

A2

NEW DIMENSIONS FROM ARUP | NO.5

The background of the entire page is a photograph showing the silhouettes of an oil pumpjack in the foreground and several wind turbines in the distance, all set against a vibrant sunset sky with orange and blue hues.

NEW ECONOMIES

RESPONDING TO THE DRIVERS OF CHANGE

CLIMATE CHANGE | URBANISATION | ENERGY | WATER | WASTE | DEMOGRAPHICS

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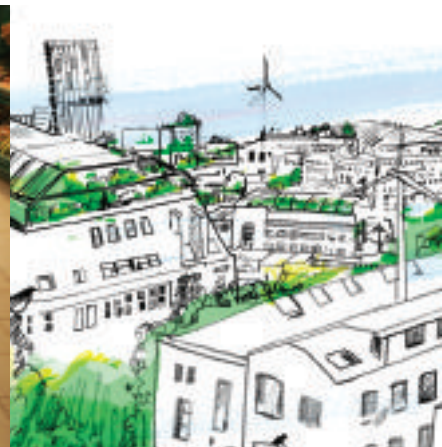
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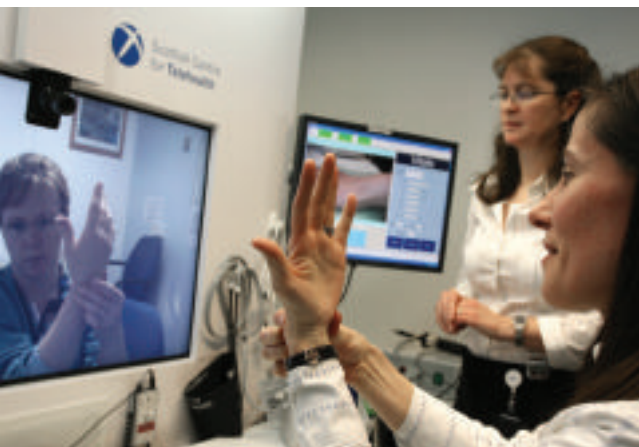
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RESPONDING TO THE DRIVERS OF CHANGE



Welcome to A², the business magazine from Arup. Arup is a leading global firm of designers, engineers, planners and business consultants.

As today's business press makes for unsettling reading, general market sentiment is summarised neatly by business leader and former UK Deputy Prime Minister, Lord Heseltine, as unease and uncertainty (page 26). Indeed, while businesses and consumers have enjoyed the benefits of strong economic growth, the challenges presented by the major underlying drivers of change, such as demographic shift, urbanisation and climate change, have been creeping ever closer.

We at Arup think there are important lessons to be taken from the challenges facing organisations today. The global economic model is creaking. Why? Put simply, the eco-system that underpins the planet's economic growth is being threatened by over consumption and inadequate resource management. With the global population projected to rise to nine billion by 2050, perhaps we need a new way of thinking. On page 16, Peter Head makes the case for a transition towards an ecological age, in which the economy is in harmony with the size of the eco-system that supports it.

Progressive organisations are thinking seriously about the opportunities presented by such a shift. Indeed, as John Miles points out on page 10, they see the potential for both short and long-term competitive gains.

A growing proportion of Arup's work today focuses on helping these organisations

“The global economic model is creaking. Why? Put simply, the eco-system that underpins the planet's economic growth is being threatened by over consumption and inadequate resource management.”

develop strategies to not only survive but thrive, profitably and efficiently, in a changing global marketplace. In this issue of A², we explore how this can be achieved across a range of sectors – in corporations, communities (page 18) and healthcare organisations (page 20) around the world.

And why is Arup any better placed than others to advise on the future? We believe it stems from our core values which place quality, an holistic approach and social impact at the heart of everything we do, along with our unique ownership model that frees us from short-termist investor influences. These factors enable us to take a long-term view of the drivers of change. The value of this model is demonstrated clearly by the work of our Foresight group, led by Chris Luebke, and outlined on page 8. Through hundreds of workshops with business leaders around the world, the team has created a future-facing research bank that informs the long-term direction of our thinking and the solutions we offer our clients.

Lord Heseltine has been quoted as saying ‘the UK doesn't do visionaries’. He explores this view on page 27.

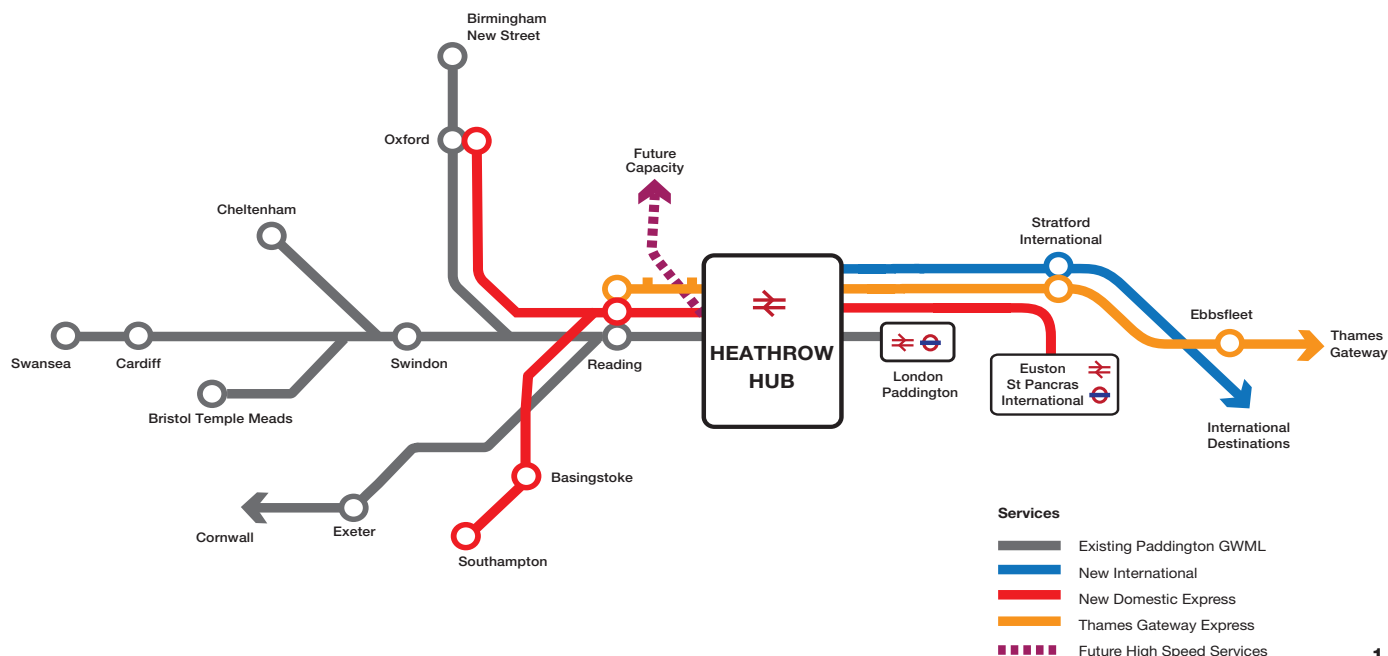
I hope you enjoy this edition of A² – practical and visionary.

Alan Belfield
Chair, Consulting Europe

HEATHROW VISION

Arup's proposal to increase capacity and accessibility of Europe's most congested airport

1 The Heathrow Hub: proposed mainline rail services.



On 16 May 2008, Arup released its proposals to transform the accessibility of Heathrow airport by the provision of new rail services. Based on three years of research, the proposals would enhance the airport's position as a world-class inter-modal transport hub, responding to the global drivers that are changing the way we live and travel.

Under Arup's proposals, Heathrow would become the first stop on an extended high-speed rail network that currently terminates at London's St Pancras International station ("High Speed 1", HS1). A new 12-platform Heathrow Hub rail station located on the Great Western Main Line would provide the airport with both a direct rail link to continental Europe and additional domestic rail services – rendering the airport instantly more accessible to the West, South West, Wales and the Midlands. The additional rail capacity provided by the link to HS1 would also enable new train services linking the M4 corridor with Thames Gateway. By 2030, these proposals, taken together with other rail developments (such as Crossrail), are expected to increase the share of passenger journeys to and from Heathrow made on public transport to well over 50%. Currently, public transport journeys are approximately 34% of the total with only 9% of journeys made on heavy rail. With the provision of a faster rail alternative,

the resulting reduction in car journeys to the airport should contribute substantially to improvements in local air quality.

"The proposal to link Heathrow into the rail network will enable people travelling from some of Heathrow's principal markets to arrive at the airport by train," explained Arup Director Mark Bostock. "Moreover, these plans fit in with emerging proposals to extend high-speed rail lines north. Looking to the future, we can see travel times from Heathrow to Leeds and to Manchester, by rail, reduced to less than two hours. Not only will this decrease journey times to Heathrow, but by improving access to the airport, passengers travelling to Heathrow will be encouraged out of their cars and on to trains, delivering environmental benefits."

After researching over 22 potential sites for the new 12-platform Heathrow Hub station Arup pinpointed an area approximately three kilometres north of the existing T5 between Iwer and West Drayton stations, just north-east of the M25 and M4 motorway junctions. This location was chosen because it will have maximum impact on rail connectivity but minimal adverse impact on property and on Heathrow's existing infrastructure.

Described by BAA as "an interesting proposal which deserves further consideration", Arup's proposals envisage the Hub station

also providing extra terminal capacity for the airport by offering check-in and baggage facilities. Bostock comments: "We have also carefully examined how to improve the internal infrastructure at Heathrow. We want to provide more space for passengers, make it even easier for them to access the airport and give them as smooth an experience as possible once they arrive at any one of Heathrow's terminals."

