
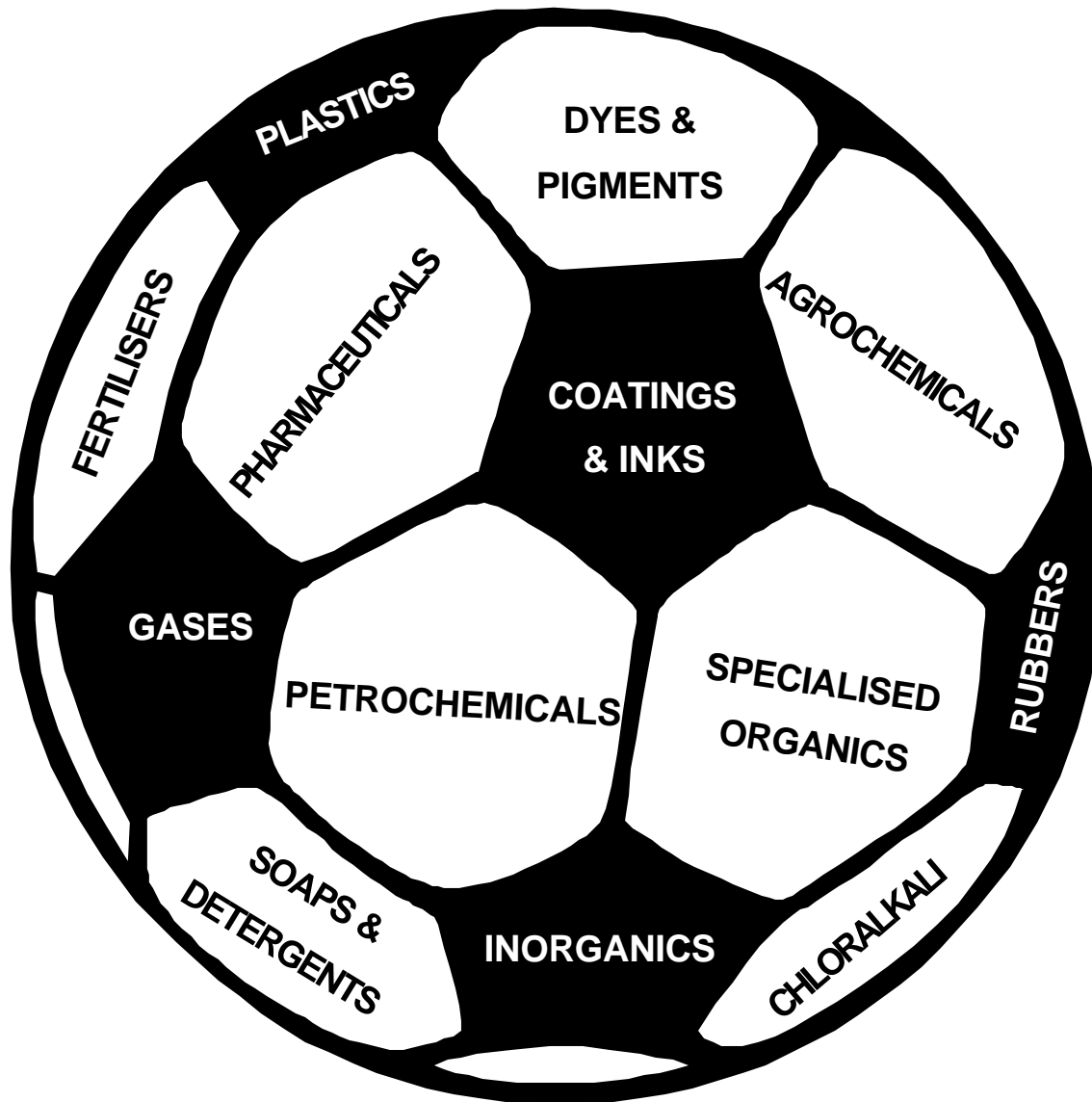


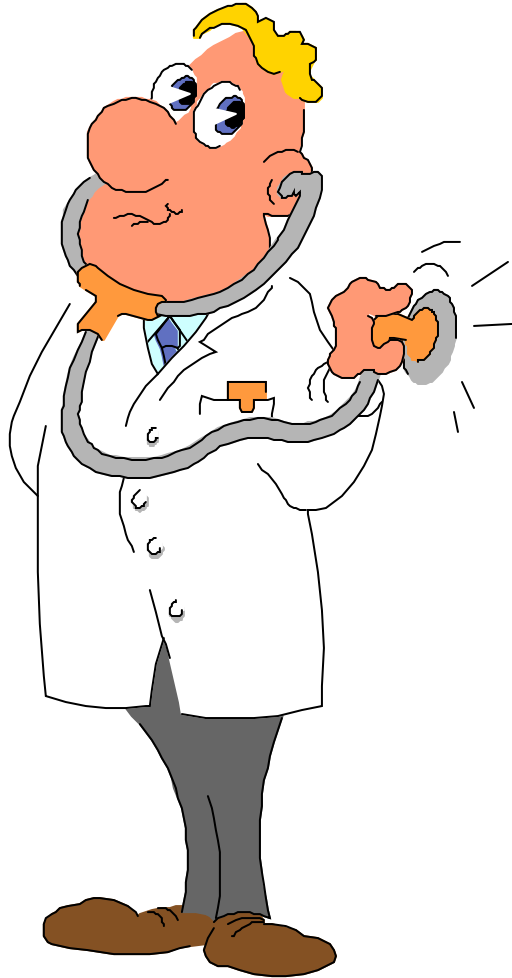


*The changing face
of chemistry in the
United Kingdom*



The Past





COST CUTTING ANOREXIA ?

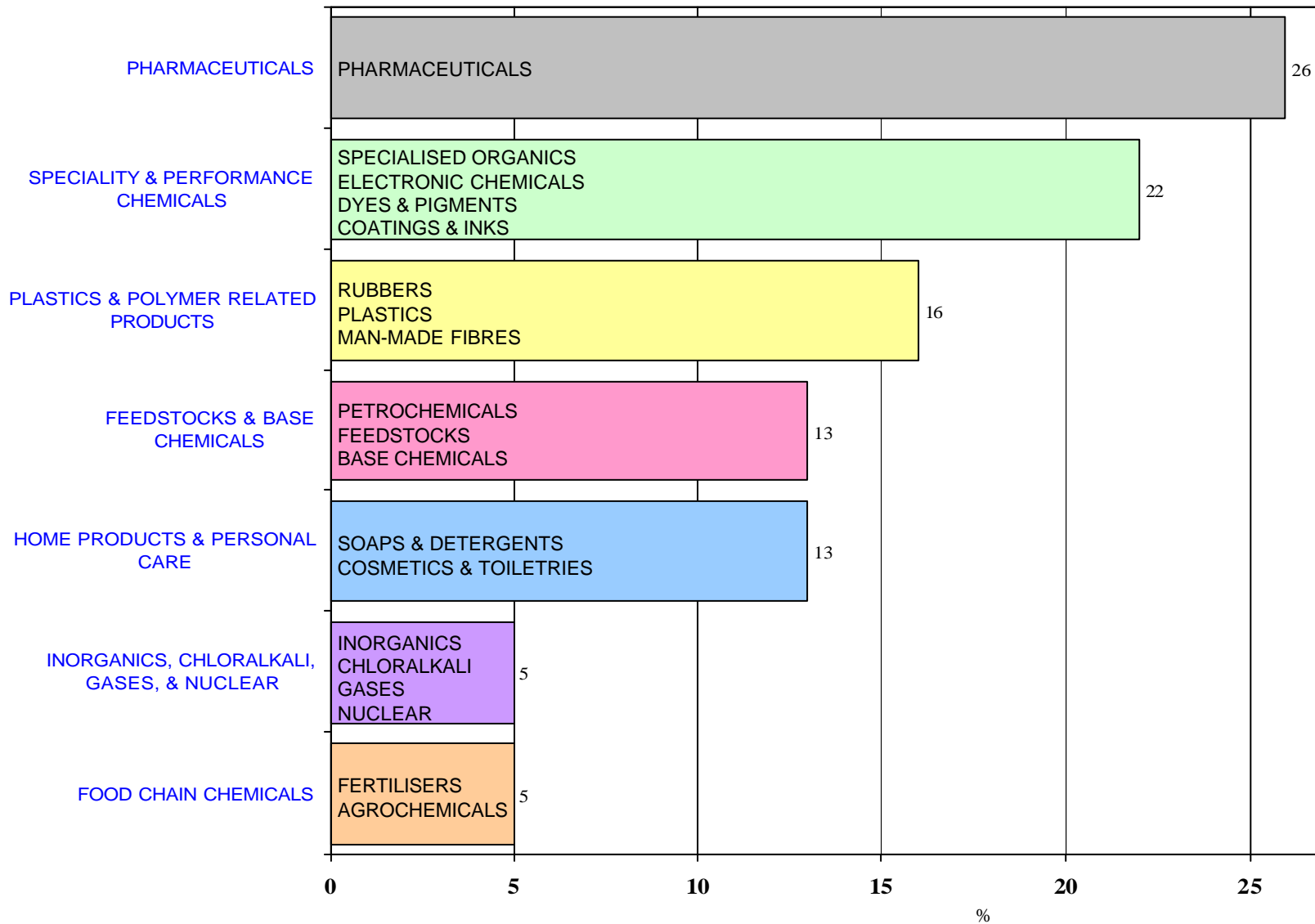
NEW PRODUCT AMNESIA ?

MYOPIC SHORT-TERMISM ?



