Construction

The Sector

The construction industry assembles materials and components designed and delivered by a multitude of suppliers from a diversity of disciplines and technologies. New construction accounts for half of fixed capital formation in the UK. The sector employs 1.7 million people and output in 1993 was £46 billions; output as a proportion of the UK's GDP (about 8 percent) is less than our continental competitors or Japan. There is a deficit of almost £2 billions in materials imports and, while input costs are relatively low, output costs are relatively high. In contrast, the UK maintains a healthy share of international contracting activity - some 12-13 percent of the global market. Investment in R&D is amongst the lowest in Europe.

The Future

The construction panel foresees huge new overseas markets opening up, particularly in Asia and the Pacific Rim countries. Market trends suggest a move away from `bespoke' production towards customised solutions from standardised components. Intense global competition will keep up the pressure to obtain competitiveness on costs and prices. These developments will underline the need for project management skills of a high order, and the benefits that can arise from improved intelligence about export markets.

Top

Priority Recommendations

The Panel recommends four engines of change and five opportunities which will contribute to a future of lower costs, greater profitability and responsibility.

Engines of change

- More appropriate education and training to meet the needs of a modern construction industry and "learning networks" to foster greater collaboration across industry and supplier boundaries;
- Mechanisms to ensure all parties are kept well informed and coordinated via information and communications technology;
- A fiscal policy that encourages and fosters long term investment and economic growth;
- An innovative culture facilitated by government, schools, industry and institutions.

Opportunities

- Customised solutions from standard components;
- Business processes in construction (working together efficiently);
- Constructing for life - buildings that are constructed to last only as long as required;
- Better assessments of environmental and social consequences of development;
- A competitive infrastructure.

Top

Practical Steps to Implement Recommendations

The Panel's report contains detailed recommendations and suggestions on how they might be implemented. Successful implementation will involve government departments, research councils, institutions trade associations and industry.

Recommendations of the Construction Panel will be passed to the new Whole Industry Research Strategy (WIRS) panel which reports to the Construction Industry Board, tasked with taking forward the Recommendations of the Latham Review ("Constructing the Team"). The WIRS panel will oversee all construction research activities, and it is therefore ideally placed to monitor implementation of the Foresight recommendations.

Top

Major tasks and implementing organisations

The following information summarises the main tasks and the organisations needed to implement them.

Task	Lead Organisations
Education / Learning Networks Establishment of a forum charged with the development of education policies and curricula designed to produce world class constructors. Promotion of learning networks.	Education Depts. EPSRC, DoE

ANNEX 6

SUMMARY REPORT ON REGIONAL WORKSHOPS

1. Introduction

1.1 Four workshops have been held during September - October 1994 for the construction sector as shown in Table 1

Table 1 Workshop Venues and Dates

Venue	Date	No of Attendees
City University London	22 September	37
University of Bristol	6 October	36
University of Dundee	19 October	30
University of Salford	25 October	33

1.2 The attendees were drawn from the construction industry and its suppliers and users. Names were provided by institutions, the expert pool and the Panel. Theyincluded about 20 per cent academics.

1.3 General reaction to the workshops was favourable and constructive, and there have been a number of useful follow up letters from delegates.

2. Delphi Questionnaire

2.1 Workshop delegates were sent a Delphi questionnaire to complete in advance of the day. Response rate varied between about 30-50 per cent. Some criticism was levelled at the Delphi questionnaire. It was considered difficult to complete, some topics were thought to be ambiguous and also there were a number of areas left out. The questionnaire was also seen as being rather building orientated, there is need to address the civil engineering aspects more thoroughly. Delegates had the opportunity to add comments and extra topics to the form. These have been collated and circulated to the Panel.

3. Workshop Programme

3.1 All workshops were structured in a similar manner.Members of the Construction Panel gave short presentations on TechnologyForesight and the work of the Panel, which was then discussed. The analysis ofthe responses to the Delphi questionnaire was then presented by a representativefrom the consultants Scientific Generics.

3.2 The delegates then divided up into four predetermined syndicates and discussed a number of Delphi topics together with some themes of their own choosing.Selection of topics was made with reference to those which had been identified inthe Delphi questionnaire as being important for wealth creation or quality of life.However attempts were also made to avoid large overlaps with subjects alreadydiscussed in earlier venues. By this means the majority of the Delphi topics hadbeen discussed by the end of the workshops. Each syndicate was chaired by amember of the Foresight Team. A rapporteur from each syndicate presented thefindings in plenary session.

