회사의 중장기 정책과 연계된 기업 연구소 R&D 추진 전략

동양제철화학주식회사
DC Chemical Co.,Ltd.

Concept

Key roles of R&D (Top Five of American CEO of Manufacturing Firms) ;

- Product Quality
- Reduced Production Costs
- Responsiveness to Market Interests
- Company's Future Strength

(Keeping up with new technology and product development)

- The goal of strategic management of R&D is to help ensure that the cash flow of a business enterprise will be sustained and will continue to grow
- How R&D can be managed effectively to support and enrich its business strategy

Leaders of business organizations recognize the critical importance of R&D management to their success in guiding their firms to becoming world-class competitions

The management of R&D must be purposeful rather than hopeful or "hands off" and must always be connected with the firm's overall business strategy

History

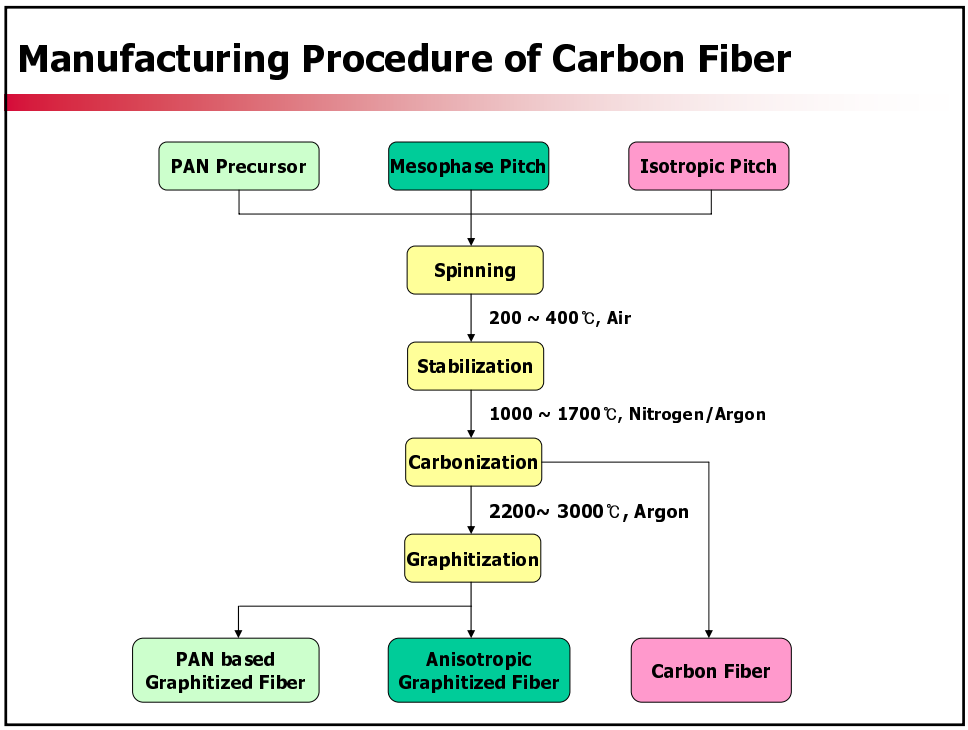
(1) 1st Generation R&D

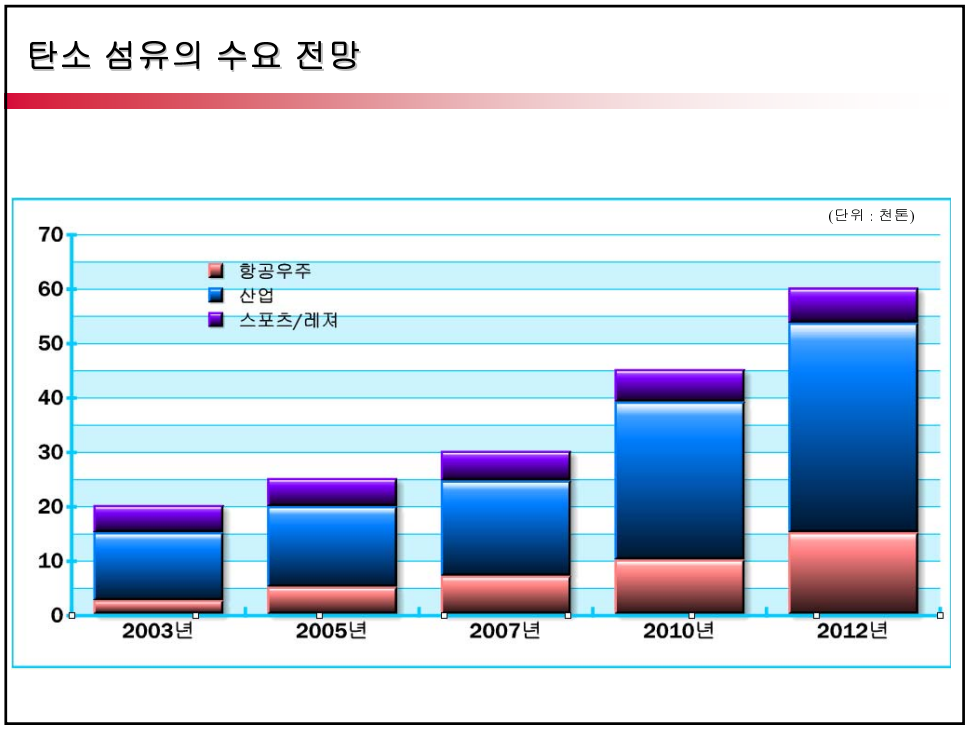
- R&D organizations are rarely integrated spiritually or strategically as full and equal partners
- Its relevance and value are unclear and its organization is physically and culturally isolated
- R&D is treated as an overhead item, or as a tax on the business
- Budgets are set in relation to sales and at a level deemed reasonable by industry practice
- Within this budget framework, decisions about areas of concentration and project continuation may be left largely to R&D management