The Present

SECTORAL BREAKDOWN OF THE EU CHEMICAL INDUSTRY PRODUCTION (BY VALUE)



TOP TWELVE R&D EXPENDITURE COMPANIES IN PHARMACEUTICALS

		R&D Spend, £bn	Sales £bn
	PA 824 (Chiron)		
	Pfizer	3.35	22.3
	GlaxoSmithKline	2.65	20.6
	Johnson & Johnson	2.48	22.7
	Aventis	2.12	13.9
	Flurotyl (Ohio Medix)		
	AstraZeneca	1.92	11.4
	Novartis	1.72	13.2
	Merck	1.70	33.3
	Roche	1.60	12.0
	Pharmacia	1.56	9.5
	Flomoxef (Shionogi)		
	Bristol Myers Squibb	1.56	13.4
	Eli Lilly	1.54	7.9
	Flosulide (Schering)		
	American Home Products	1.29	9.8
	Prozac (Eli Lilly)		
	Fleroxacin (Roche)		

PHARMACEUTICAL COMPANIES LISTED ON THE LONDON STOCK EXCHANGE

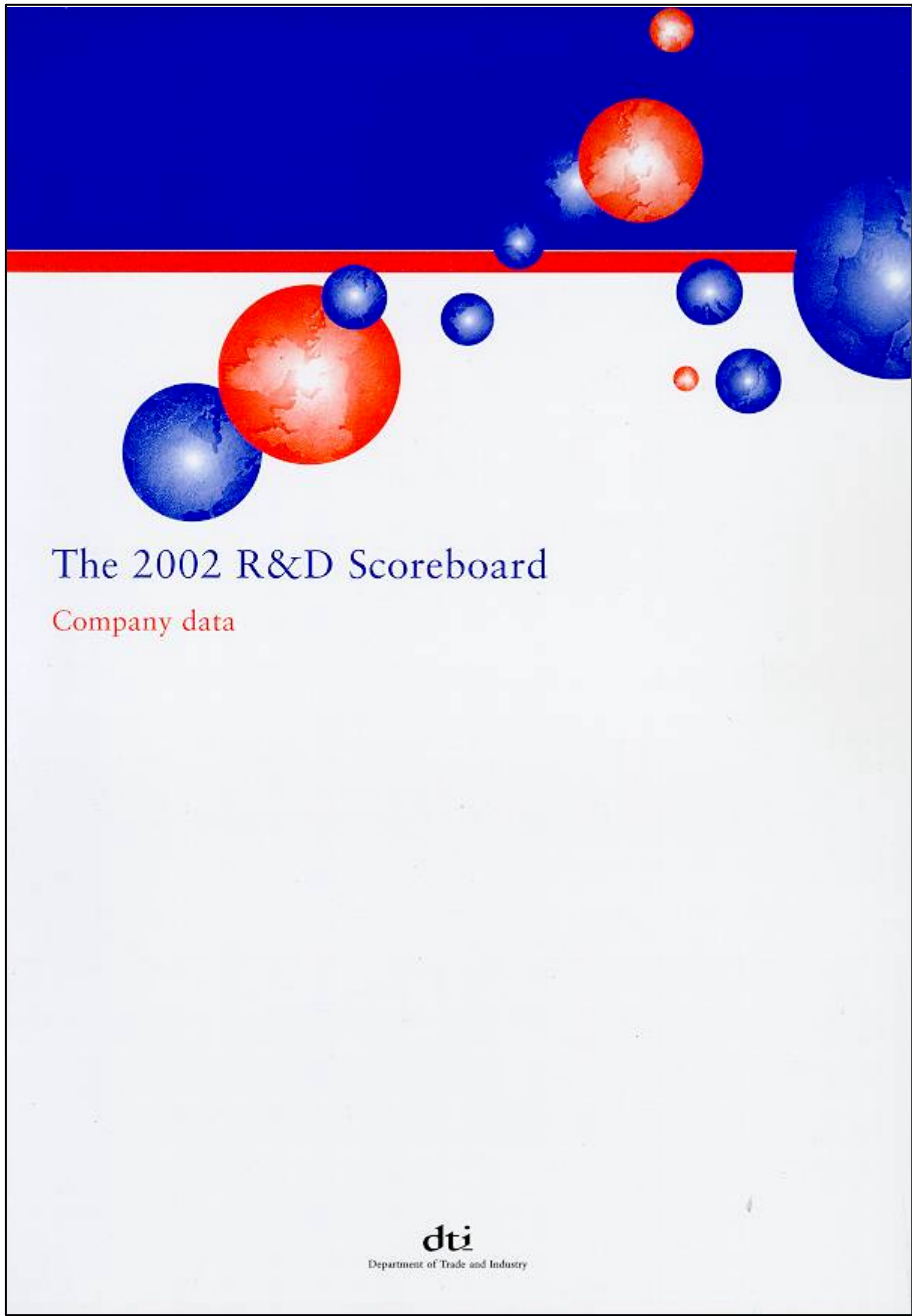
THE TIMES – APRIL 1992

Glaxo
Smith Kline

THE TIMES – APRIL 2002

Acambis
Alizyme
Antisoma
AstraZeneca
Axis-Shield
Bioglan Pharma
British Biotech
Celltech
CeNeS Pharmaceuticals
GeneMedix
GlaxoSmithKline
Goldshield
Intercare Group
KS Biomedix
ML Laboratories
Osmetech
Oxford Biomedica
Oxford Glyco
PPL Therapeutics
Pharmagene
Phytopharm
Powderject
Profile Therapeutics
Protherics
Provalis
Wm Ransom
SR Pharma
Shire Pharmaceuticals
SkyePharma
Theratase
Vernalis
Weston Medical
XTL Biopharm
Xenova

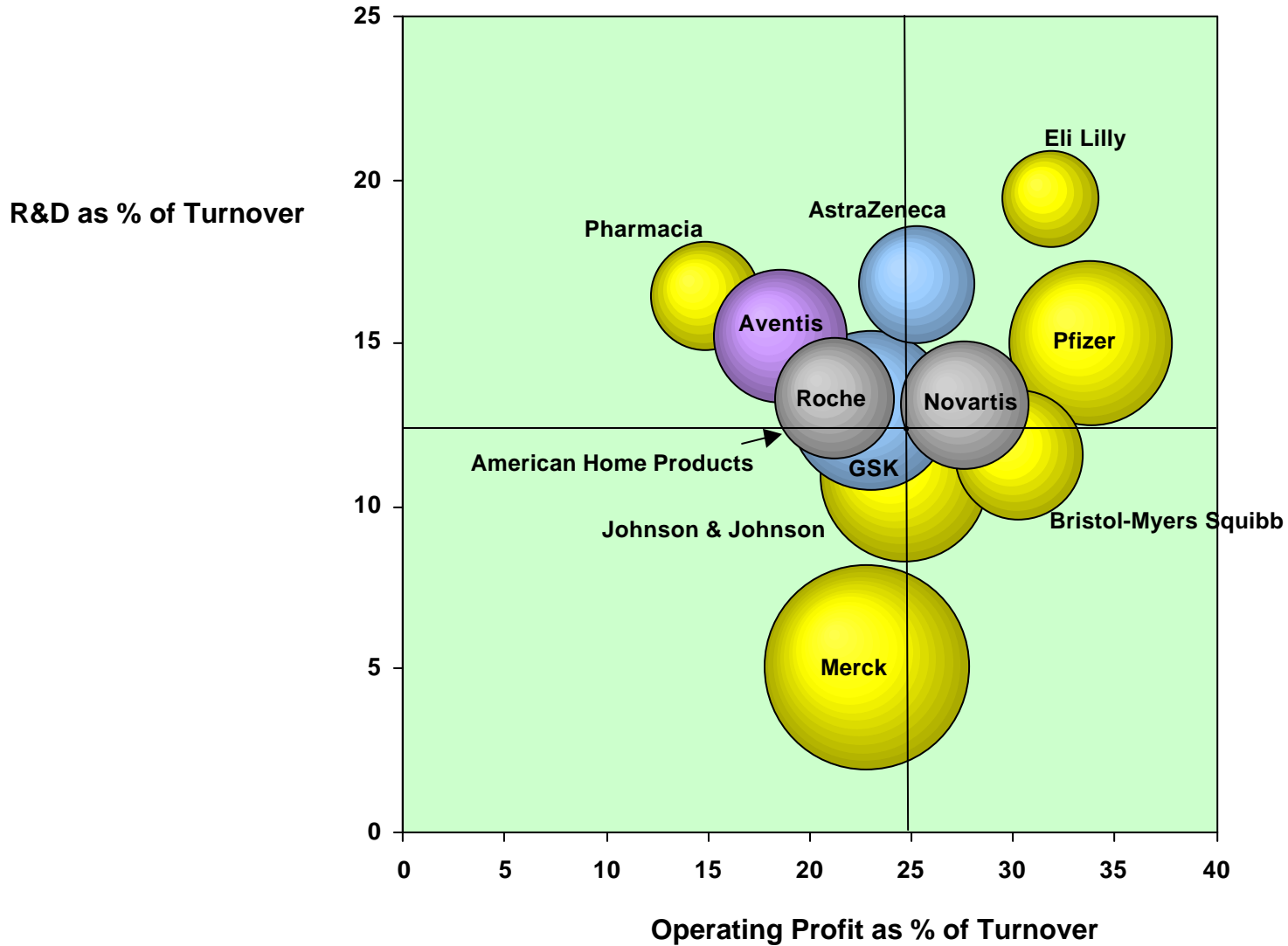
The 1992 list does not classify "Pharmaceuticals" separately, they are under "Industrials".