3.3 Delegates were invited to rescore the Delphi topics discussed. These 'MiniDelphi' responses were analysed after each workshop by Scientific Generics.

4. London Workshop

4.1 The workshop was hosted by Professor Roger Wooton from City University and chaired by Professor Patrick O'Sullivan, both members of the Panel.

4.2 Lively discussions took place both in syndicate and plenary session, gapswere identified in the off-shore and industrial building sectors. Other keyareas highlighted were training and employment issues.

4.3 Themes discussed included:

- Designing of buildings for specific functions / shorter lifespans
- Recurrent vs capital costs
- Education systems to ease transfer of people and technology
- Urban regeneration
- Industrialisation of construction
- Needs of the elderly and disabled
- Dismantling to create by-products of economic value
- Modulisation
- Design in a virtual environment
- Environmental and safety aspects of construction materials / activities
- Designing buildings and public spaces for enhanced security
- Use of temporary bridges and roads to minimise maintenance impact
- Profitable construction
- Mandatory periodic inspection of buildings

5. Bristol Workshop

5.1 The workshop was held in the Victoria Rooms, University of Bristol. Thedelegates were welcomed by Professor Sellin from the University. The meetingwas chaired by Herb Nahapiet (Chair of the Construction Panel) and TurloghO'Brien. Some concern was expressed on the length of the initial presentations,which did not allow sufficient time for general discussion. This was taken accountof in the later workshops.**5.2** Themes discussed included:

- Technology in the building process
- Modulisation
- Precise and reliable measurement

- Trenchless technology
- Cost savings from widespread use of low maintenance components
- Remote access to on-line services by more users
- Guarantees for buildings
- Totally integrated transport systems
- Remote sensing in building management systems
- Education systems to ease transfer of people and technology
- 'MOT' inspections for buildings
- Environmental considerations
- Procurement of professional services by competitive tender
- Industrialisation of construction
- Recurrent and capital costs

6. Dundee Workshop

6.1 The workshop was chaired by Professor Malcolm Horner from the University of Dundee. Useful output was produced from all syndicates.

6.2 Themes discussed included:

- Increased use of secondary and recycled materials
- Use of standard elements
- Development of 'zero energy' buildings which are independent of utilitiesetc.
- International trade involvement for SMEs
- More effective use of frontier space eg reclaimed land
- Development of community level control systems to improve security andcomfort
- Funding of research
- Increase in rate of renewal of building stock
- Design and detailing of buildings in a virtual environment
- Health, safety and environmental issues
- Development of construction, organisational and management skills
- Investment in construction
- Elucidation of the relationships between people space and places
- Location independent working
- Environmental impact assessment
- Replacement of competitive technology by value engineering

7. Salford Workshop

7.1 The workshop was chaired by Professor Peter Brandon from the University of Salford. In addition to the standard programme a short presentation was given onthe work on virtual reality being carried out at the University.

7.2 Themes discussed included:

- Reduction of distances travelled to work
- Standardisation of interfaces
- internationally accessible databases of such items as procurement, regulatory
- Negotiated contracts

- Adaptive buildings
- Widespread use of knowledge based engineering systems
- Data capture on structures using laser and other sensing devices
- Financial incentives to aid British firms export
- Recolonisation of obsolete office space by small businesses
- Reflection of whole life performance in building codes and standards
- Information systems for integration of design build and componentmanufacture
- Government support of emerging technologies
- Movement of UK balance of trade into credit for construction items
- Use of neighbourhood offices
- Availability of intelligent integrated model of new buildings
- Development of advanced technologies in response to extreme conditions

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ANNEX 7

CONTRIBUTIONS FROM ORGANISATIONS AND INDIVIDUALS

The Construction Panel is grateful to the large number of people who have completed questionnaires, provided written contributions to the programme, sent names of experts or attended one of the construction workshops. In some cases all of these! In addition they are indebted to the institutions, trade associations and other organisations who provided inputs to the programme and/or nominees to assist the Foresight process.