- No assurance that the R&D organization, left to its own devices, will pursue programs related to business on corporate strategy, either in focus on in degree of innovation and risk
- Hiring good people, having them work in a creative - possibly remote - setting, leaving them alone and hoping they produce commercially viable results (" the strategy of hope")
- Business people think "researchers are uncontrollalbe" and researchers think that "administration smothers creativity"
- Business managers complaints that "results are always just around the corner", the researchers retort that "breakthroughs can not be forecasted"

투자의사 결정

	회수기간법 (Payback Period)	순현가법 (Net Present Value)	내부 수익률법 (Internal Rate of Return)
기 준	투자자금 회수기간	현재가치의 극대화	투자 수익률의 극대화
적 용	회수기간이 짧은 프로젝트 선택	. 순 현재가치(NPV)가 0 보다 큰 프로젝트 선택 . 순 현재가치가 더 큰 프로젝트의 선택	. 내부 수익율이 자본비용보다 더 높은 프로젝트 선택 . 내부 수익율이 더 높은 프로젝트 선택
계 산	$\sum_{t=1}^{n} C_t - I_o > 0$	$\sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - I_o > 0$	$\sum_{t=1}^{n} \frac{C_t}{(1+IRR)^t} - I_o = 0$

I_0 : 투자비 C_t : 순 현금 유입액 r : 할인율


Manufacturing Procedure of Carbon Fiber
PAN Precursor
Mesophase Pitch
Isotropic Pitch
Spinning
200 ~ 400℃, Air
Stabilization
1000 ~ 1700℃, Nitrogen/Argon
Carbonization
2200~ 3000℃, Argon
Graphitization
PAN based Graphitized Fiber
Anisotropic Graphitized Fiber
Carbon Fiber