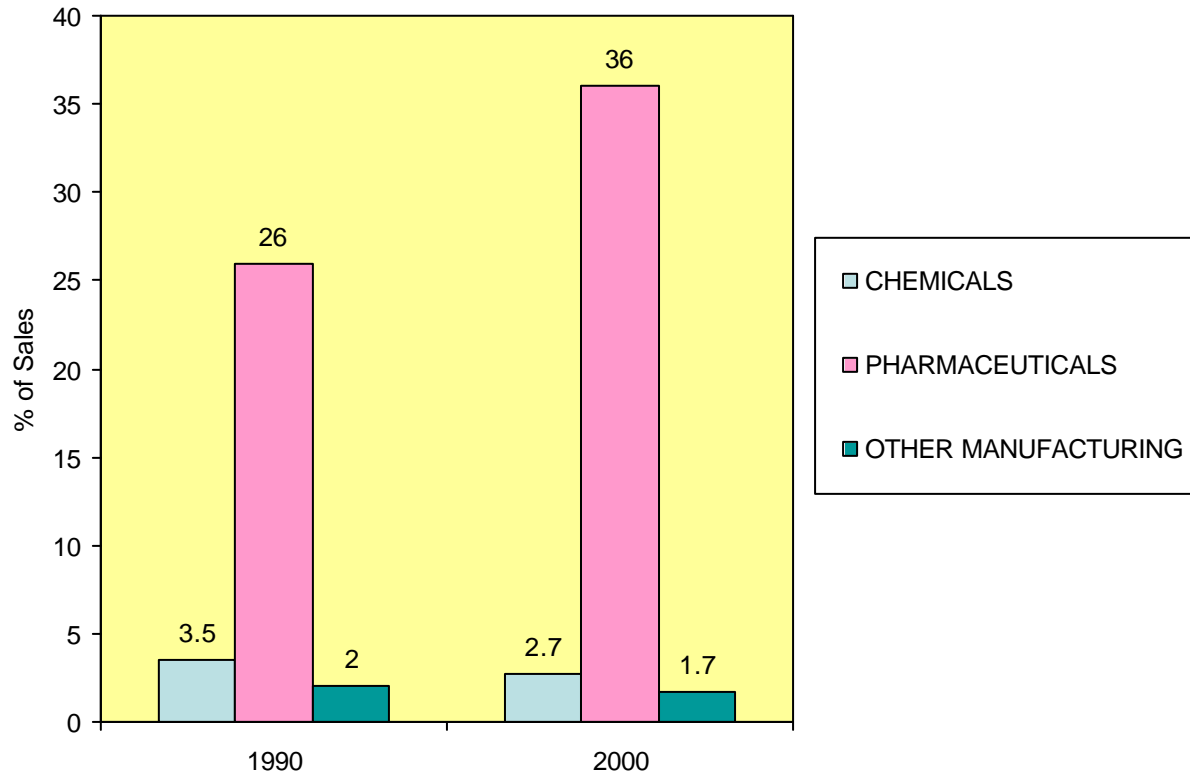
The 2002 R&D Scoreboard

Company data

R&D Scoreboard for Pharmaceuticals - 2002



UK R&D EXPENDITURE AS A PERCENTAGE OF SALES



Office for National Statistics (Business Enterprise R&D 2000, and PRODCOM)

CHEMICAL COMPANIES LISTED ON THE LONDON STOCK EXCHANGE

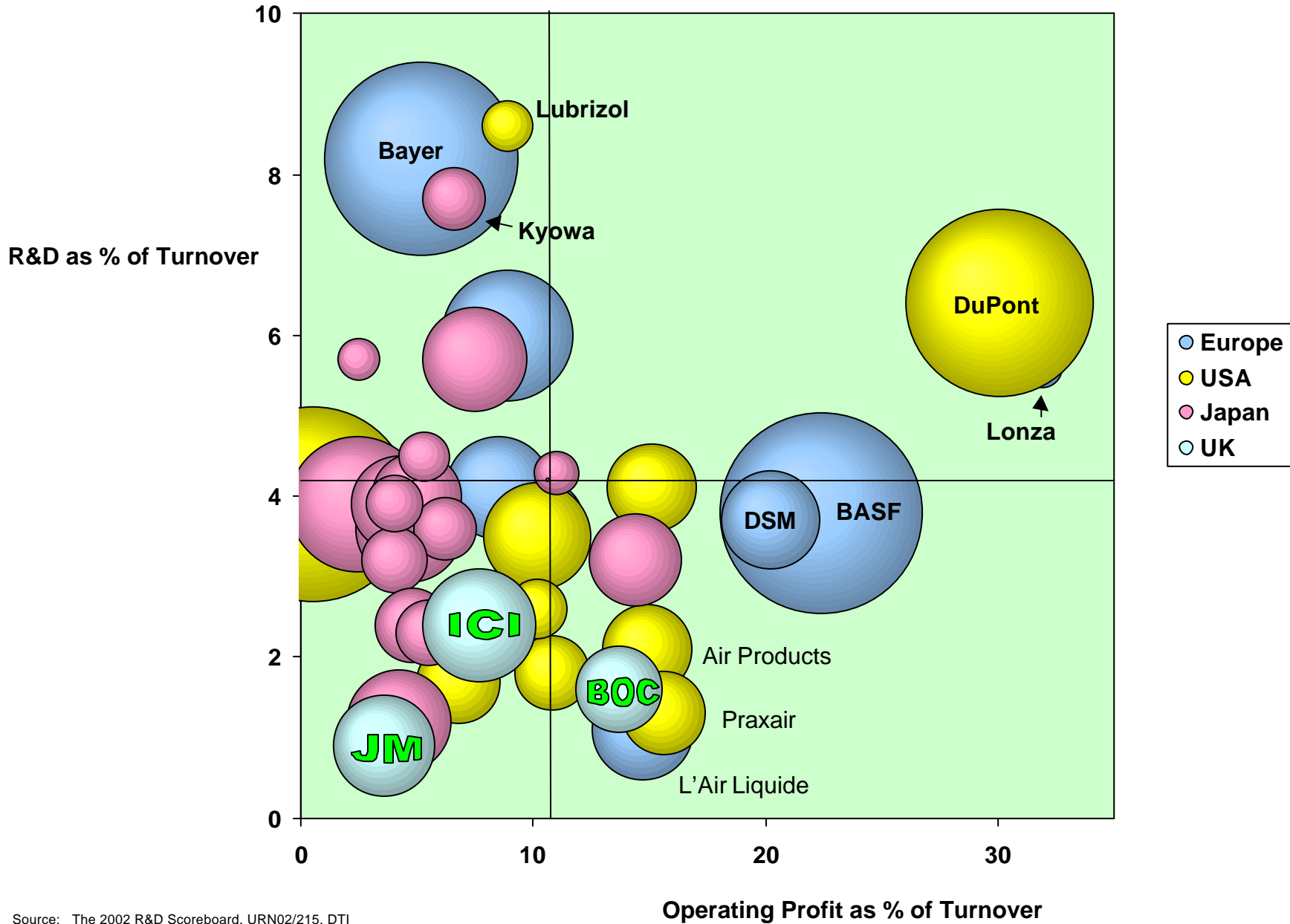
THE TIMES – APRIL 1992

Allied Colloids
Amersham
Anglo United
BTP
Bayer DM50
Blagden
Brent Chemicals
Caird Group
W Canning
Croda
Ellis & Everard
Euro Colour
Evode
J Halstead
Hickson
Hoechst
ICI
Laporte
Leigh
MTM
Norsk Hydro
Peterson Zochonis
Plysu
Porvair
Rentokil
Sutcliffe Speakman
Wardle Storeys
Wentworth
Wolstenholme
Yorkshire Chemicals
Yule Catto

THE TIMES – APRIL 2002

Amberley Group
BASF DM
BOC
Bayer DM50
British Vita
Croda
Dyson
Elementis
Euro Colour
Hoechst
ICI
Porvair
Scapa
Syngenta
Takeda Chemicals
Victrex
Yorkshire Group
Yule Catto