In particular the Panel would like to thank the following organisations:

Architects and Surveyors Institute
Association of Building Engineers
Association of Consulting Engineers
Association of Consulting Architects
Board of Incorporated Engineers and Technicians
British Property Federation
British Institute of Architectural Technologists
British Flat Roofing Council
Building Services Research and Information Association
Building Research Establishment
Chartered Society of Designers
Chartered Institute of Building
Chartered Institution of Building Services Engineers
Construction Industry Council
Construction Procurement Group
Construction Industry Research and Information Association
Construction Industry Employers Council
Constructors Liaison Group
Consultant Quantity Surveyors Association
Contractors Technical Study Group
Department of the Environment
Engineering and Physical Sciences Research Council
Ground Forum
Institute of Physics
Institute of Maintenance and Building Management
Institute of Plumbing
Institute of Highway Incorporated Engineers
Institute of Clerks of Works of Great Britain
Institute of Construction Management

Institute of Building Control
Institution of Structural Engineers
Institution of Civil Engineers
Institution of Civil Engineering Surveyors
Landscape Institute
National House - Building Council
Natural Environment Research Council
Royal Institution of Chartered Surveyors
Royal Society of Chemistry Electrochemistry Group
Royal Institute of British Architects
Royal Town Planning Institute
Society of Chemical Industry Electrical Technology Group
Society of Surveying Technicians
The Met Office
The Business Round Table Ltd
UK Global Environmental Research Office
Water Services Association

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ANNEX 8

SCENARIOS

The following upside and downside scenarios have been developed:

Upside

Political	World Trade grows faster than GDP (expansion and take up of GATT).
	Consumer Investment increases, interest rates increase: Stabilisation and opening of USSR, East Europe Hong Kong/China - satisfactory leading to opening up of China Markets
Economic	Confidence in accepting the risk in productive investment increases: Low, stable inflation, UK investment opportunity for Europe, USA, Japan, Hong Kong
	Longer term perspective on short term commodity price changes: Move away from share price to profit as a measure of success
	Low price energy
	Change in amplitude of business cycle.
Social	Development of 'whole world' attitude: European Integration.
	Reduction in urban crime (drugs decline as leisure activity increases).
	Employment increases: Shorter/more effective work for all Woman's skills fully utilised.
	Improved education and training: transferable skills.
Technology	New sources of energy: Carbon dioxide reduction
	Improved health/life style, cures for AIDS, cancer.
	Breakthrough in solution to personal transport problem.

Result: Sustainable growth, increased confidence, extrovert, participating, individually rewarded.

Downside

Political	War (out of area operations)
	Political errors leading to poor political relations: Europe increase in nationalism US/ Japan
	Emergence of other political players: Eastern Europe/Pacific Rim/Korea
Economic	Decrease in confidence in accepting the risk in productive investment: rise in trade barriers, collapse of GATT, external investment in UK down, inflation increases.
	High price energy

	View of buildings as an investment changes: buildings seen as long time scale consumption rather than investment
	Change of amplitude of business cycle.
Social	Development of racism
	Increase in urban crime
	Middle class disenfranchisement (old and poor).
Technology	Low risk taking environment
	Major technological disaster (e.g. nuclear, Channel Tunnel, Severn Bridge)
	Major increase in environmental health problems/issues e.g. major pharmaceutical drug failure