Arup believes the proposals could be operational by 2019. The costs of tunnelling a high-speed rail line from central London to Heathrow, and construction of a new rail station with international and regional services, is estimated at £4.5bn. The Heathrow Hub proposal has already received the support of the Conservative Shadow Secretary of State for Transport, Theresa Villiers, and Arup has met with Secretary of State for Transport, Ruth Kelly, to discuss how the private sector could finance and deliver the project.

For more information, please visit www.arup.com

ELECTRIC TRANSPORT

Swapping the pump for the plug

How can we achieve zero-emission transport in our cities? That was the question asked at Arup's 'Electrification of Transport' conference on 1 May 2008. The event brought together for the first time a wide range of stakeholders including vehicle manufacturers, energy distributors, logistics businesses, public transport providers, local authorities and Government.

"Electric vehicles offer us the chance to significantly reduce transport's CO₂ emissions," says Neil Ridley from Arup's Advanced Technology and Research Group. "However, to maximise the reductions we need to not only consider the vehicles, but also how they will integrate into the infrastructure and built environment, as well as the changing social and economic needs for transport. With Arup's experience of masterplanning, transport planning and vehicle design, we recognised the need to bring together a wide range of stakeholders to address this important subject."

The conference has resulted in a number of studies being developed to examine the market for electric vehicles and ease their introduction. The findings from these studies will be published later in the year.

1 'Electrification of Transport' conference, 1 May 2008.

2 The internal view of the Nokia Green Building, Beijing.



A GROWING CONCERN

How should business adapt to a low-carbon world?

Organisations must work together if we're to tackle the issues surrounding climate change. This was the finding of 'A Growing Concern' – a recent Arup-backed report published by the Management Consultancies Association.

With insight from contributors in business and academia, the report's author Fiona Czerniawska concluded that carbon management has moved up the corporate agenda. Companies were keen to find meaningful solutions, with offsetting considered to be a last resort. Fiona comments: "If the price of carbon was higher, it would focus the attention of senior managers to pursue economic and environmental goals with equal determination."

Czerniawska also found that fundamental change would be needed to address issues such as the supply of natural resources; and the report highlights examples where this is beginning to happen. However, more still needs to be done. "At the heart of this lies the need for greater collaboration between organisations," says Czerniawska. "But that will mean over-turning some of our most cherished and respected ways of doing business."

To download this report, please visit www.arup.com/sustainability

BEIJING: BEYOND THE GAMES

Latest piece of the capital's sustainable transformation

With the world's attention focussed on Beijing during the Olympics, many of the iconic projects commissioned to support the Games have been in the spotlight. Arup has been involved with sporting venues, such as the 'Bird's Nest' National Stadium, the 'Water Cube' National Aquatics Center and the Fencing Hall/National Convention Center, as well as other major projects in the capital, including Beijing Capital International Airport's new Terminal 3 and the China Central Television (CCTV) headquarters. Away from the action of the Games, Arup has also worked on the Nokia Green Building and GreenPix Zero Energy Media Wall – two of the latest sustainable developments in the city.

Nokia China's new headquarters, the Nokia Green Building, is the first new-build commercial office building in China to be awarded a Leadership in Energy and Environmental Design (LEED) certificate by the United States Green Building Council. Water conservation devices and double-layer glass walls have been combined with advanced design techniques to reduce water use by 37% and energy usage by 20% compared with typical commercial buildings. Arup's broad involvement in the Nokia Green Building included building sustainability consultancy, masterplanning, architectural design, fire, lighting and acoustics, as well as structural, electrical and mechanical engineering.

To find out more about Arup's work in Beijing, please visit www.arup.com/beijing



RISKY BUSINESS?

Mapping and mitigating security risks

A white paper and monthly bulletin from Arup Security Consulting are helping businesses around the world to better understand their exposure to geopolitical and terrorism-related risks.

The recently published white paper 'Geopolitical Risk & Terrorism' examines the drivers of risk in today's turbulent security climate and how the evolution and globalisation of business operations are increasingly exposing corporations to established and emergent epicentres of risk. The white paper explores the impact of these factors on businesses and how affected organisations can manage their exposure through building resilience into their operations.

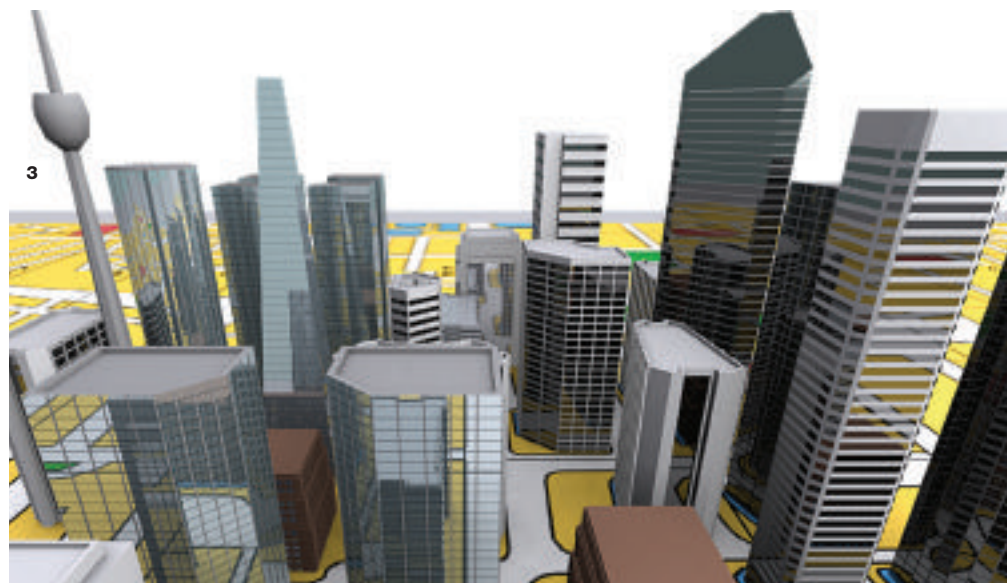
Complementing the white paper, the free monthly Arup Security Bulletin provides readers with up-to-date information on

political risks throughout the world. The Bulletin offers key insights into regional security issues and uses the Arup Terrorism Database to provide some of the most extensive reporting available on global terrorism incidents. Produced by Arup's security experts, the Bulletin also draws on the firm's network of regional offices and local intelligence sources embedded in key positions around the world. The immediacy of global and local media reporting can often force noteworthy incidents out of headlines soon after occurrence. Each month the Bulletin describes in further detail significant terrorism incidents, picked by the firm's analysts for specific assessment.

To receive a copy of the white paper or the latest issue of the Security Bulletin, please email securitybulletin@arup.com

3 Understanding exposure to asset portfolios is a key part of risk management.

4 Bay Area Rapid Transit District operates a network of public rail transport serving the San Francisco Bay Area.



RTPI AWARD WINNERS

Arup has been named the Royal Town Planning Institute's 'Planning Consultancy of the Year 2007.' The judges applauded the firm's broad involvement in both shaping policy and its implementation, as well as its exemplary contribution to areas such as climate change, energy, skills and capacity.



ENERGY PERFORMANCE

European Union's buildings directive comes into force

The European Union's (EU) Energy Performance in Buildings Directive (EPBD) came into force for new non-domestic buildings over 2500m² on 1 July 2008. With the UK Government's transition period coming to a close on 1 October 2008, property owners, tenants and portfolio holders are under pressure to make sure their buildings comply.

As part of the firm's Living Buildings initiative, Arup's Advanced Technology and Research (AT+R) team – which launched as a global practice on 23 July this year – helps clients ensure their buildings meet the new EU targets. They also seek to optimise the performance of buildings in terms of operating cost, energy efficiency and environmental quality, from design to post-occupation.

All the senior members of the AT+R team have been trained as assessors, so they are able to offer real insight into what the regulations demand. Barry Austin, Associate Director at Arup, says "In many cases it is possible to make significant performance improvements by implementing simple cost-effective measures – from reviewing facilities management procedures to optimising building control systems."

CALIFORNIA DREAMING

Sustainability in the sunshine state

A guide to be released by Arup and The Climate Group later this year will offer organisations across California simple steps to cut their greenhouse gas (GHG) emissions. It comes in the wake of the Global Warming Solutions Act of 2006, which aims to reduce the state's GHG emissions to 1990 levels by 2020.

"Many businesses go straight to offsetting emissions or purchasing renewable energy," says Fiona Berry, a Senior Sustainability Consultant in Arup's San Francisco office. "In fact, simple measures such as turning the lights off provide quick and cheap ways to start climbing down the carbon ladder."

Fiona and her colleagues are helping organisations across California find solutions to the challenges of climate change. Arup is working with the San Francisco Bay Area Rapid Transit District to calculate its carbon footprint. Meanwhile, in the City of Concord, Arup is masterplanning the redevelopment of a naval weapons base, and using a groundbreaking methodology to assess its climate change impacts. This was developed especially for the project in the absence of any formal state guidance on acceptable GHG emissions thresholds.

CARDS ON THE TABLE



At a time of unprecedented change, Dr Chris Luebke introduces Arup's latest set of Drivers of Change cards: 150 rigorously researched observations that will have a huge influence on business and the public sector. For forward-looking organisations, it's time to start dealing in facts.