R&D Scoreboard for Chemicals - 2002



Barometer of competitiveness - 2000

November 2000



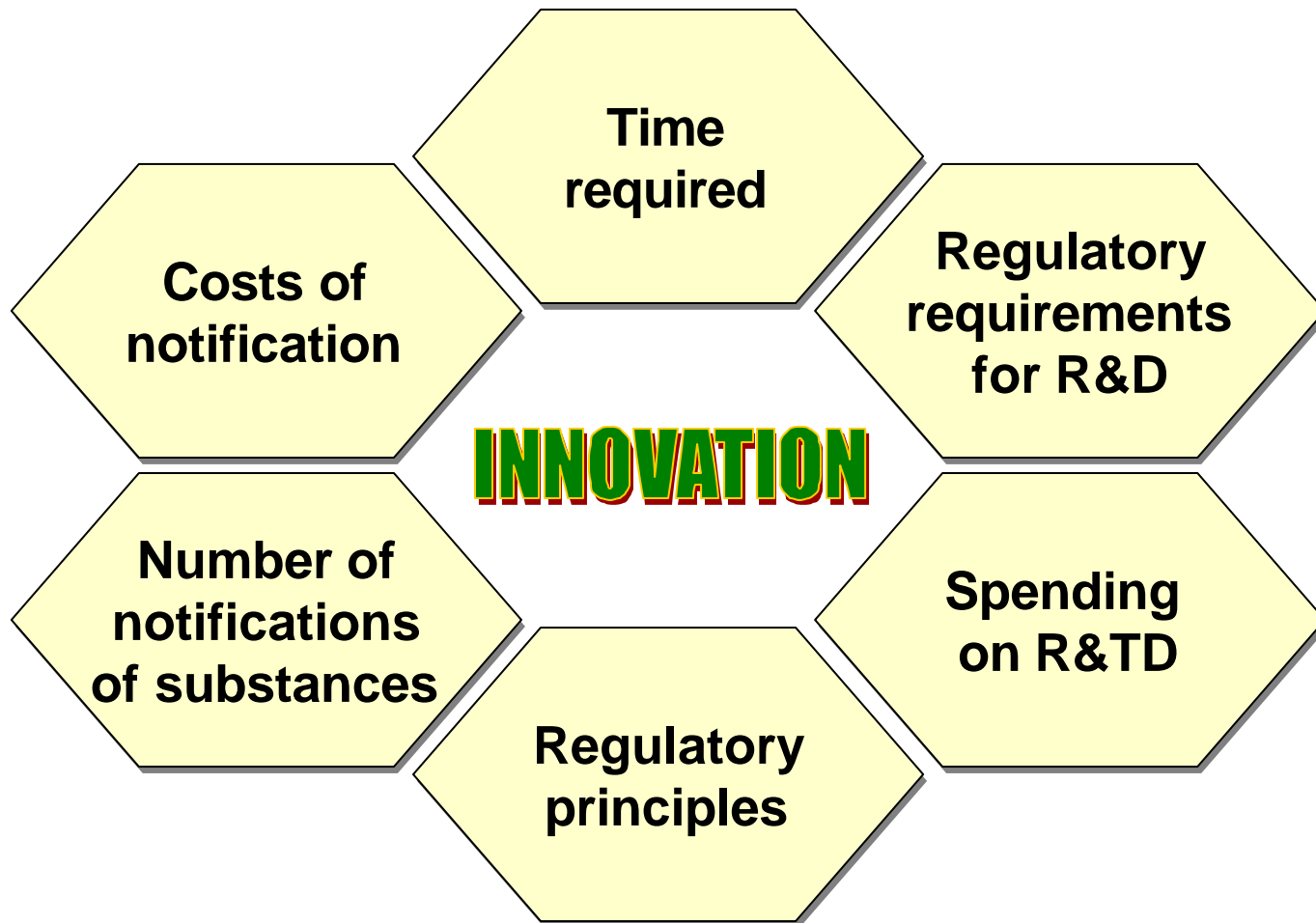
INNOVATION
&
COMPETITIVENESS

Barometer of competitiveness 2002

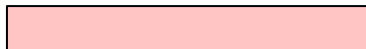
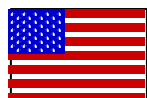
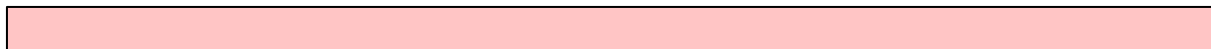
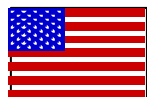
Business impact of New Chemicals Policy



FACTORS PENALISING INNOVATION IN THE EU CHEMICAL INDUSTRY

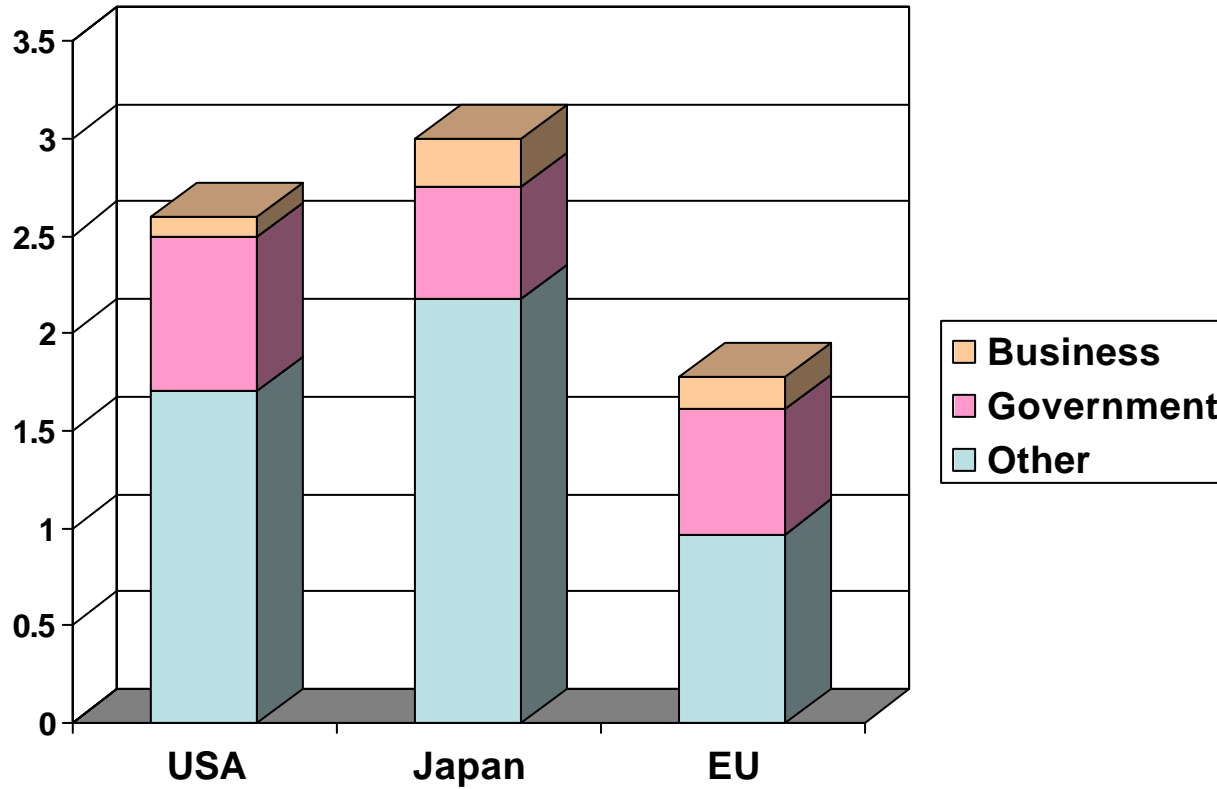


COST & TIME OF BRINGING A NEW CHEMICAL (of > 1 tpa) TO MARKET



R&D SPENDING BY CATEGORY

% of GDP



EU CHEMICALS POLICY

SUMMER 2001

BACKGROUND TO THE EU CHEMICALS POLICY WHITE PAPER

The European Commission issued its White Paper on the "Strategy for a future Chemicals Policy" in mid February 2001. The White Paper proposes major changes in the way that the use of chemicals will be controlled through legislation.

The White Paper addresses four existing pieces of legislation: the Existing Substances Regulation; the Dangerous Substances Directive (CHIP & NONS); the Dangerous Preparations Directive and the Marketing and Use Directive.

In essence, it is proposed that legislation for new and existing chemicals should be merged into one, with all chemicals manufactured at over one tonne being registered. Higher tonnage of manufacture will attract an increasing degree of testing. Chemicals of high concern will have to be positively listed, with manufacturer and use approved prior to marketing. Whilst there is a clear improvement for new substances, the proposal has the potential to be extremely burdensome for all other substances, not least as it is proposed that all testing be completed by 2012. The proposed system will be known as REACH. The assessment of chemicals will be controlled centrally through a central body, possibly the European Chemicals Bureau.

The White Paper was discussed and recommendations made for progression at a meeting of EU Environment Ministers on 7 June 2001. The Commission was given instructions to produce a regulatory framework which is likely to reach an unofficial draft by early 2002, with an official first draft Regulation(s) by end 2002 and entry into force by 2004 at the latest.

The European Parliament is drafting a report on the White Paper. This will be agreed in mid-October and will help form the views of the European Commission in its drafting of the legislation.

The events leading to the White Paper can be broadly described as follows:

- Wide recognition of the problems of the current regulatory regime for existing substances.
- *Confidence in Chemicals* programme initiated voluntarily by the European chemical industry

- Industry voluntary global initiative - 1,000 high production volume chemicals by end 2004.
- EU process started Spring 1998.
- UK policy agreed December 1999.
- Joint White Paper of DG Environment and DG Enterprise in February 2001.
- Little consultation with industry - or member states


The White Paper sets out proposals for learning more about all manufactured substances, taking a precautionary approach should anything be found of concern, ensuring all users of the substance are aware of the hazard and exposure and making information found more widely accessible. A broader degree of research is called for in examining various mechanisms and stakeholders will be invited to help steer the process.

Confidence in Chemicals and the White Paper share many goals and propose similar mechanisms. As ever, concerns lie in the detail.

CONTENTS

<i>Background to the EU Chemicals Policy White Paper</i>	1
<i>New EU Chemicals Strategy</i>	2
<i>Response by the Chemical Industries Association</i>	3
<i>General Comments</i>	3
<i>Aspects We Welcome</i>	4
<i>Proposed vs Current Regime</i>	4
<i>Issues to be Addressed</i>	5
<i>Important Unresolved Issues</i>	5
<i>A CIA Interpretation of the UK Government Position</i>	6
<i>Opportunities Presented by the White Paper</i>	6
<i>Communicating with Members</i>	6





The Future

INDUSTRY UNDER PRESSURE



- **Global markets & competition**
- **Rapid pace of technology change**
- **High cost & risk of R&D**
- **Stockholder demand for near-term profits**
- **Government regulation**
- **Customer pressure on costs**
- **Technology / product complexity**
- **Competing materials**



EXPORTS

£28.7 billion

IMPORTS

£23.2 billion

Contribution to the balance of payments in 2001:

£5.5 billion

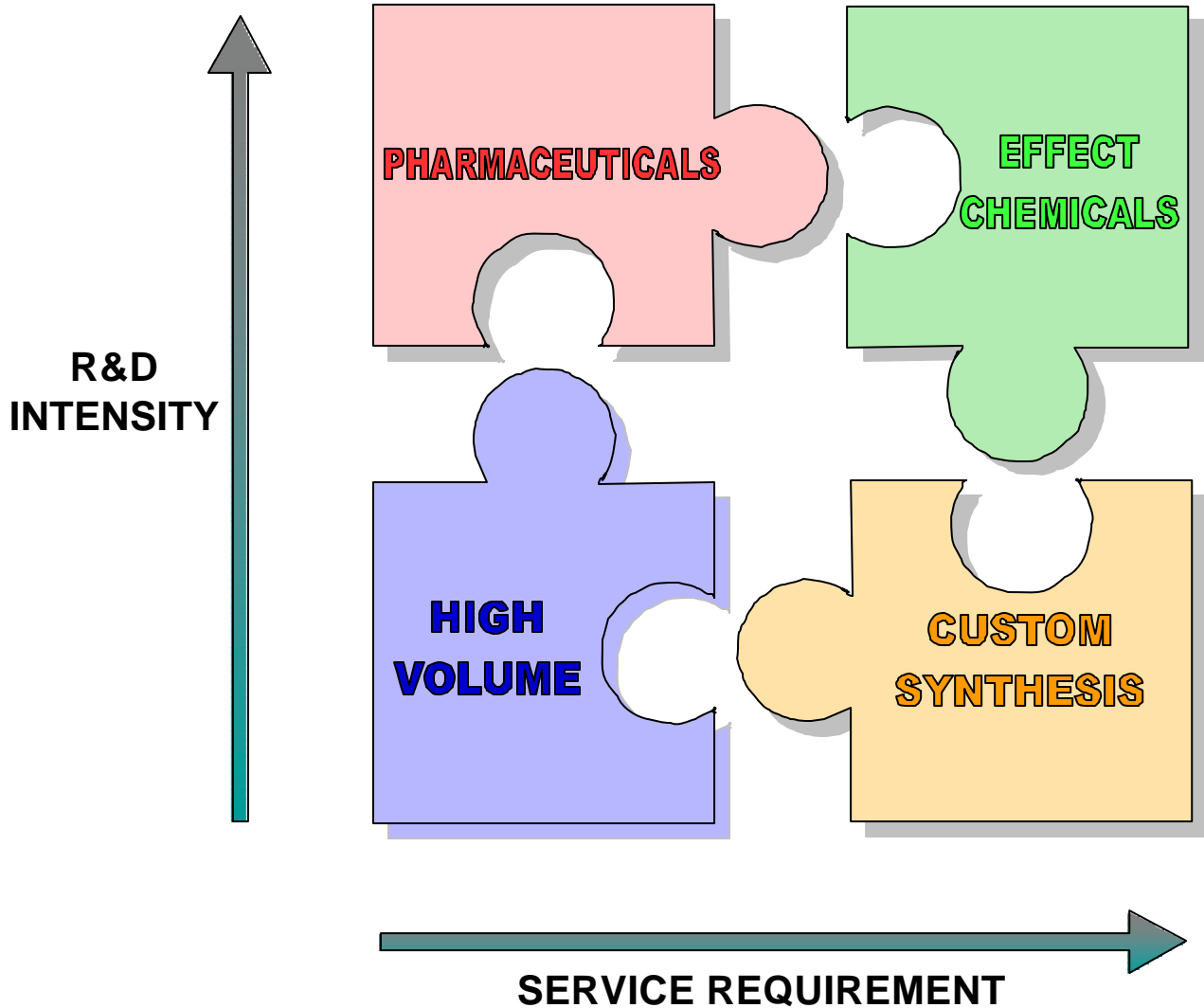


CHEMICAL INDUSTRIES
ASSOCIATION

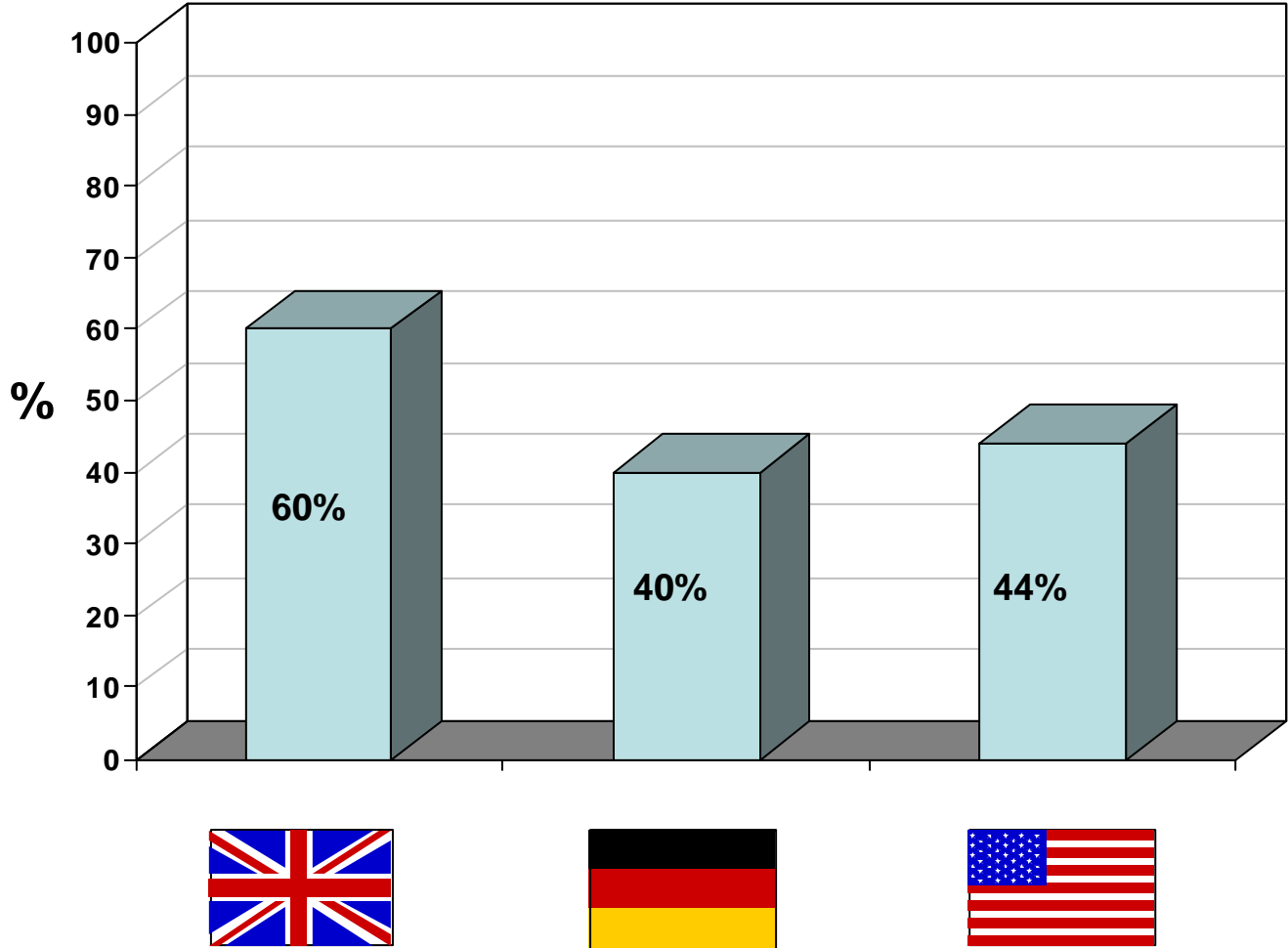
Trends and Research Priorities
for the Chemical Industry –
Looking to the Future

dti

Department of Trade and Industry



PROPORTION OF CHEMICAL INDUSTRY IN HIGHER ADDED VALUE SPECIALITY CHEMICALS



GOAL

SUSTAINABLE & COMPETITIVE UK CHEMICAL INDUSTRY

MARKETS

Impact on growth

Healthcare
Electronics

Large but low impact

Automotive
Defence / Aerospace
Housing

Technical innovation slow to impact

Energy
Food
Environment

ENABLERS

Intellectual property
Legislation & regulation
R&D / technology management
Interdisciplinarity

TECHNOLOGIES

Pacing

Nanotechnology
Process intensification
Biosciences (biotechnology, genomics, proteomics)
Combinatorial (including high-throughput) technologies
Catalysis / synthesis

Key

New materials
Environment
Formulation
Computational (informatics, data analysis, modelling)
Processing
Separation

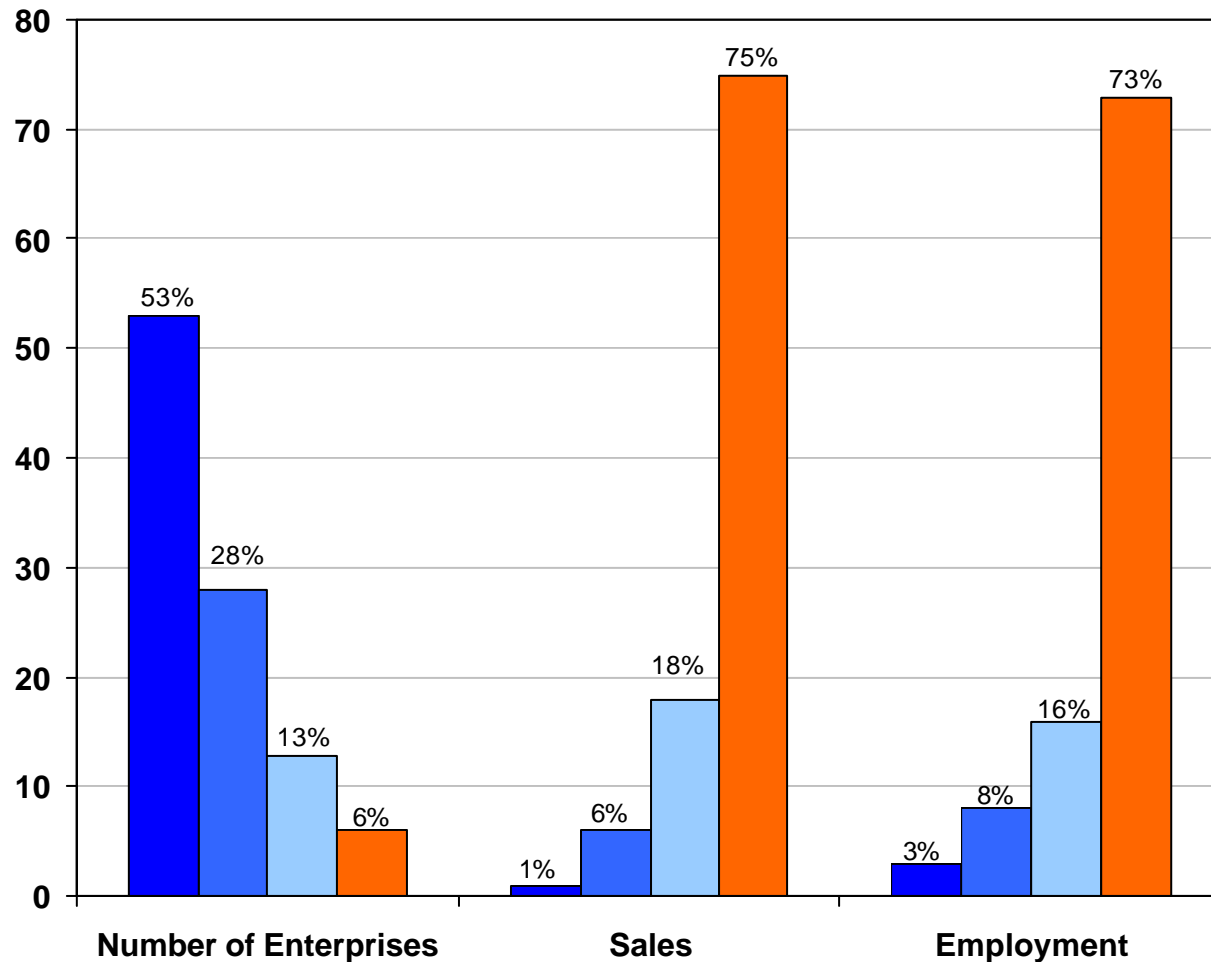
Platform / base

All branches of chemistry and chemical engineering and their interface with other disciplines (e.g. biology & materials)