탄소 섬유의 수요 전망
(단위 : 천톤)
70
60
50
40
30
20
10
0
항공우주
산업
스포츠/레져
2003년
2005년
2007년
2010년
2012년

국내 탄소 섬유 시장 동향

- 소비현황

(단위 : 톤/년)

수요업체	소비량	주용도
SK Chemical	700	산업용 프리프레그(Prepreg)
한국카본	500	"
기 타	800	건축자재, 스포츠/레저, 반도체부품
합 계	2,000	

-. 프리프레그 (수지침투가공제) : 탄소섬유 직물에 열경화성수지 (에폭시 수지등) 함침

- 생산동향

-. 효성 : 진주시 " 탄소밸리"에 2,000억원 투자 발표(07년 11월)

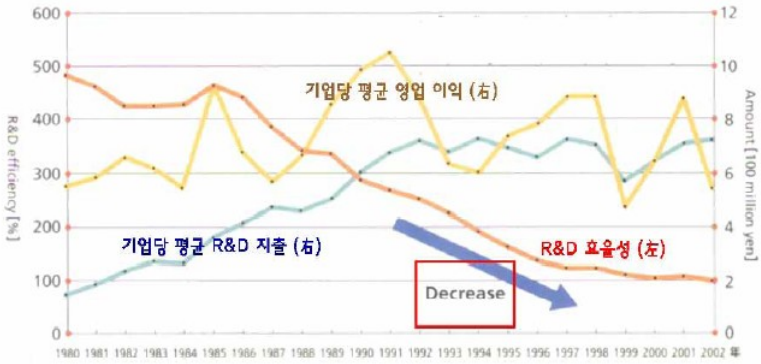
생산능력 연산 1,000톤 규모 (PAN계)
원료 Precursor(PAN)는 해외 조달

(2) 2nd Generation R&D

- Seeking to quantify the cost and benefits of individual projects and to monitor progress against project objectives
- Managers outside the R&D area participate in suggesting or reviewing projects
- Cost accounting and control systems have been extended into R&D budgets
- R&D function has characteristically resisted this pressure for short-term measurable results, because the results most of the time cannot be seen to be counted
- The business resent the R&D resistance to being held accountable or comparable terms
- The R&D program may be pushed toward conservative, incremental projects
- The relationship of the R&D program to overall company strategy is incomplete
- It attempts to link R&D and technology to the needs of the business on a project-by-project basis, failing to deal adequately with activities not directly related to existing business but import on a corporate level
- No optimizing R&D resources for the business or for the corporation as a whole

1990~2000년대 일본 제조업의 R&D 효율성 저하

- 2000년대 초 일본 제조업의 R&D 효율성* 저하가 사회적 이슈로 등장
  - 특허 수(1위), R&D 지출(2위) 등 높은 기술 수준과 마케팅(39위), 기업가정신(60위) 등 낙후된 경영 방식의 불균형이 원인으로 지적



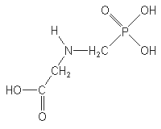
* R&D 효율성 = 측정년도 기준 과거 5년간 영업이익 / 5년 전 기준 과거 5년간 R&D 지출

자료: 일본 文部科學省 (2003). 『平成15年版科學技術白書』.

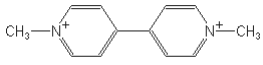
Agrochemical Products

❑ *Herbicide*

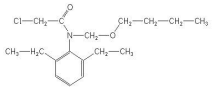
- Glyphosate



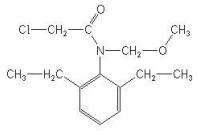
- Praquat



- Butachlor

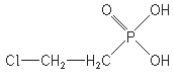


- Alachlor



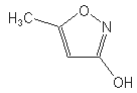
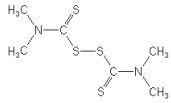
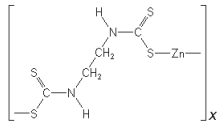
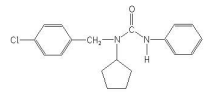
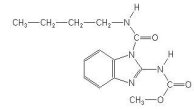
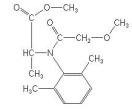
❑ *Plant growth regulator*