Result: Growth collapses, confidence reduced, introvert, defensive

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ANNEX 9

BIBLIOGRAPHY

1 Research Foresight and Exploitation of the Science base, HMSO, London, 1993
2 Feedback on Foresight, SQW and PREST, Cabinet Office, London, 1994
3 Forward with Foresight, Ben Martin, SPA, 1994
4 Focus on Foresight, Cabinet Office, HMSO, London, 1993
5 Technology Foresight, ACOST HMSO, London, 1994
6 Technology Foresight Programme, Cabinet Office, HMSO, London, 1994
7 The Context of Foresight, O Sparrow, HMSO, London, 1994
8 Innovation and Foresight, R Freeman, HMSO, London, 1994
9 Technology Foresight 4: An Information Technology View, J McClelland, HMSO, London, 1994
10 Co-nomination in Foresight, L Georghiou, D Lovendge, M Nedeva, CabinetOffice, London, 1995
11 The Fifth Technology Forecast Survey; Science and Technology Agency (Japan), 1992.
12 Turning Research into Wealth the Japanese Way, J Chisholm, HMSO, 1994
13 Innovation, Learning from Japan (Seminar), R Hinder, 1993
14 UK Technology Foresight, Parliamentary Office of Science and Technology,1994
15 Coastal Engineering Research Requirements; Institution of Civil Engineers, 1990
16 R & D for the Construction Site Process. Report of an ENBRI Symposium heldin Luxembourg on 5 February 1993.
17 UK Environment Foresight Project, Vol 1-3; CEST, HMSO, 1993.
18 Technology Forecasting in Japan, B Bowonder, T Miyake, Futures, Sept 1993
19 A National Agenda for Long Term and Fundamental Research for CivilEngineering in the United Kingdom; Report of the ICE an Development Panel,Institute of Civil Engineers, 1992.
20 Vision 2000: Trends Shaping Architecture's Future. Washington DC. TheAmerican Institute of Architects, 1988.
21 The Implications of Change: A Vision 2000 Survey, Washington DC,The American Institute of Architects, 1988.
22 Congress for the United States Office of Technology Assessment: Technologyand the Futures of the US Construction Industry, Washington DC AIA Press,1987
23 Building Britain 2001; Centre for Strategic Studies in Construction, University of Reading 1988.
24 Capital and Counties Report: Japanese Construction Industry; J. Bennet, RFlanagan, G Norman, Centre for Strategic Studies in Construction, Universityof Reading, May 1987.
25 The future for Building Products. An Assessment of the Impact of the GreenRevolution, Building Design. Angela Doggett Associates, 1991.
26 An Agenda For the Future. Report on the Stockholm ConstructionSymposium, David L Hawk. Stockholm School of Economics, May 1991
27 Coping with Technological Risk: a 21st Century Problem; J DRimmington, RAE, 1993.
28 State of Trade Survey Spring 1994; National Council of Building Producers,London, March 1994
29 British Construction: In Pursuit of Excellence; Clive Priestley, TheBusiness Round Table Ltd, Feb 1994.

30 Draft Research Strategy 1994; Centre for Window and Cladding Technology,1994
31 Building and Development Economics in the EC, Bernard Williams Associates,London Financial Times Business Information, 1993
32 National Contractors Group 2001 Report, 1989
33 Innovative Manufacturing a New Way of Working; Report of the InnovativeManufacturing Panel, SERC, Feb 1994,
34 Profit from Innovation, Construction Industry Council, 1993.
35 Climate change - Our Programme for C02 Emissions (A discussion document); DOE,1992
36 This Common Inheritance - The Third Year Report, Cm 2549, HMSO,London, 1994; DOE
37 Sustainable Development - the UK Strategy; DOE, HMSO, Jan 1994
38 The UK Environment (Government Statistical Service); DOE, HMSO, 1992
39 Made in the UK - The Middle Market Survey; Coopers and Lybrand, 1994
40 Construction and the National Technology Foresight Programme - produced for the Construction Sponsorship Directorate of the DOE, Technopolis-IPRA Limited May 1994.
41 Beyond 2000: a Source Book for Major Projects. Major Projects Association, Templeton College, 1992.
42 The New World Order. Oliver Sparrow, 1994.
43 Global Scenarios for the Energy Industry: Challenge and Response. AdamKahane, Shell International Petroleum Company Ltd, 1991.
44 20-20 Vision, Targets for Britain's Future. Edited by Madsen Pirie, Adam Smith Institute, 1994.
45 Report of the National Critical Technologies Panel, 1991, NationalCritical Technologies Panel, Arlington, VA, March 1991.
46 How Long should Housing Last? Some Implications of the Age and ProbableLife of Housing in England, J L Meikle and J N Connaughton, ConstructionManagement and Economics, 12, 315-321,1994.
47 Environmental File, Institution of Civil Engineers, Thomas Telford, 1994
48 Europe: Funding from the Fourth Framework Programme for Research andTechnological Development (1994-1998), Office of Science and Technology, HMSO, 1994
49 Strategies for the European Construction Sector: A Programme for Change,Office for Official Publications of the European Communities, 1994
50 Future Skills Needs of the Construction Industries, IPRA, Department ofEmployment, HMSO, 1991
51 Restructuring a Traditional Industry: Construction Employment and Skills inEurope, H Rainbird, G Syben (eds), Oxford 1991
52 Environment file, Institution of Civil Engineers, Thomas Telford London, 1994
53 Meeting the Global Challenge, Martin Bangemann, Kogan Page Ltd, 1992
54 Digest of Data for the Construction Industry, Department of the Environment,HMSO, January 1994.

Further references are to be found in *Technical Assessment Report Construction,* Technopolis.IPRA Ltd December 1994 (companion paper 1).

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