In Shanghai, one of the world's fastest growing cities, half of the 630,000ha of land administered by the authorities has been reserved for urban farming. The quest for new oil reserves led oil companies to invest more than US\$36bn in exploration in 2005. Every 24 hours, deforestation releases as much CO₂ into the atmosphere as eight million people flying from London to New York. There are now more overweight people in the world than malnourished. More than half of the world's urban population live not in major cities but settlements of less than 500,000 people.

Facts that make you stop and think? If so, Arup's new Drivers of Change card set will make you pause for considerable thought. The facts above are just a small sample of the wealth of data, forecasts and expert opinion covered by the cards on six major topics: energy, water, waste, urbanisation, demographics and climate change. Some will be more relevant to your organisation than others. But such is their breadth and topicality that almost any organisation is bound to find something in the six sets of 25 cards of which they need to take very serious notice.

The Drivers of Change cards have their own driving force behind them: Director of Arup's Foresight group, Dr Chris Luebke. "Today's business person is typically so busy that they rarely allow themselves time to think about the context of the world in which they are playing an active role. There are so many decisions and actions to take concerning today and the day after that, that the day after tomorrow is always at the bottom of the list of things to do."

"So the cards are designed to allow that busy businessperson to periodically pick them up and find a small nugget that helps them think about what they're doing now but also what they might be doing in two, three, five or even 20 years time."

Each Drivers of Change topic is broken down into five separate themes: social, technological, economic, environmental and political. The cards themselves follow a common format: a provocative, issue-raising question and statistic or quote on the front, followed by a bite-size analysis of the issue, backed up by rigorously-researched graphical information and data on the back.

It's not every business consultancy that would commit a team for several months at a time to such an enterprise. But, owned in trust and not answerable to shareholders, Arup is free to invest in knowledge building like this and therefore offer long-term value to clients.

Certainly, the Foresight team has left no stone unturned in finding out which issues are of most concern to the international business community. The six topics emerged from a series of workshops with more than 12,000 people around the world. The Foresight team encouraged groups from chief executives to graduates and from investment bankers in Johannesburg to citizens of Denver, to identify the key drivers of change in their individual worlds. Consistently, these six topics topped the lists.

It is quite an achievement to render such vast and sometimes intimidating topics down into accessible, manageable portions. But there is no pretence that the cards



1 Chris Luebke leads a Drivers of Change workshop.

2 Arup's Drivers of Change cards.

3 The Drivers of Change exhibition took place in Spring 2008 in the public exhibition space in Arup's new offices at 8 Fitzroy Street, London.

represent exhaustive summaries of each topic; they are intended as a tool for initiating thinking. "It was quite a challenge for our researchers," says Luebke, "to boil and condense, with great pain sometimes, these enormous topics into the 25 most important issues. Each one could easily have had 100 cards to itself."

So, how best to use the cards? That depends on the corporate culture, says Luebke; on how open or hierarchical it is, and how ideas are transferred within it. Fortune 100 companies, graduate and senior schools have



“Every scenario painted by the cards, even those concerning mega droughts and disease pandemics, contains positive possibilities for business leaders.”

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© Tuca Vieira, Rua 25 de Março, São Paulo, 2006

We have tried very hard to take a balanced stance on all of them.

“There is already a lot for people to think about concerning the here and now. But, to constructively pause, to try to think about what the impacts could be, I would suggest, is prudent. The data about disease, for example, is not science fiction. The question is, how sensitive is your business operation to that? Have you even thought about it?”

The cards have also been used extensively by Arup in Foresight workshops with organisations ranging from Procter & Gamble and British Airways to the Crown Estate, and to kick-start thinking on major design projects. They have also helped to build Arup’s profile among other thought leaders in major corporations and institutions.

“It’s my premise that corporations are the major drivers of change today,” says Luebke. “20 to 30 years ago, it might have been the universities, but in our built environment, it is corporations who are the change-makers.”

To find out more about the Drivers of Change programme or the services offered by Arup’s Foresight team, please visit www.arup.com/driversofchange. To request a set of cards, please email a2@arup.com.

all made use of the cards. He reports, for example, that they have been used at board level in “a very large company in Atlanta”, where they were dealt to executives who were then asked which issues were most important for the corporation.

“Another company I know used them with their operations team. Each member was given a stack of 20 cards and had to pick out five that would be important to their business, asking how each is going to impact on the delivery of their product or service today.”

Taken together, the cards present a fairly uncompromising and, for many, uncomfortable view of humanity’s future. But every scenario painted by the cards, says Luebke, even those concerning mega droughts and disease pandemics, contains positive possibilities for business leaders. “What we’ve tried to do is not to pose these issues as threats or opportunities, but as observations of drivers of change. It is up to each individual to determine, ‘Is this driver a threat or an opportunity?’ I’d suggest to you that every driver is both.



Dr John Miles, Chairman of Arup's Global Consulting Sector, takes a closer look at some of the major drivers of change and explores their implications for business.

DRIVERS OF CHANGE

The importance of fundamentals in times of turbulence

Constant change now underlies the business models of most big organisations. This state of flux is driven by sources of supply and demand that are globalising; product cycles that are getting shorter; and permutations of customer choice that are getting larger. Fierce competition, both at home and abroad, accentuates these drivers.

As our world becomes more complex and inter-connected, the underlying forces which provoke this sea of change become more difficult to understand and predict. There is much superficiality and 'froth' in the market and this can distract leaders from the underlying imperatives, particularly in times of stress. So, underneath the froth, what are the real fundamentals that drive lasting change, and how might they affect the development of today's business strategies?

From the previous article, you will have seen that we spend a lot of time at Arup thinking about these issues. The Drivers of Change card set is an example of such thought. So is the report entitled 'A Growing Concern' referred to on page 6 in this edition of A². This article looks at the importance of such fundamentals in the context of the current financial turbulence.





© Ben Stansall/AFP/Getty Images



© Samuel Aranda/Getty Images

1 In September 2007 the global credit crunch provoked the first run on a British bank in more than a century.

2 The fragility of lean business: a major transport disruption could leave supermarket shelves empty within 24 hours.

From NICE to VILE

The sudden and widespread contamination of the global credit markets, and the abrupt loss of confidence in our banking systems, are interesting illustrations of how finely-tuned, interdependent, global systems can be unexpectedly disrupted. Until the summer of 2007, most observers would have expressed a view that the global credit markets were more robust than they had ever been because of the dispersion of risk that flowed from the practice of securitisation. That assumption proved to be unexpectedly flawed, and the consequences for us all have been immediate and painful. The loss of confidence has rippled out from the financial world into the economic world, and there is now a growing feeling that the West is facing its biggest financial crisis since the Second World War. The outlook for the next few years has been described as Volatile Inflation, Low Expansion (VILE) – a marked contrast to the preceding decade of No Inflation, Constant Expansion (NICE). In short, we are suddenly faced with a very uncertain outlook.

In times of such uncertainty, it is vitally important to maintain a clear understanding of the fundamentals. For those who can keep their heads, great opportunities arise during times of market correction. The immediate pitch and churn of the markets may reflect all sorts of temporal distortions (financial speculation, cash-flow crises, debt foreclosures), but for those that run a tight ship, the fundamental market drivers will open the doors to real business opportunities. It is a clever person who can predict what the future holds, but there is a saying that 'chance favours

the prepared mind'. So there is merit in considering future possibilities.

Significant changes ahead?

There are at least three factors in evidence today that suggest we could be on the verge of very significant business change.

First, the potential for unexpected disruption of global, interdependent, business systems is not confined to the financial world. The modern trend of lean business has made many industries critically reliant on a web of interdependent relationships which allow small inventories, just-in-time supply chains, and business process outsourcing. The production and distribution of almost all consumer products is subject to this observation. In addition, supply and consumption patterns that were historically local (like the production, distribution, and consumption of food) have been distorted by our ability to exploit energy very cheaply. So we now grow food remotely, transport it over great distances, and deliver it through finely-tuned logistical operations to the point of consumption. For the last few decades the increasing adoption of these 'lean' systems has been hugely beneficial for consumers all over the developed world. But at what latent risk? A major transport disruption, arising from an accident or a terrorist strike, could leave supermarket shelves empty within 24 hours. A sustained break-down in our overcrowded transport infrastructure in the UK could precipitate national food shortages in a manner that could never have happened when food was grown and traded locally. This has nothing to do with a shortage of food itself; rather, it illustrates the potential

fragility of the business systems which bring it to our tables. These concerns about system fragility, and the risks posed by terrorist attack or natural disaster, are not confined to food production and distribution. We also need to think carefully about the fragility of many of our essential industries. The response of fragile systems to disruptive inputs can be swift and unpredictable (like the credit crunch). There is, therefore, a need to consider robustness and business resilience as an integral part of system design and business planning in a manner that was given scant consideration in times past. Business resilience should now be very high on the planning agenda for all leading organisations. *(Continues)*





© Diego Cervio

disaster? (Similar questions might be raised with regard to the depletion of mineral and energy resources). If, in the case of food, it was evidence of mankind's ability to avert disaster, a second 'Green Revolution' is now required. We must increase crop yields still further, or increase the available land which can be cultivated. Previously unfashionable solutions may become fashionable. Genetically modified foods may provide the answer to increasing crop yields; increased use of fertilisers and large-scale irrigation projects may provide the answer to increasing the availability of arable land. Both routes may require significant further technological developments to address the obvious sustainability shortcomings; both will probably present investment opportunities for bold decision-makers within the next few years. Making such decisions effectively will require more of a 'long view' than a 'short view'.