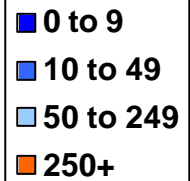
EUROPEAN CHEMICAL COMPANIES

94% of all chemical companies employ fewer than 250 employees, generating over 25% of sales and employment

Number of enterprises
& sales by employment
size-class (share in %)



Employment
class



INNOVATION METRICS

1980

**Amount spent on R&D
per annum**

1990

**Proportion of turnover coming from new
products (<5 years old)**

2000

**Proportion of profit coming from new products
(< 3 years old)**

**Number of extra employees arising from new
product introductions**



*Fore*sight

Making the future work for you

**New materials
that will shape
our future**

MATERIALS PANEL CASE STUDIES

SPIN-OUTS FROM CHEMISTRY DEPARTMENTS

<p>IMPERIAL</p> <p>Photobionics Casect Proteom Ltd IC-Vec Ltd Argenta Discovery Ltd Molecular Vision Powewrlase Ltd</p>	<p>CAMBRIDGE</p> <p>Polight Technologies Ltd Biotica Technology Ltd Akubio Solexa Astex Technologies Millenium Pharmaceuticals Ltd</p>	<p>OXFORD</p> <p>Opsys Biosensors Ltd Pharminox Inhibox Oxonica Ltd Zyentia</p>	<p>UMIST</p> <p>Advanced Hall Sensors Gentronix Ltd Microarray Ltd Oncoprobe Osmetech plc Phototherapeutics Ltd</p>
<p>SHEFFIELD</p> <p>Luminaries Ltd Shefcote Ltd Webelements Ltd Cavendish Instruments Ltd</p>	<p>MANCHESTER</p> <p>Manchester Organics Muscagen Nanoco Technologies Ltd</p>	<p>QUEENS, BELFAST</p> <p>Quill QuCHEM Questor Technologies Ltd</p>	<p>HUDDERSFIELD</p> <p>TDL Sensors Bioscrubb</p>
<p>LIVERPOOL</p> <p>Stylacats Charterhouse Therapeutics</p>	<p>LEEDS</p> <p>GlucO Ltd Lumenia Ltd</p>	<p>SALFORD</p> <p>CUD Technologies Photonic Research Systems Ltd</p>	<p>YORK</p> <p>Vistatec York Ltd DMD Chiral Ltd</p>
<p>WARWICK</p> <p>Warwick Analytical Services Warwick Effect Polymers</p>	<p>STRATHCLYDE</p> <p>Smart Tech Ltd Ocutec Ltd</p>	<p>LOUGHBOROUGH</p> <p>Charnwood Catalysis Phlogiston Scientific Ltd</p>	<p>SCHOOL OF PHARMACY</p> <p>Lipoxen Technologies Ltd PharMaterials</p>
<p>UCL</p> <p>Capture Sensors Ltd</p>	<p>EAST ANGLIA</p> <p>Photodynamic Therapy</p>	<p>EDINBURGH</p> <p>Albachem Ltd</p>	<p>GLASGOW</p> <p>XstalBio</p>
<p>LEICESTER</p> <p>Scionix Ltd</p>	<p>ST ANDREWS</p> <p>Innov8ive</p>	<p>CARDIFF</p> <p>Muscagen Ltd</p>	<p>DUNDEE</p> <p>AMCET Ltd</p>
<p>HULL</p> <p>Kingston Chemicals Ltd</p>	<p>PLYMOUTH</p> <p>Daviron Instruments Ltd</p>	<p>KINGS</p> <p>Katamid Ltd</p>	<p>GALWAY</p> <p>Aran Chemicals</p>

SPIN-OUTS FROM MATERIALS SCIENCE DEPARTMENTS

	Start-ups < 3 years old	Start-ups > 3 years old	Acquired or floated as a public company
Electronics / Optics	Kingston Chemicals (Hull) Ecertec Ltd (Leeds) Optiglass Devices Ltd (Leeds)	Cambridge Display Technology (Cambridge) Opsys (Oxford)	IQE (Cardiff)
Nanotechnology	Oxonica (Oxford) Riohm Tec (Oxford) IMPT (Imperial) Mesophotonics (Southampton) NanoCo Technologies Ltd (Manchester) NanoMagnetics (Bristol)		Disperse Technologies (Leeds) Nano Instruments (Oxford)
Sensors / Analytical Instrumentation		Kindbrisk (Oxford) Microarray Ltd (Leeds) SensAlyse Ltd (QMC) International Interstitial Technologies (Manchester)	
Manufacturing equipment / software	Novarc (Oxford) IPSA Power Engineering (UMIST)		Osprey Metals Ltd (Swansea)
Healthcare	Adaptive Screening Ltd (Imperial/Glasgow) Birmag (Birmingham) Novothera (Imperial) CellTran Ltd (Sheffield) Hybrid Systems (Birmingham)	M Gill (Leeds)	
New materials	Auxetic Materials (Bolton Institute) Gluco Ltd (Leeds) Smart Tech (Strathclyde) Surfactant Solutions (Napier)	Bodycote SHU Coatings (Sheffield Hallam) Newlands Scientific	
Miscellaneous	Ceres Power (Imperial)	Adelan (Birmingham)	
General Consultancy		CAPCIS (UMIST) Kingston Polymer & Composites Consultancy Swansea Tribology Services (Swansea)	



Faraday Partnerships



comit.uk.com

Faraday Partnership



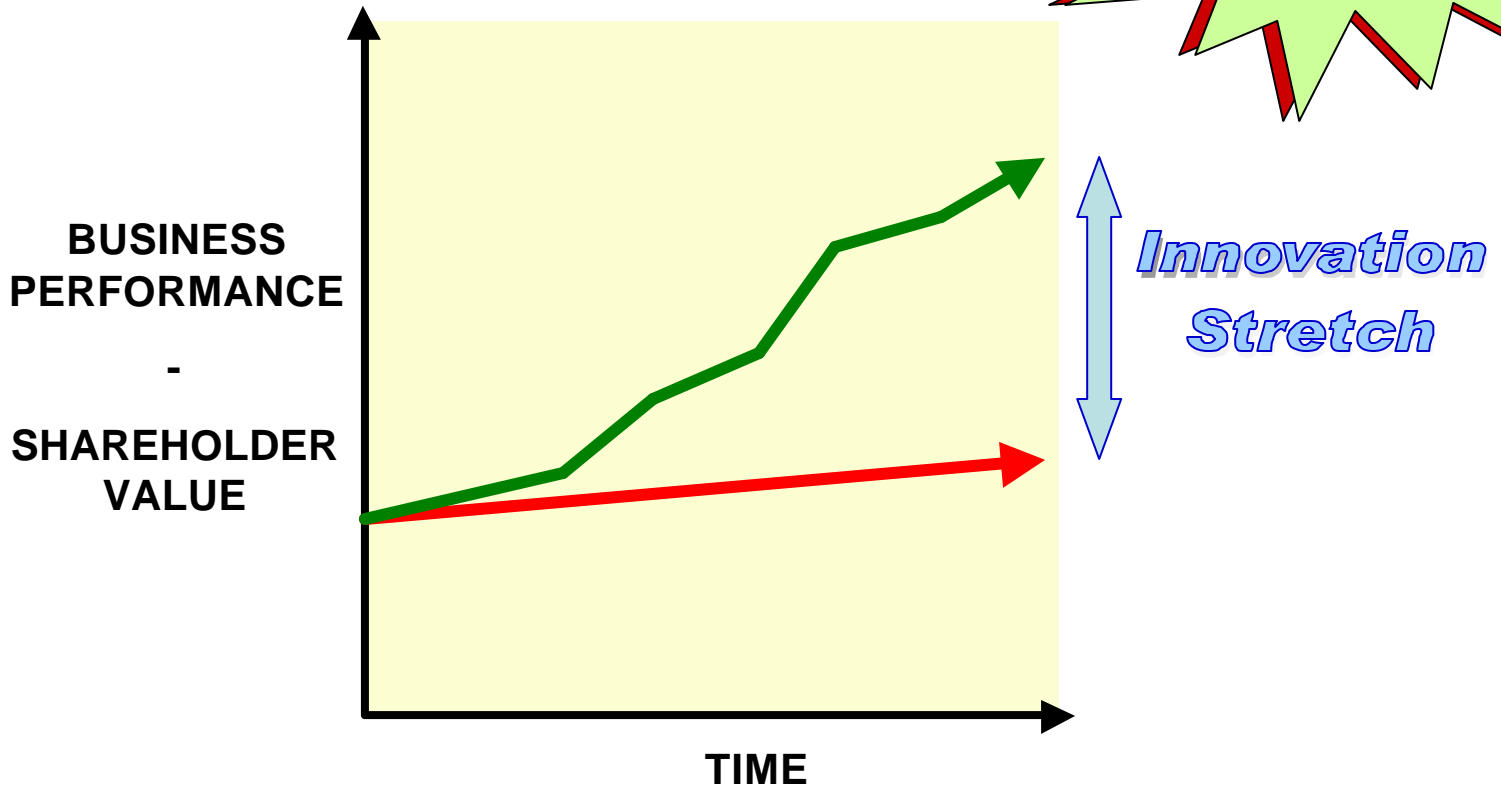
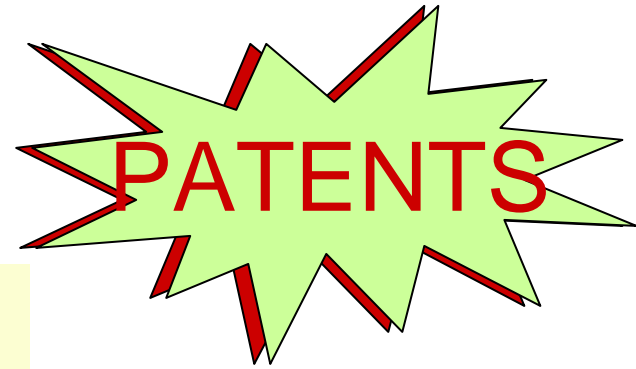
PowdermatriX 