- Ethephon



- Maleic Hydrazide
- Atonic

❑ *Fungicide*

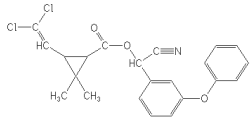
- **Hymexazol** 
- **Thiram** 
- **Zineb** 
- Pencycuron 
- Benomyl 
- Metalaxyl 

❑ *Fungicide*

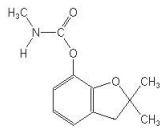
- **Procymidone**
- **Captafol**
- **Ferbam**
- **Medi**
- **Isoprothialane**
- **Carbendazim**
- **Oxide-Copper**
- **Tecloftalam**
- **Trycyclazole**

❑ *Insecticide*

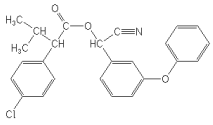
- Cypermethrin



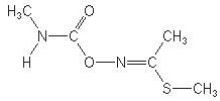
- Carbofuran



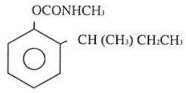
- Fenvalerate



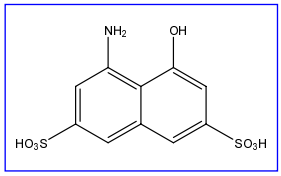
- Methomyl



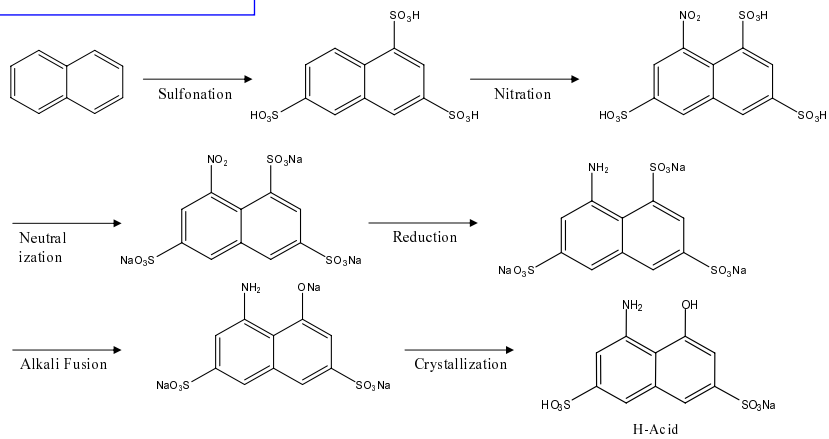
- BPMC



H-Acid



- 1- Naphthol-8-amino-3,6-disulfonic acid, mw. 319.3
- Intermediate of Azo dyes : 고급 반응성 염료 핵심 중간체



H-Acid Market

- 염료 및 고가 중간체는 Fine Chemical로 선진국 화학회사가 시장 장악
- 1980년대 말 세계시장

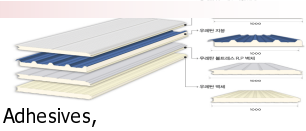
Country	주요 Maker	생산량
독일	Bayer	7,000 T/Y
영국	ICI	4,000 T/Y
일본	Sanwa Chem.	1,200 T/Y

- 가격

  : 독일산 (9.9 $/kg), 영국산 (9.6 $/kg), 일본산 (9.1 $/kg)

Research Achievements

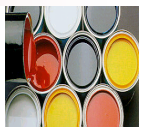
Polymer & Chemicals



- PVA (Polyvinyl Alcohol) : Textile & Paper Sizing Agent, Adhesives, Raw Materials for Functional Film, Gunsan
- Carbomer (Polyacrylic Acid) : Water Soluble Resin, Thickener for Cosmetics, Pohang