Third, the pressures of pending disaster demand actions not only on the technology front, but also on the policy front. Many

Unexpected outcomes?

The 'Green Revolution' has seen wheat yields per hectare jump from less than 500kg to nearly 3,000kg between the 1960s and today. Despite well argued predictions of imminent global famine (e.g. P.R. Ehrlich's 1960s book 'Population Bomb'), the reality of the last 40 years has been that food supplies for much of the world became abundant, and countries like India became self-sufficient.

Second, mankind's circumstances (for good or ill) can be changed dramatically through concerted developments in new technology. So the outcome when faced with pending disaster is not always what might have been predicted. The current spike in food prices is a reminder of this. The number of people on the face of the earth is increasing, but the land area on the face of the earth is not. Fundamental considerations mean that food prices must rise, but by how much? Will we reach the point when the world cannot feed its population? There have been many cycles of pessimistic predictions regarding our ability to feed ourselves over the past 200 years but, to date, those predictions have been unfulfilled. In the most recent example, the world responded to a similar perception of food crisis in the early 1970s and, as a result of determined technology and policy interventions, crop yields shot up dramatically (*see left-hand inset*). The result was 25 years of unexpectedly abundant food for a large fraction of the world's population – the precise opposite of the forward prediction. This is a wonderful illustration of the ability of technology to come to the rescue. But was it a 'blip' in a long-term trend towards eventual widespread famine, or was it an illustration of the enduring ability of mankind to rise and overcome pending

"The number of people on the face of the earth is increasing, but the land area on the face of the earth is not... Will we reach the point when the world cannot feed its population?"

of today's fundamental issues, like energy shortages; food shortages; and climate change; require policy interventions in the world's markets if significant change is to be triggered. But co-ordinated governmental action in the face of such global issues is rare and prone to impasse. The Kyoto process is a case in point. The negotiations, to date, have been fraught with frustration and delay, mainly because each individual government faces intense lobbying from its own electorate to protect it from disadvantage. In most societies, governments can only change gear when public opinion accepts and supports the need. This has been well illustrated on more than one occasion in one of the largest global industries – automobile manufacturing. During the 1950s in America, Ford found that it could not charge for safety-related devices (e.g. seat-

belts) as customer-specified 'extras'. The public simply did not recognise a need for it. But, in the late 1960s, public opinion turned and the Federal Government introduced sweeping safety legislation. Suddenly, car makers selling vehicles in the USA were required to provide occupant protection devices in order to comply with the law. Cars all over the world have subsequently become safer and, interestingly, the implicit increase in cost has been completely accepted.

Public opinion's essential role. Permission granted?

For most governments, policy enactment depends on a willingness of the population to accept a change of direction. Without a strong undercurrent of public encouragement to enact difficult legislation, industry self-interest and other pressure groups have an enormous ability to resist change. The California zero-emission vehicle proposals in the 1980s illustrate legislation that did not have sufficient popular support to enable its successful subsequent enactment.

The same process was illustrated in the 1990s when some US States tried to introduce zero-emission vehicle requirements. The technical case in support of such change was the same then as it is now, but the lack of concerted public support meant that the major automotive manufacturers ultimately escaped the full intentions of the legislation (*see inset above*). By way of contrast, it seems that the current climate of public opinion will allow the proposed tail-pipe emission regulations in Europe to 'stick'. Likewise, there are possibilities for much more aggressive carbon trading and energy reduction policies across a range of industries. So, sea-changes in the policy environment are a distinct possibility in the near future and great opportunities therefore exist

for businesses that are willing to think about hydrocarbon fuel consumption and atmospheric emissions in radically different ways. Energy generation from renewables, waste, and nuclear sources, coupled with distribution and storage systems using hydrogen and advanced battery technologies, all represent great opportunities for entrepreneurial businesses.

Unintended consequences and chance's favour

Times of change may be times of great opportunity. But that is not to say that everything in the business garden is going to come up roses. With each opportunity there will be pitfalls and conflicts. For example, at a national scale, the cost of building exclusively zero-carbon homes in the UK by 2016 may defeat the objective of building enough homes to provide everyone with decent living accommodation. On a global scale, the demand for bio-fuels to replace oil-based fuels may defeat the objective of universal food provision. Therefore we must innovate, but we must guard very carefully against unintended consequences which are worse than the original ill.

As stated before, it is a clever person that can predict the future. But chance favours the prepared mind. Our work on the Drivers of Change is intended to provoke consideration of the fundamental forces at play in business and society. If you would like a set of Drivers of Change cards for your own consideration, please email a2@arup.com.

Will chance favour your business during the coming turbulence?



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“Sea-changes in the policy environment are a distinct possibility in the near future and great opportunities therefore exist for businesses that are willing to think about hydrocarbon fuel consumption and atmospheric emissions in radically different ways.”

1 The globalisation of supply chains.

2 Technology and innovation stand to play a vital role in increasing crop yields to feed the rising global population.



© David Nigel Owens

Opportunity or threat: what do you see?

Arup's Foresight group is a multi-disciplinary team of experts examining global trends to better understand the context of tomorrow, and so help Arup and our clients stay at the leading edge. Whether it's the degradation of the environment, the looming healthcare crisis, or the end of the oil-dependency age, we offer a range of tools and services to help you respond and plan for an emerging future.

Lectures

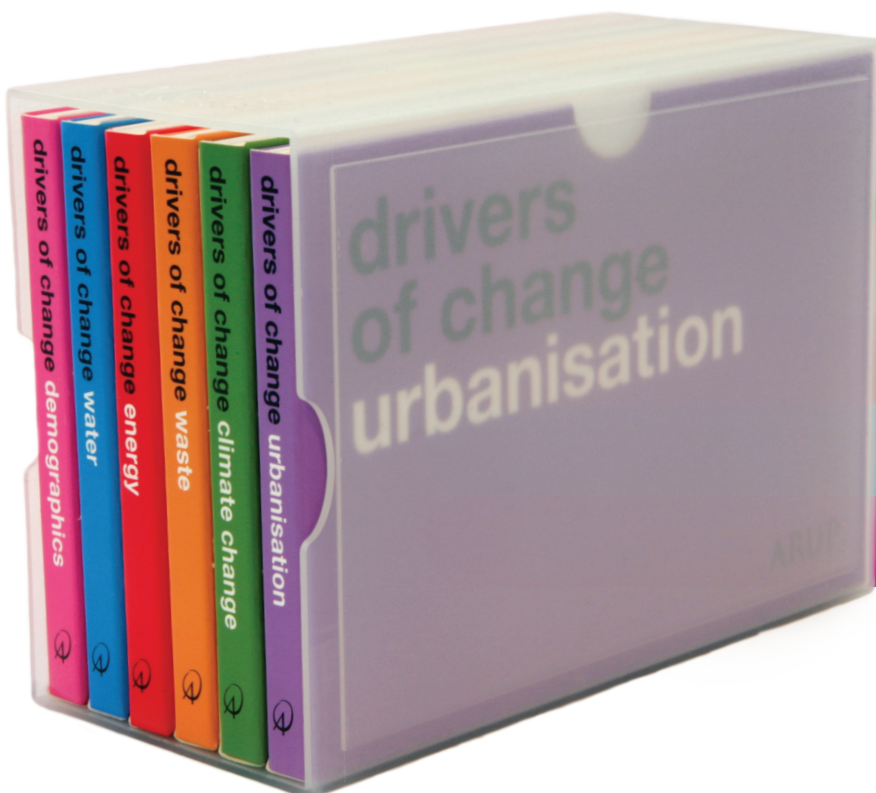
Arup Foresight has **delivered over 150 lectures** in the past five years to a variety of industry sectors and heads of government, focusing on future challenges and the evolving global business context.