Faraday Partnerships concept modelled on Fraunhofer Gesellschaft



THE INNOVATION STRETCH (STEP CHANGE)





“It is difficult, if not impossible, to engage in noble enterprises without money to spend on them”



Aristotle

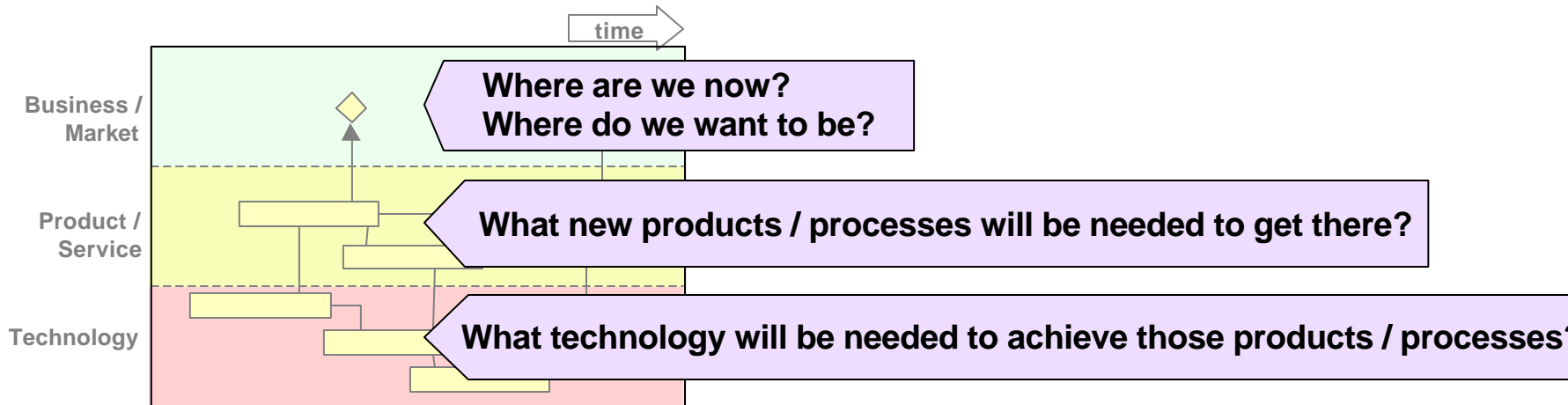
dti

ENHANCING THE
COMPETITIVENESS AND
SUSTAINABILITY
OF THE UK CHEMICALS
INDUSTRY

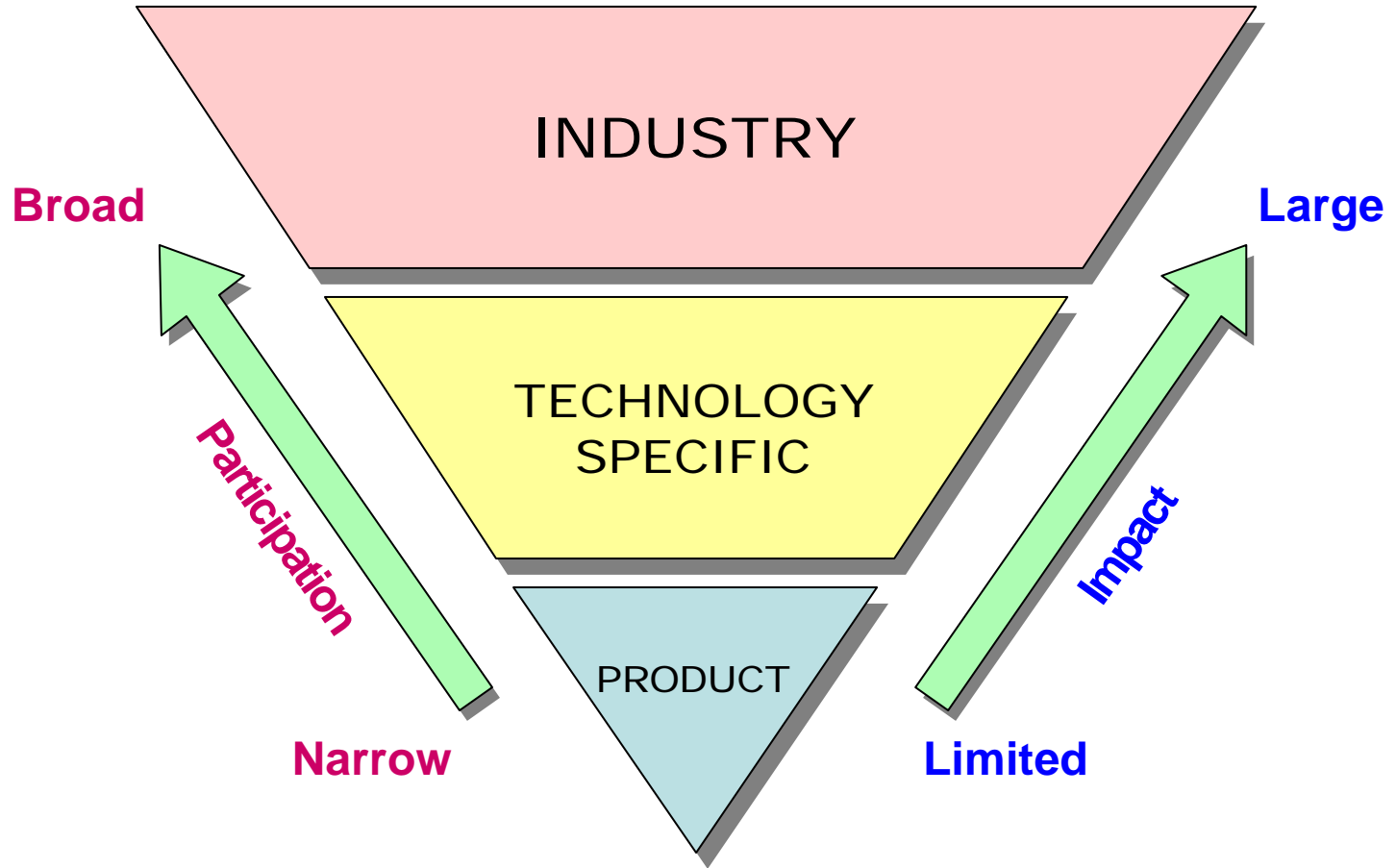
A report by the
chemicals
innovation and
growth team

DECEMBER 2002

TECHNOLOGY ROADMAP LOGIC



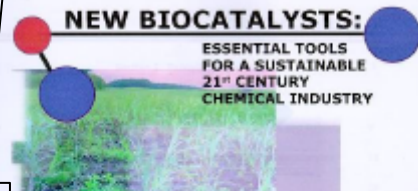
TYPES OF TECHNOLOGY ROADMAPS



Technology Roadmap
for
Materials of Construction,
Operation and Maintenance
in the
Chemical Process Industries

NEW BIOCATALYSTS:

ESSENTIAL TOOLS
FOR A SUSTAINABLE
21ST CENTURY
CHEMICAL INDUSTRY



Alumina Technology Roadmap

Sponsors
Alcan Inc.
Alcoa World Alumina
Aluminium Pechiney
Canalco Aluminium Limited
Hindalco Industries Ltd
Hydrus Aluminium Metal Products
Kaiser Aluminium & Chemical Corporation
Queensland Alumina Limited
Womney Alumina Pty Ltd

U.S. Department of Energy
Office of Industrial Technologies

U.S. Department of Industry, Science and Resources
Energy Efficiency and Product Program