- Polyester Polyol : Main Component of PU, Pohang
- Liquid Pitch : Reduced Cost for Transportation, Pohang/Gwangyant
- Plasticizer : Trimellitates , Adipates, Pohang
- Maleic Anhydride (MA) : From Reaction Gases Produced in PA Plant, Ulsan/Yong-Yeon
- Calcium Chloride : Deicing, Incheon

Specialty



- Porous Silica (Micloid) : Anti-Blocking Agent for Polymeric Film
  Matting Agent for Paint, Abrasive for Tooth Paste,
  Filtering Aids for Beer & Beverages Production
  30 Grades, Gunsan Plant
- Fumed Silica : Fillers, Gunsan Plant
- Coated Percarbonate (PC) : New Grade Coated PC, Detergent, Bleaching Agent
  Alabama Plant (USA)
- Phosphoric Acid : LCD / Electronic Grade, Gunsan
- Hexachlorophene (HCP) : Antibacterial Agent, Dioxin Free, Approved by FDA (No. 6430)
  Pohang
- BAS-514, 518 : Herbicide, Gunsan

(3) 3rd Generation R&D

- Continuous interactive process, creating an environment in which the right R&D is done and in which R&D is done right to support corporate success
- It demands active dialogue and a sense of partnership in technology among the leadership of R&D and other key managers focused on business strategy
- The most decisive factor in the overall success of R&D is the selection of strategically worthwhile R&D goals and that the allocation of resources and establishment of policies must be determined by senior management in a timely and effective fashion
- Integration of general managers and R&D into equal partnership with the corporation and its business, in deciding what to do, why, and when
- Working to formulate integrated corporate/business/R&D/technology strategies that take account of synergies and trade-offs between projects across business and corporate programs
  - How important is R&D to its various business?
  - How effective is our integration of R&D, business, and corporate strategy?
  - What is the quality of our plans' balance in time, risk, reward, and competitive impact?
  - How good is the spirit of partnership between R&D and the other functional communities?

선진 기업의 **R&D** 유형

구분	1세대	2세대	3세대	4세대
주요 시기	19C 후반 ~	2차 대전 ~	1980년대 ~	1990년대 후반 ~
혁신 이론 관점	투입 중심의 선형 모형	과정 중심의 선형 모형	Chain-linked 모형	Chain-linked 모형, 네트워크 모형
조직/책임자	연구소장, 랩장	VP of R&D	CTO	CInO, CDO 등
현상	개인발명가 역량 활용, 기업 R&D 본격화	과제관리 프로세스, 경제성 분석	전략적 R&D, 연구소-사업부 연계	R&D 주도의 신사업 발굴
Management 주안점	People (R&D 인력)	Process	Product (기술 포트폴리오)	혁신지향적 3P관리 (People, Process, Product)
키워드	연구개발 (R&D)	Stage Gate, 성과 평가, 프로세스 혁신	전략 기술 및 기술 로드맵, 지식경영	비연속혁신, 개방형 혁신, 창조·혁신경영
R&D의 관심 이슈	"How to make" - 어떻게 만들 것인가 (효율성) - 발명·특허, 프로세스 - Do the right thing in the right way!		"What to make" - 무엇을 만들 것인가 (적합성) - 사업부 연계, 신사업 발굴 - Do the right thing in the right way!	
예	·에디슨랩→GE研 ·샤프, 마쓰시타 등 개인 발명가 창업	·도시바의 i³ (i-cube) (영업, 생산, 개발 프로세스 혁신)	·소니의 Target-oriented R&D ·히타치特研프로젝트	·GE의 IB ·IBM의 EBO ·DuPont APEX 등