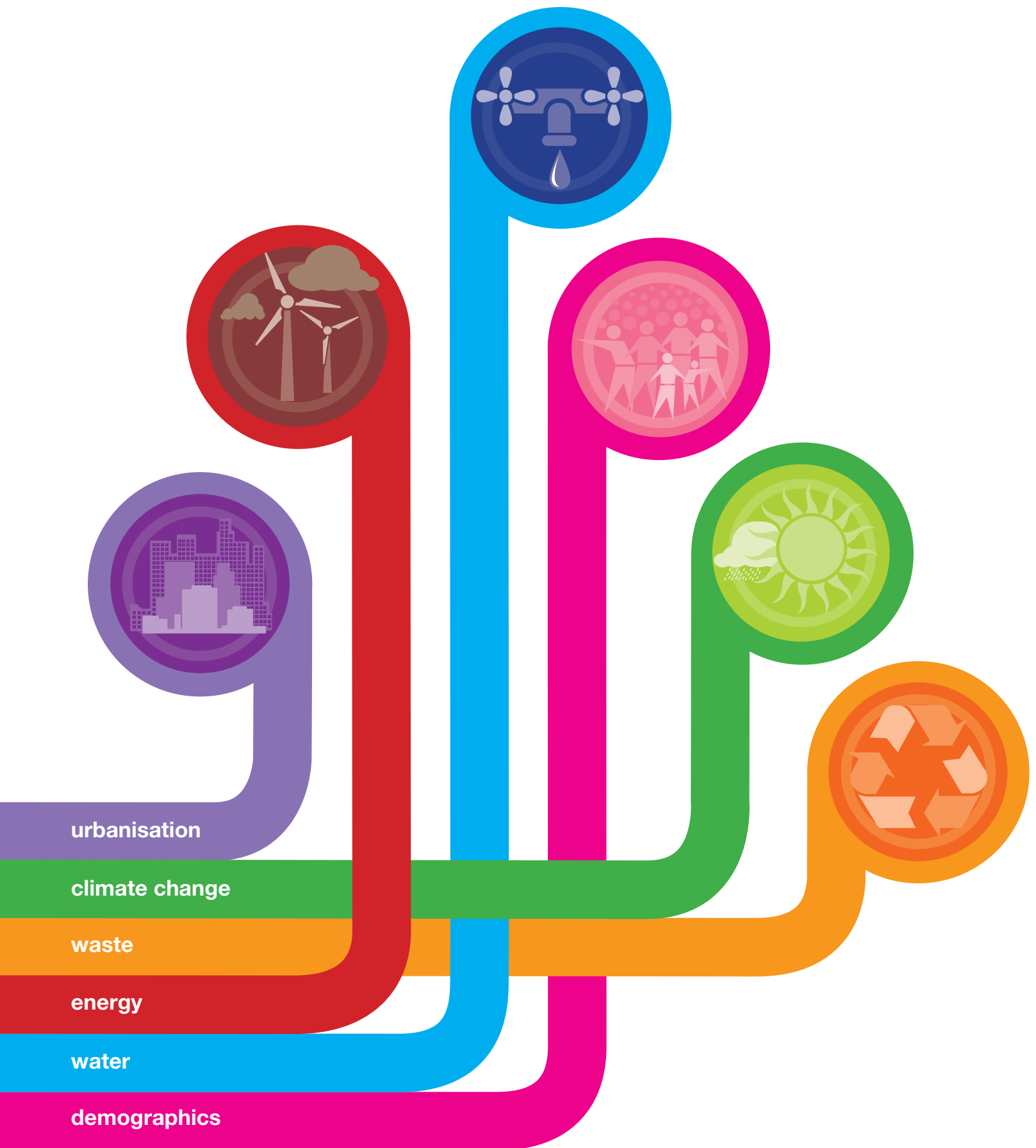
Bespoke workshops

We have facilitated and executed intense **working sessions with several thousand people globally** to help clients address the key drivers of change in their industry and plan for a range of plausible futures.

Research

The **Drivers of Change cards** are but one example of the **Foresight team's research programme**. Our specialists continue to investigate some of industry's and society's most pressing issues to identify **step-change opportunities** in business and the built environment. To request a set of Drivers of Change cards, please email a2@arup.com.





To find out more about how Arup's Foresight team can help your organisation, visit www.arup.com or contact us at a2@arup.com

ARUP

OPPORTUNITY IN THE



How business can benefit from the global shift to sustainability.

In order to respond to the drivers that are changing our planet and the way we live upon it, we must enter an ecological age – a sustainable way of living where the global economy is in harmony with the size of the eco-system that supports it. This is the vision of Arup Director, Peter Head. He believes that businesses are an essential part of the move to an ecological age and argues that they are already benefiting from the opportunities this transition is creating.

Delivering the inaugural Institution of Civil Engineers' Brunel Lecture in June 2008, Peter Head, Director and Head of Global Planning at Arup, outlined his vision for the move to an ecological age. "As things stand, the very system that underpins our planet's economic growth is threatened", he explains. "We are being profligate in our use of mineral and energy resources, our agricultural inefficiency is threatening our ability to feed our growing population and our open use of resources is polluting air, water and soil. This not only affects the way we do business but also threatens the lives of increasing numbers of people."

In order to support a projected global population of nine billion, Head argues that

by 2050, we must move to an ecological age, which has reduced CO₂ emissions by 50% on average, and by 80% in developed countries, compared to 1990 levels; an ecological footprint of 1.44ha per capita (down from today's 6 in UK cities); and increase the Human Development Index, improving living standards.

He acknowledges that achieving these goals and moving to an ecological age will require a fundamental change in thinking, and particularly a combination of new land-use planning approaches, which aim for sustainable development targets, backed up by appropriate infrastructure investment. Implementation will need a combination of effective national government policies to incentivise change and very large public-private partnerships.

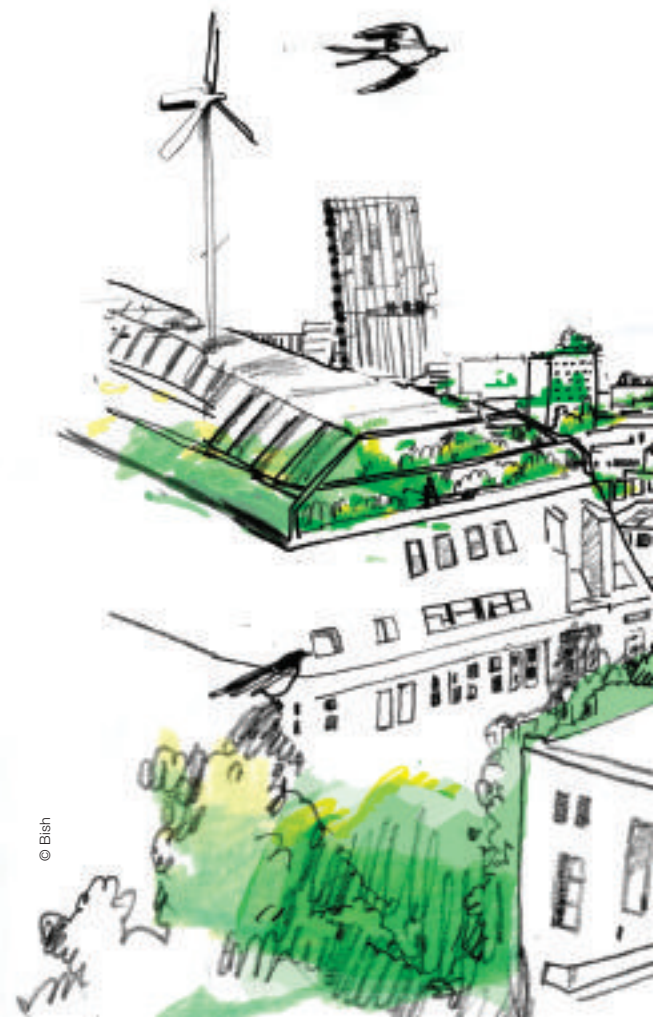
When implementing these, Head argues that we would do well to learn from the planet's successful organisms. "Taking inspiration from nature in this way is an idea espoused by Janine Benyus in her brilliant book, 'Biomimicry,'" explains Head.

The principles of biomimicry are:

1. Use waste as a resource
2. Diversify and co-operate
3. Gather and use energy efficiently
4. Optimise not maximise
5. Use materials sparingly
6. Clean up not pollute
7. Do not draw down resources
8. Remain in balance with the biosphere
9. Run on information
10. Use local resources.

Arup is already using these principles to unlock opportunities for clients around the world. Dongtan eco-city in China, for example, embraces all of the principles of biomimicry, harnessing renewable energy to provide a secure and sustainable energy supply, while also connecting energy, food, water and waste systems to ensure the city runs efficiently. At the Gallions Park development in the UK, a combination of high energy efficiency and renewable energy sources will create a zero-carbon development that also meets the commercial needs of its developer. Meanwhile, the Treasure Island sustainable development in San Francisco Bay will make use of economically-viable technology. Once complete, the former military base will become a vibrant, liveable community; a neighbourhood that incorporates best practices in sustainable, low impact development and green building.

As Head acknowledges, embracing the principles of biomimicry to enable resource efficiency and increased use of renewables



ECOLOGICAL AGE

to drive growth, rather than growth consuming non-renewable resources, will require policy development on a global scale. But here too he sees opportunities for business. Policy will need to address, for example, the fact that previously free natural resources and services – such as the ability to emit CO₂ or discharge waste – have to be declared scarce economic goods. To some, energy feed-in legislation, polluter pays taxes and tradable emissions permits may sound like a threat to their way of doing businesses, but for others measures like these are already producing opportunities.

According to UN data, the annual additional shift in investment from carbon pricing alone will amount to around US\$400bn by 2030. On the ground, policy makers will need business to provide many of the technological solutions that will support the move to an ecological age. Sustainable urban design principles require smart technologies such as LED lighting, electric and hydrogen-fuelled transport,

carbon capture and intensive food production using hydroponics and nutrient feed. Companies who lead the way in areas such as these will be rewarded with access to opportunities.