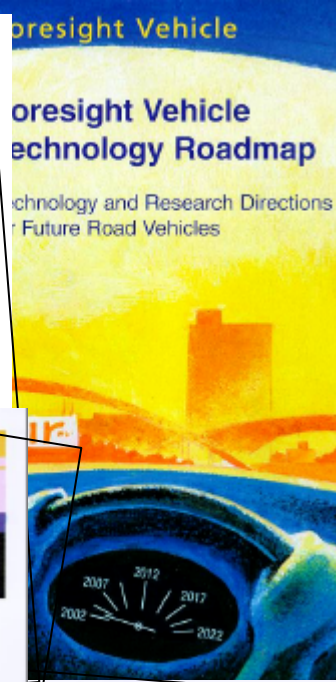
AMIRA INTERNATIONAL

Alumina Technology Roadmap

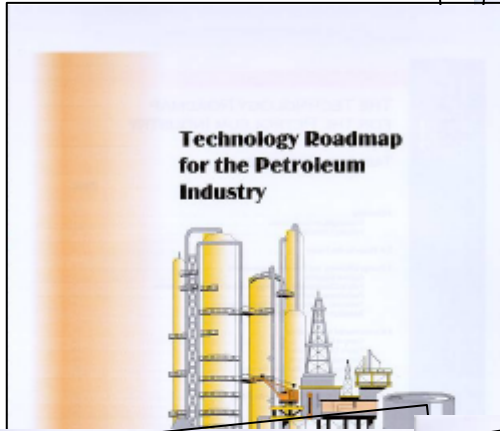


Presight Vehicle Technology Roadmap

Technology and Research Directions
for Future Road Vehicles



Technology Roadmap for the Petroleum Industry



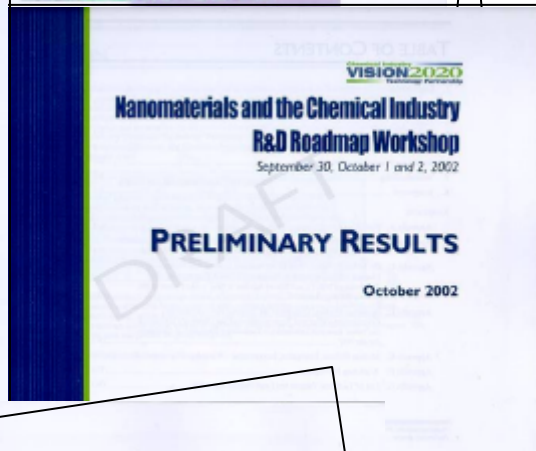
VISION2020

Nanomaterials and the Chemical Industry R&D Roadmap Workshop

September 30, October 1 and 2, 2002

PRELIMINARY RESULTS

October 2002



GLASS

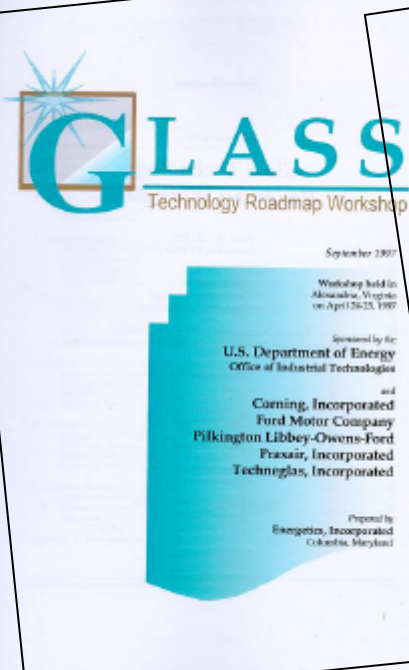
Technology Roadmap Workshop

September 1997

Workshop held in Alexandria, Virginia on April 28-30, 1997

Sponsored by the
U.S. Department of Energy
Office of Industrial Technologies
and
Corning, Incorporated
Ford Motor Company
Pilkington Libbey-Owens-Ford
Praxair, Incorporated
Techniglas, Incorporated

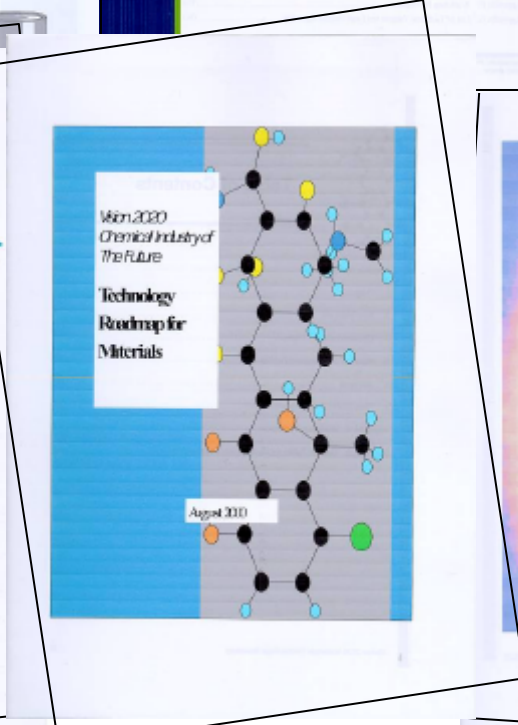
Prepared by
Energetics, Incorporated
Columbia, Maryland



VISION2020 Chemical Industry of the Future

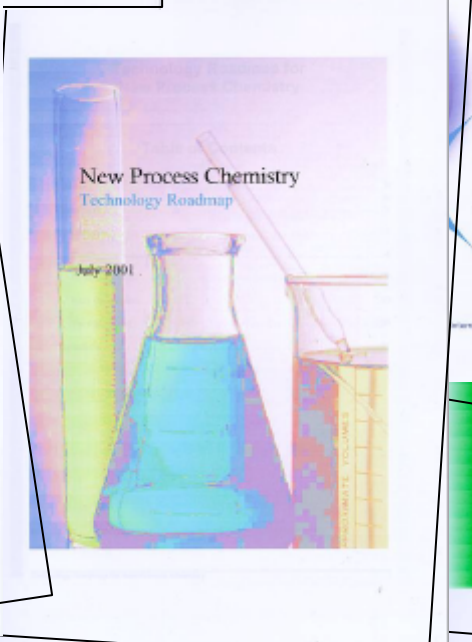
Technology Roadmap for Materials

August 2000

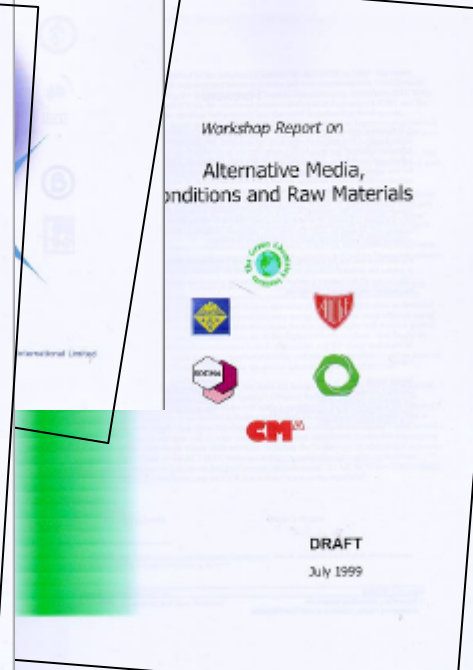


New Process Chemistry Technology Roadmap

July 2001



Workshop Report on Alternative Media, Conditions and Raw Materials



DRAFT
July 1999

WHAT'S IN IT FOR YOUR COMPANY ?



Reduce the cost and risk of R&D



Leverage technical resources



Guide technology investments



Boost corporate image



Capitalize on existing research

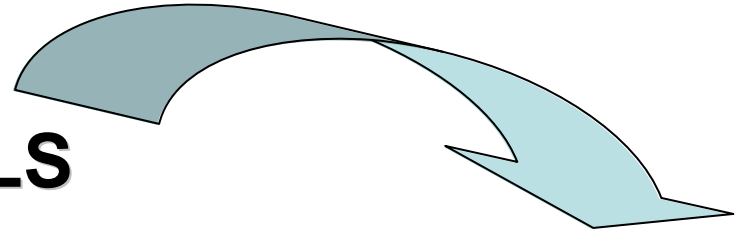


Co-ordinate access to R&D funding resources

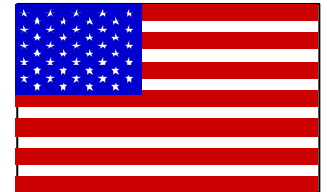


US – FIELDS POISED FOR EXPLOSIVE INTELLECTUAL AND COMMERCIAL GROWTH

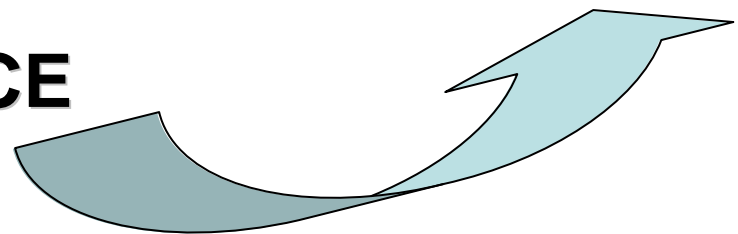
ADVANCED MATERIALS



MOLECULAR BIOLOGY



INFORMATION SCIENCE



KEY THEMES FOR THE UK

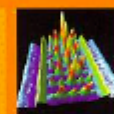
- **ENERGY**
- **MEDICAL**
 - **Imaging**
 - **Tissue engineering**
- **INFORMATION & COMMUNICATIONS**
 - **Photonics**
- **SYSTEMS FOR LIFE**
 - **Water**
 - **Food Safety**
 - **Security**

Chemistry at the Centre

An International Assessment of University
Research in Chemistry in the UK



New Dimensions for Manufacturing A UK Strategy for Nanotechnology



Report of the UK Advisory Group on
Nanotechnology Applications submitted to
Lord Sainsbury, Minister for Science and Innovation
by Dr John M Taylor, Chairman, June 2003



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- Diploma available
- individual modules available



Integrated Graduate Development Scheme *supported by* Engineering and Physical Sciences Research Council

For further information, please contact:

Brian Dickson
Department of Chemical & Process Engineering
University of Strathclyde, James Weir Building
Montrose Street, Glasgow G1 1XJ

Tel: 0141-553 4131
Fax: 0141-552 2302
E-mail: brian.dickson@strath.ac.uk

FOURTH GENERATION R&D R&D R&D R&D

Managing Knowledge,
Technology, and Innovation
William L. Miller and Langdon Morris

MANAGING THE LINK TO
CORPORATE STRATEGY

THIRD GENERATION

“Innovation is a difficult and complex problem that is constrained in many dimensions, but it is also an important activity and its mastery is vital for long-term well-being of nations, companies, communities, and families. Only innovation increases the size of the pie, which means that only innovation leads to improved standards of living.”

TAMARA J. ERICKSON
ARTHUR D. LITTLE, INC.

“It may be innovative but there is no way we can try it . It’s never been done before”

