AT2 : chemical materials management**
 - AT3 : life science ethics**
 - AT4 : supply chain management**
 - AT5 : life cycle engineering**
 - AT6 : product design review**



・Tech. Mng. (AT) ,Cont'd

AT7 : total quality assurance

AT8 : information security

AT9 : advanced manufacturing systems

AT10: factory safety management

AT11: environment management

AT12: technology management in SMEs



Applications(A) ・ Adv. Ind. Creation(AA)

- **Subjects**

AA1 : leading edge machinery business

AA2 : leading edge information business

AA3 : leading edge bio business

AA4 : leading edge nano-tech business

AA5 : leading edge environment business

AA6 : high secure info. system management

AA7 : bio diagnosis tech. development

AA8 : material business



Applications(A) · IPR & Ind. Std.(AI)

- Educate IPR & Ind. Std. ability to develop enterprise technological activities
- Subjects
 - AI1 : IPR management
 - AI2 : IPR defense & utilization
 - AI3 : advanced machinery IPR
 - AI4 : information systems IPR
 - AI5 : bio-technology IPR
 - AI6 : environment technology IPR



・IPR & Ind. Std(AI) Cont'd

AI7 : industrial tech. standardization

AI8 : standardization strategy



Applications(A) ・Management Strategy(AM)

- Educate advanced mng. & adm. ability
 - Subjects
- AM1 : enterprise management strategy
- AM2 : enterprise structure
- AM3 : management of tech. develop.
- AM4 : commercialization process of R&D results
- AM5 : enterprise competitiveness & evaluation



Manage. Strategy (AM), cont'd

AM6 : marketing strategy

AM7 : venture business strategy



Project Research(P)

- Educate enterprise management ability with technological risks
- Subjects
 - P1 : **internship** of technology manage.
 - P2 : **field study** of technology manage.
 - P3 : **case study** of technology manage.
 - P4 : **business planning** of technology management



E-Learning System

Urban campus



田町教室と小金井キャンパスを光ファイバーケーブルで繋ぎ、双方向のリアルタイム講義を実施。学生は、どちらの教室でも受講できます。

Down town campus



E-Learning

TV lecture

Post lecture

… 講義の音声やパワーポイント、さらに教室の雰囲気映像をビデオ配信するシステムを完備。出席できなかった講義を自宅でも、出張先のホテルからでも受講できます。



Learning support sys.

Professors

- シラバス記入
- 講義資料の掲載
- 学生からの質問への回答
- 課題揭示



インターネットを活用した学生と教員とのコミュニケーションシステムを完備。予習、復習用に講義資料を開覧でき、レポート提出や質問、講義に関するお知らせなどにも活用しています。

Students

- 予習
- 教授への質問
- 受講生同士の意見交換
- 課題提出