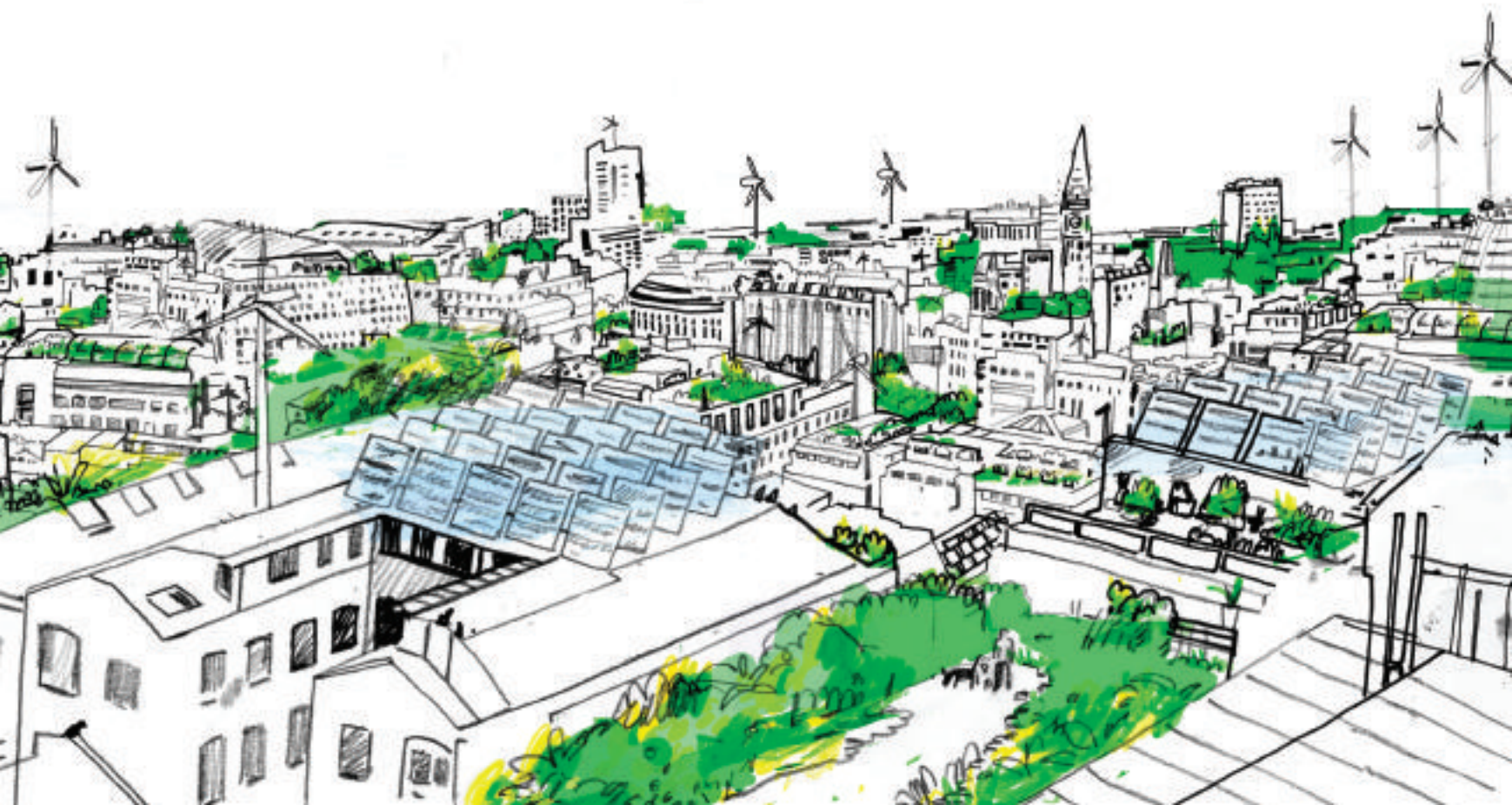
“There is clear evidence that the first movers in the transition to an ecological age are enjoying opportunities at both a business and a regional level,” says Head. “The Global Cities Clinton Climate Initiative establishes global buying clubs to create a market for new technologies, generating demand for businesses working in areas such as traffic and street lighting, green buses and waste-to-energy systems.” Already there are large public building retrofit contracts emerging in this programme in the USA.

Reports such as the Stern Review on the Economics of Climate Change have shown that the cost of not acting on climate change will be great. It has been reported that every £1 we invest now will save £5 in the future. Businesses entering the ecological age can certainly take advantage

of eco-efficiencies such as using renewable energy, exploiting waste as a resource and designing out obsolescence in products.

Head argues that there are also wider opportunities emerging as we move to an ecological age. “Radical transformation of the infrastructure that supports life on the planet is needed if we are to attain a sustainable future,” he says. “This requires strong partnerships between public, private, NGOs and community groups, and the funding for good projects may increasingly come from pension funds looking for long-term security of return. Businesses will be at the forefront of the move to an ecological age.”

To download a copy of Peter Head's paper, “Entering the ecological age: the engineer's role”, which accompanies the Institution of Civil Engineers' Brunel Lecture series, please visit www.arup.com



With many of our towns and cities increasingly vulnerable to the effects of climate change, Arup's Urban Strategy Leader, Gary Lawrence, introduces a new disaster-resilient design approach which is making vulnerable areas safer, more sustainable and quicker to recover from natural disaster.



DISASTER-RESILIENT COMMUNITIES



This page:
The Treasure Island development
in San Francisco Bay.

Opposite:
Dongtan eco-city, Shanghai.

© Arup/SOM/dbx



“A disaster-resilient community is, in its truest sense, a sustainable community. It seeks to optimise conditions for human development over an extended period of time, and has an in-built capacity for adaptation.”

Climate change, it is now acknowledged, has been fuelled by human activity, and communities around the world are increasingly feeling the effects, in forms such as extreme weather events and the spread of tropical diseases. Indeed, it is in our largest, densest settlements that infrastructure is at its most brittle and vulnerable, as existing design paradigms often focus on resisting disaster, resulting in catastrophic systems failures and long recovery lead times. And it is here, in our rapidly expanding urban centres, that development has disturbed and destroyed important natural systems that might otherwise have kept disaster at bay. There is no more graphic example of this than the flooding of New Orleans in the wake of Hurricane Katrina in 2005. This might not have been so costly to lives and property if marshlands around the city had not been filled for housing development and replaced, as a flood defence, by poorly designed levees.

So, how should our towns and cities respond to these increased threats and in-built frailties? New, integrated design and planning strategies are being pioneered at Arup that focus on disaster resilience rather than resistance, affording communities – particularly those in vulnerable zones – greater protection of infrastructure and essential systems, and the chance to recover much more quickly in the aftermath of a natural disaster.

According to Gary Lawrence, Arup's Urban Strategy Leader and a former sustainability advisor to the British, American and Brazilian heads of state, “A disaster-resilient community is, in its truest sense, a sustainable community. It seeks to optimise conditions for human development over an extended period of time, and has an in-built capacity for adaptation.”

Up until now, says Lawrence, most buildings and infrastructure have been designed to stand firm in the face of natural or human-caused disasters... but only up to a pre-determined break point. Once natural forces exceed that point, catastrophic failure follows, with massive, widespread and

costly consequences. Often the impacts can be felt far beyond the immediate disaster zone because of the interconnectedness of communities through large-scale energy, water, food and finance distribution systems.

What's more, design strategies such as these are focused on sudden, high-impact events, rather than long-term, high-impact events such as climate change (which can, of course, lead to their own very abrupt events). “Those strategies tend to be based on extrapolations of historical data,” says Lawrence, “and fail to take into account how modern human activity can amplify natural processes and exacerbate natural disasters over the long term.”

Such is the pressure to grow on towns and cities around the world, that development is bound to continue in areas that are vulnerable to natural hazards and where existing systems are stretched. “The challenge for those places,” says Lawrence, “is to design infrastructure and buildings that recognise that system failures are inevitable, and that can not only reduce the harm and expense caused when they happen, but also enable the community to recover more quickly. That capacity to be resilient in the face of unpredictable natural phenomena is becoming crucial to the competitiveness and quality of life of towns and cities.”

According to Lawrence, disaster-resilient communities are becoming a reality thanks to integrated design approaches that bring together skills and partners from the private and public sectors and the community to design buildings and systems.

There are examples of new, resilient communities under construction today: new urban zones where buildings and infrastructure are designed to fail “gently” rather than catastrophically, and where energy, water and communications systems are independent of large systems and grids.

In seismic zones, for example, hospitals and other essential facilities are being designed using non-bonded braces. These elements isolate structural failure points within the building, so that when

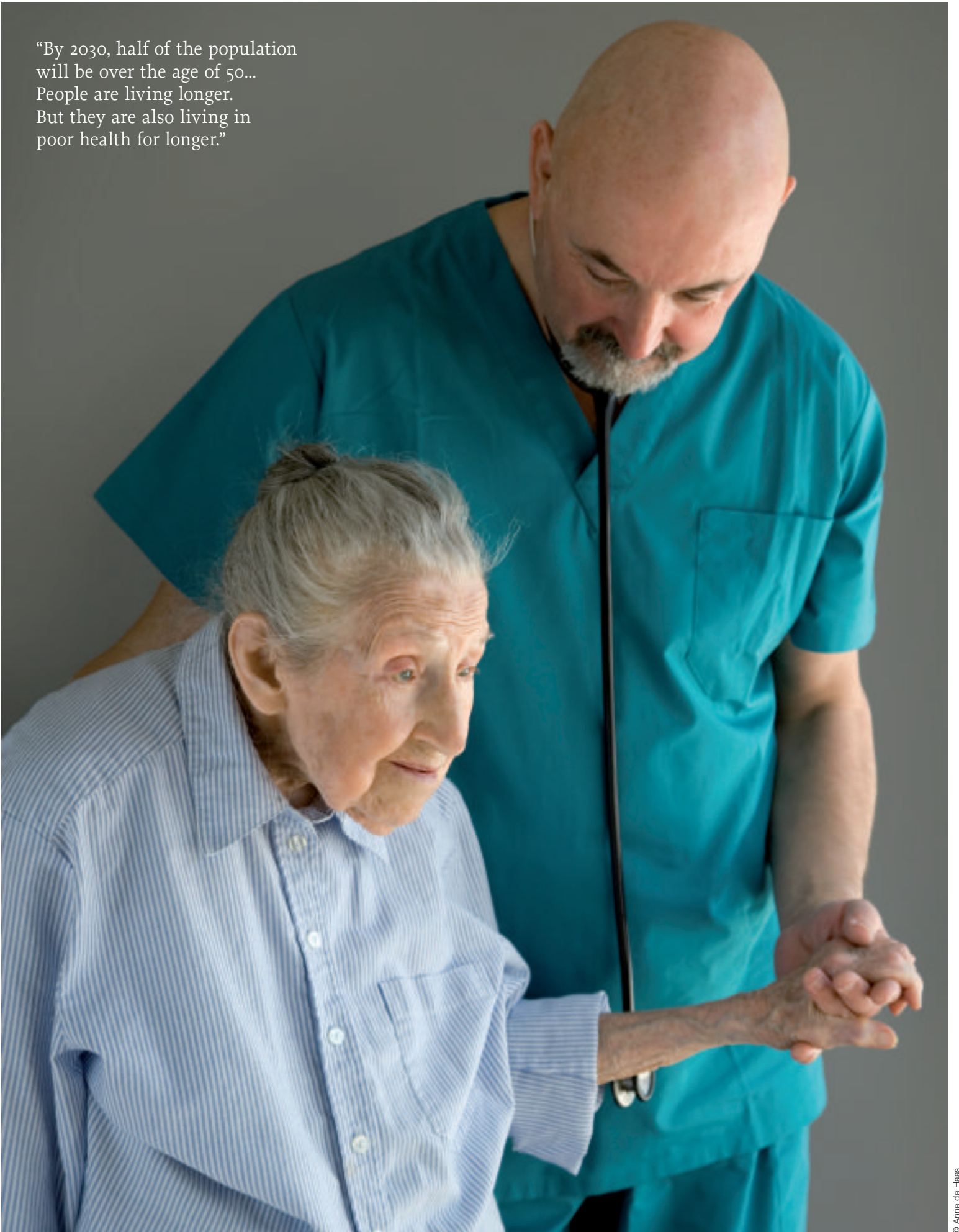
earthquakes occur, the building's structure ‘fails’ at the points of these braces. The joints can therefore be replaced quickly and the facility can continue to support the community through the crisis.