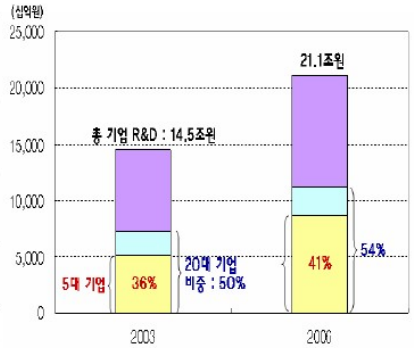
국내 기업간 **R&D** 투자의 양극화 심화

- 삼성전자, LG전자, 현대자동차 등 상위 기업의 R&D 지출 및 비중은 지속 확대되고 있으나, 그 외 대부분 기업의 R&D는 여전히 영세한 수준

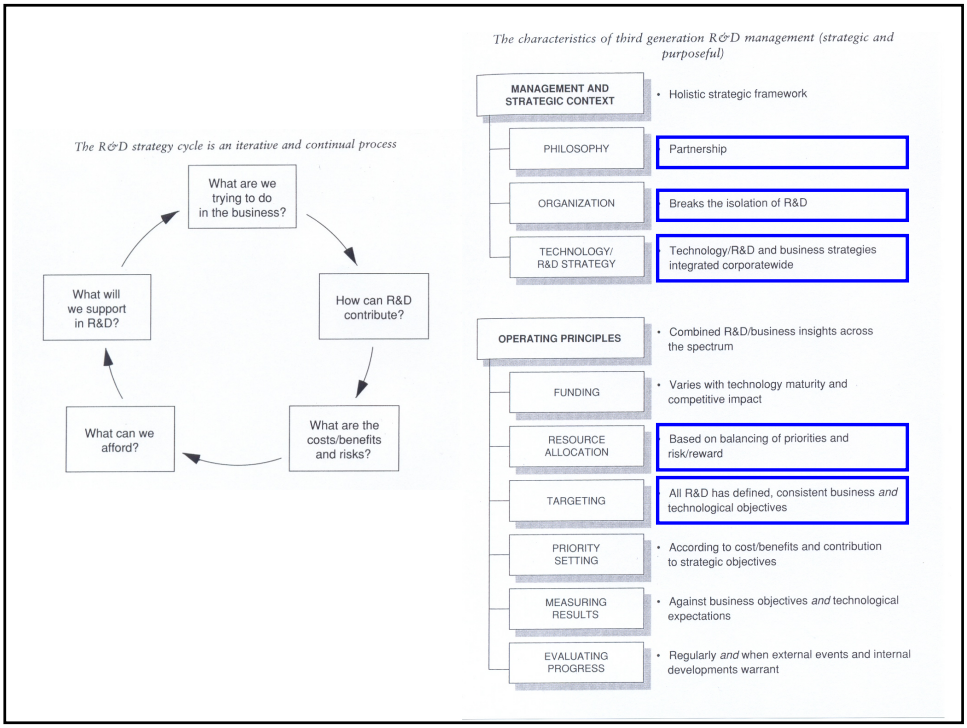
· 국내 총기업 R&D 중 5대 기업 비중 : 36%(2003) → 41%(2006)

글로벌 기업 vs. 한국기업의 R&D 집중도

국내 R&D 상위 기업의 비중



자료: EU, Industrial R&D investment Scoreboard; 산기협, 각 연도 R&D 통계



R&D Strategy

- Activation in operating committee for reviewing the research program
- Consensus on research topics (What we should do, and What we can do well)
  - How relevant and important to the company would the successful completion of program A be within X years it might take?
  - Do we have the critical mass of resources required? Are they in-house or available externally?
  - Given their relative importance, likely time frames, and resource availability, should we proceed with all the programs proposed or only with some?
  - Which programs should get priority?
- Project based matrix organization instead of Team based organization
- Motivation and Reward (First of all, researchers should have the passion and the professional interest on research topics)
- Establishing the dual ladder system

- **Mission Oriented Research**
  - What we should do ?
  - What we can do well?
- **Glue Technology**