Arup is developing the masterplan for Dongtan eco-city on Chongming Island, off Shanghai, where the entire community is designed to be energy-independent. Should extreme weather events interrupt the energy supply from wind, solar and bio-fuel sources, the city's specially-adapted hydrogen-powered buses will be “plugged” into hospitals, communication centres and other critical facilities to keep them supplied with the power they need.

Arup's sustainability plan for Treasure Island, a 180ha brownfield site located halfway along the San Francisco-Oakland Bay Bridge, takes the idea of disaster resilience even further. The island was artificially created in 1936-37 for the Golden Gate International Expo, and is now the site for a model self-sustaining mini-city of 5,000 houses and several office towers. To protect the city from sea level rise, the entire site is being raised and new seawalls installed. Deep piling will strengthen buildings' resistance to seismic activity. If the bridge fails, fuel cell-powered ferries will maintain a connection with the mainland, and the entire community's water demand will be met by recycling water and rainwater capture.

In our resource constrained world, a more sustainable approach is the most rational pathway to long-term value creation and competitive advantage. A disaster-resilient community is the truest sense of a sustainable community, and a precondition to effectively addressing the likely consequences of climate change on urban environments. “There is no ‘right’ answer to this,” says Lawrence, “only the best answer that is politically feasible and technically possible today. But, no matter what the scale, an integrated approach is the key to success.”

“By 2030, half of the population
will be over the age of 50...
People are living longer.
But they are also living in
poor health for longer.”





Healthcare organisations have their hands full just doing the day job, without confronting demographic upheaval and climate change. But, says Stephen Pollard, Arup's Head of Healthcare in Europe, looking at the bigger picture is the key to cracking the tough issues of today.

HOLISTIC HEALTHCARE

Ask most healthcare managers and clinicians about the impact of climate change on the running of their services and you might be met with a worried look. That's not because senior staff in healthcare are unaccustomed to change; their industry is one vast, continually moving feast. It's because the kind of issues that consume their attention are much more immediate: technological change, medical advances, increasing competition, staff retention, the democratisation of choice, to name a few. Addressing what appear to be longer-term drivers of change comes low down on the list of priorities for commissioners and providers of healthcare, as it does for many businesses and public service organisations.

Climate change, though, is a key driver of change for healthcare organisations. Reducing their carbon footprint may come further down their list of priorities, but healthcare services consume energy on a colossal scale and at enormous cost. And it is not just light bulbs and buildings that burn energy at an alarming rate. In the UK, for example, the Sustainable Development Commission has reported that 20m tonnes of CO₂ emissions are attributable to healthcare each year. Of that, just 20% is generated by the built environment. Another 20% is created by transport. The bulk – 60% – of healthcare's carbon footprint is the result of providing clinical services.

However, holistic solutions are needed. Transport is linked to buildings, which are linked to operations and services. Change the two 20% slices of the carbon footprint and you'll impact the 60%. It is about

looking at the whole picture. The expertise exists to help healthcare providers to kill two considerable birds with one stone: to adopt low carbon strategies that allow improvements to be made to clinical services, facilities, financial performance and the retention of staff.

The other key driver of change for healthcare organisations is one of demographics. Today, it's not just ourselves that are getting older; it's also our society – our patient population. The demographic profile of developed countries is transforming with every passing year.

“Climate change and demographic change are happening now; they are not events that can be put off or ignored... but getting to grips with them need not be done in isolation from the other issues on managers' desks.”

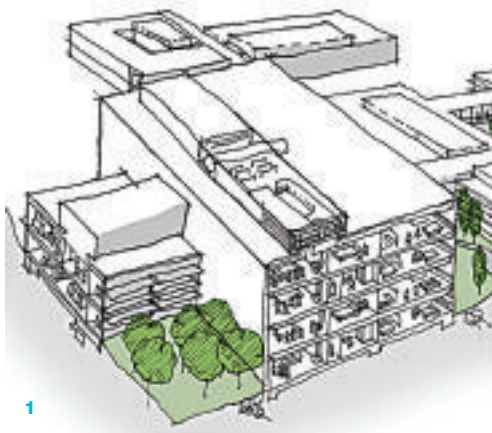
By 2030, UN projections show, at least half of the Western population will be over the age of 50. The ratio of workers to retirees is expected to halve in that time, from 3:1 to 1.5:1, leaving fewer people to care for and support the elderly. With chronic (long-term) illnesses the major cause of death among the elderly, the implications for individuals and for health services of these trends are profound. People are living longer. But they are also living in poor health for longer. Long-term conditions like dementia will

become an increasing problem, with diagnosed cases expected to double to 1.4 million in the next 30 years in the UK.

The services simply don't exist in most countries to deal with the huge rise in people living with multiple chronic diseases. Current services such as hospitals and care homes are not designed to support the kind of independence and autonomy of lifestyle that the new elderly generation demand and need. Commissioners of healthcare need to be able to draw on a new, integrated range of services, tailored to support the care needs of their community. They need to ask: what are those needs? What's going to work in our area?

For healthcare providers, this emerging demand for new services presents huge opportunities and equally huge challenges. To win a slice of the new healthcare market, providers will have to transform not just their services and skills, but also their facilities and financial organisation. New, demonstrable solutions are required today if we are to address the demographic revolution of tomorrow.

Climate change and demographic change are happening now; they are not events that can be put off or ignored. What's more, getting to grips with them need not be done in isolation from the other issues on managers' desks. The very opposite is true: addressing the more immediate forces of change has to be done with the larger ones in mind. Shifts in population profile and climate present the biggest challenges to the competitiveness and sustainability of healthcare organisations. *(Continues)*



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Satellite image © 2008 Google

- 1 Typical deep-plan hospital design.
- 2 Narrow-plan design.
- 3 Arup's strategic masterplan for a potential hospital and university site redevelopment.
- 4 Single-room occupancy helps treatment.
- 5 Cisco telehealth unit in operation. The Cisco Health Presence concept has been developed by the Cisco Internet Business Solutions Group (IBSG).

The sustainable healthcare business

Too many healthcare organisations are unsustainable. For them, the prognosis is straightforward: they may not exist in ten or 20 years' time. The reasons are not hard to identify. Typically, their building stock is old, dispersed, inefficient, expensive to run, inflexible and ill-suited to housing modern healthcare technology. Some of their estate is in a state, providing a poor therapeutic environment for patients and a poor working environment for staff. And because staff cannot do their job to the best of their ability, the standard of clinical services is not what it should be.

To become sustainable, healthcare organisations must adopt a more commercial approach, identifying and eliminating wastage of resources, improving the performance of facilities and staff, and providing the best possible service to their customers. The encouragement to change comes from new mechanisms, such as payment by results, under which funding follows patient choice.

Part of that change of mindset demands that the whole-life cost of new facilities replaces the upfront capital cost as the main consideration about whether to invest. This longer-term view reveals the true cost of keeping existing buildings or facilities with that of building and maintaining new ones.

For many healthcare organisations with

sprawling, ageing estates, the cheaper – and more sustainable – long-term option is reconfiguration: rethinking the relationships between parts of a hospital estate, for example, and replacing wasteful, inefficient buildings with fewer, better integrated, more flexible facilities. In consolidating facilities and reducing the physical footprint of the estate, sites become available whose sale value can help to meet the capital cost of redevelopment.

Even so, it is a major undertaking that demands expertise and experience in fields such as masterplanning, risk analysis, flexible financing, financial management, procurement, logistics and design. Here at Arup, healthcare clients have benefited from finding all of those skills under one roof.

For many organisations, the need for estate reconfiguration and for more modern facilities is inescapable. A consensus is building around the best way to achieve hospital environments that are low-energy, flexible in use, efficient for staff and therapeutic for patients. Facilities with deep-plan configurations are still being built but the use of mechanical ventilation to service large floors does little to promote the principles of sustainable design. The narrow-plan model has been shown to aid patient recovery. Where this incorporates one-person rooms, infections can be more easily contained and patients can



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“In time, telemedicine will improve the quality and convenience of health services while reducing the financial and operational pressures faced by acute care services.”

experience greater privacy, rest and security, which speeds their recovery and allows more patients to be treated. The reduced energy use makes for healthier finances and a lower carbon footprint.

Some forward-looking providers, such as Maidstone & Tunbridge Wells Hospital, soon to be the first 100% single-room occupancy hospital in the UK, are already adopting the model in their plans to reconfigure their estates. Theirs is the model of the future.

Smarter services

The ageing of the population is forcing healthcare organisations to develop alternative models of care for elderly sufferers of chronic disease. New retirees have expectations of independence and mobility that their predecessors of a generation ago didn't dare hope for. Services are needed that maintain those retirees' autonomy of lifestyle into old age as they live with one or more long-term conditions, and that treat the home as the centre of care. There is no shortage of research and conceptual solutions in this area; we should now be moving towards the take-up of those solutions by engaging healthcare professionals in the development process.

For Airedale NHS Trust, Arup has helped to develop a strategy for telemedicine as part of the Trust's plans for an Innovation

Centre. The strategy is looking at new solutions for services, and integrating them with new information and communication technologies for the home. In time, telemedicine will improve the quality and convenience of health services while reducing the financial and operational pressures faced by acute care services.

In the EU, one of the most important large-scale demonstrators is the Ambient Assisted Living (AAL) programme, funded by the European Commission to the tune of €600m in five years, whose aim it is to accelerate take-up with a series of pilot projects and a European award scheme for smart homes and independent living applications. These will demonstrate the viability of weaving telemedicine and other digital technologies into the fabric of homes and into the provision of new clinical services to support care in the community.

The path to sustainability

There are no universal panaceas that will see healthcare organisations through the transition into sustainable businesses. Every case is unique. The structures for commissioning and providing healthcare vary from country to country, cater for culturally and economically diverse populations, and evolve at widely different rates. However, the transfer of skills, knowledge and experience between

healthcare cultures can stimulate innovation and allow organisations to more quickly identify what's right for them.

Arup is ideally placed to cross-pollinate ideas and expertise. Owned in trust by its staff and operating an open, collaborative structure, the company is able to freely move skills and knowledge in a wide array of healthcare fields around the world. For example, a senior project manager, recently transferred from the UK to Australia, will have a vital input into the Aus\$1.7bn Marjorie-Jackson Nelson Hospital in Adelaide, one of the country's largest new hospitals to be procured by the PPP route. Arup's experience of PPP on healthcare projects in the UK was a key differentiator in the winning bid.

The drivers of change in the healthcare sector are presenting healthcare commissioners and suppliers around the world with a plethora of immediate and long-term challenges. But the everyday issues that confront healthcare managers are inextricably linked to climate change and demographic change. Only by providing sustainable facilities, and high-quality, community-based services for the ageing population can healthcare systems continue to survive.



From advances in R&D to demographic change and global warming, a rapidly changing business environment creates opportunities and threats. Dr Jennifer Schooling, Arup's Research Business Manager, investigates how businesses can manage this degree of change and develop positive responses that leverage the opportunities and mitigate the risks.

ROADMAPPING OPPORTUNITY FROM CHANGE



Arup uses a strategic roadmapping methodology developed by Cambridge University to create opportunity from change, both as a service for clients and to plan its own research programme. "It's a dynamic way of bringing clarity and order to a turbulent environment," says Schooling. "Roadmapping is also an excellent tool for engaging a range of stakeholders in the strategic planning process, and for communicating the strategy across the organisation."

So what is strategic roadmapping?

Roadmapping is a management forecasting and decision-making tool originally developed in the semiconductor industry. Business opportunities are plotted over a timeline and against a context of trends, product development and competitor activity. A roadmap is a living document. Regularly revisited and updated, it enables business plans to be adjusted to respond to market developments.

Identifying the change

The roadmapping process begins with a facilitated workshop involving stakeholders from all areas of the business, whether they're working in product design or the boardroom. When Arup undertakes roadmapping with clients, specialists from across the firm or external research partners are brought in to help

participants to identify and position the key facets of change in their industry.

Workshops address:

- What is the change and why is it happening?
- Who will the change impact and how will it impact them?
- Will the impact of this change vary across the organisation?
- When will this change occur, how well can we track the timeline for both short and long-term factors?

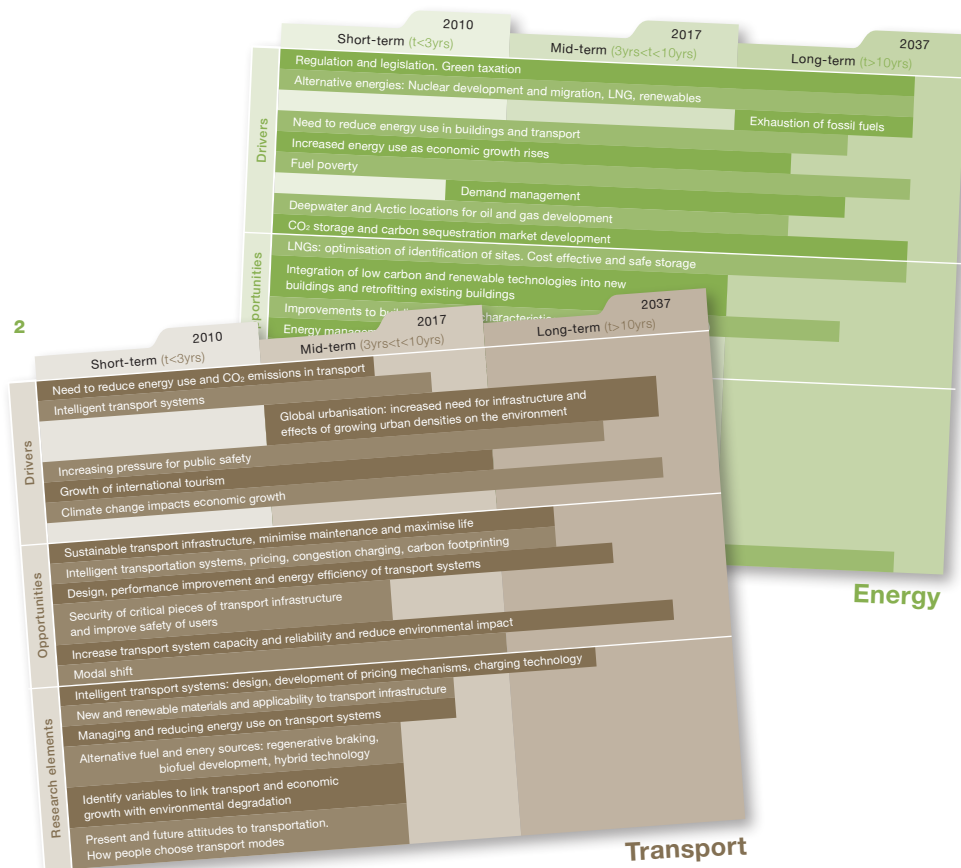
Developing the response

Having established a clear picture of the change, the workshop moves on to identify a response, asking:

- How does the change affect the fundamental purpose of the organisation?
- What new products and services might we deliver to take advantage of the change?
- What enablers, such as research or new technology, can be used to respond positively to the change and what resources will we need?

Charting the roadmap

Finally, the analysis can be brought together as one comprehensive record, linking business or sector drivers to opportunities and enabling elements.



1,3,4 Arup Roadmapping Workshops.
2 Examples of Arup's Research Roadmaps.

Represented in a simplified single sheet format with a clear structure, the roadmap is also an excellent tool for communicating strategy to stakeholders.

"The complete roadmapping process is a great way of pooling knowledge and views on change, and securing buy-in from stakeholders through their participation in the process," says Schooling. "It highlights gaps in understanding. It also supports decision-making, linking strategic drivers to business opportunities and required actions."

Case study: Arup Research Roadmaps

Roadmapping can be used across a wide range of industries. Schooling and her colleagues use roadmaps to provide a strategic focus for Arup's research, so whether it's the SuperLight Car or external microclimates that allow cities to adapt to climate change, Arup's Research Roadmaps identify areas that respond to key drivers of change.

Arup's Research Roadmaps have also been used by the Engineering and Physical Sciences Research Council (EPSRC) – the UK Government's leading funding agency for research and training in engineering and the physical sciences – to inform its work. EPSRC Senior Construction Sector Manager, Claire Tansley, says, "The Arup Roadmap provided useful and timely advice to the EPSRC Construction, Environment

and Water sector team in developing their overview of the Built Environment sector, and team consultation on sector technology priorities. The work of the sector team will inform future EPSRC Research Programme priorities."

Case study: ICT and automation roadmaps

One of the key benefits of roadmapping is that its workshops bring together a range of stakeholders but only demand a day or so of senior executives' time. This made it an ideal process to help Constructing Excellence set a framework for research into information and communications technology and automation (ICTA). Arup facilitated roadmapping workshops as part of a process to identify key research topics to be addressed.

ICTA is one of three strategic research themes that the National Platform for Construction ran recently, exploring industry-led research programmes and initiatives. The work, funded by a combination of industry and Government (BERR), aimed to understand the role that ICTA could play in supporting the future competitiveness of the UK construction industry. Roadmapping helped identify what types of information, communication and automation technologies needed to be developed and how they could successfully be integrated together to respond to the

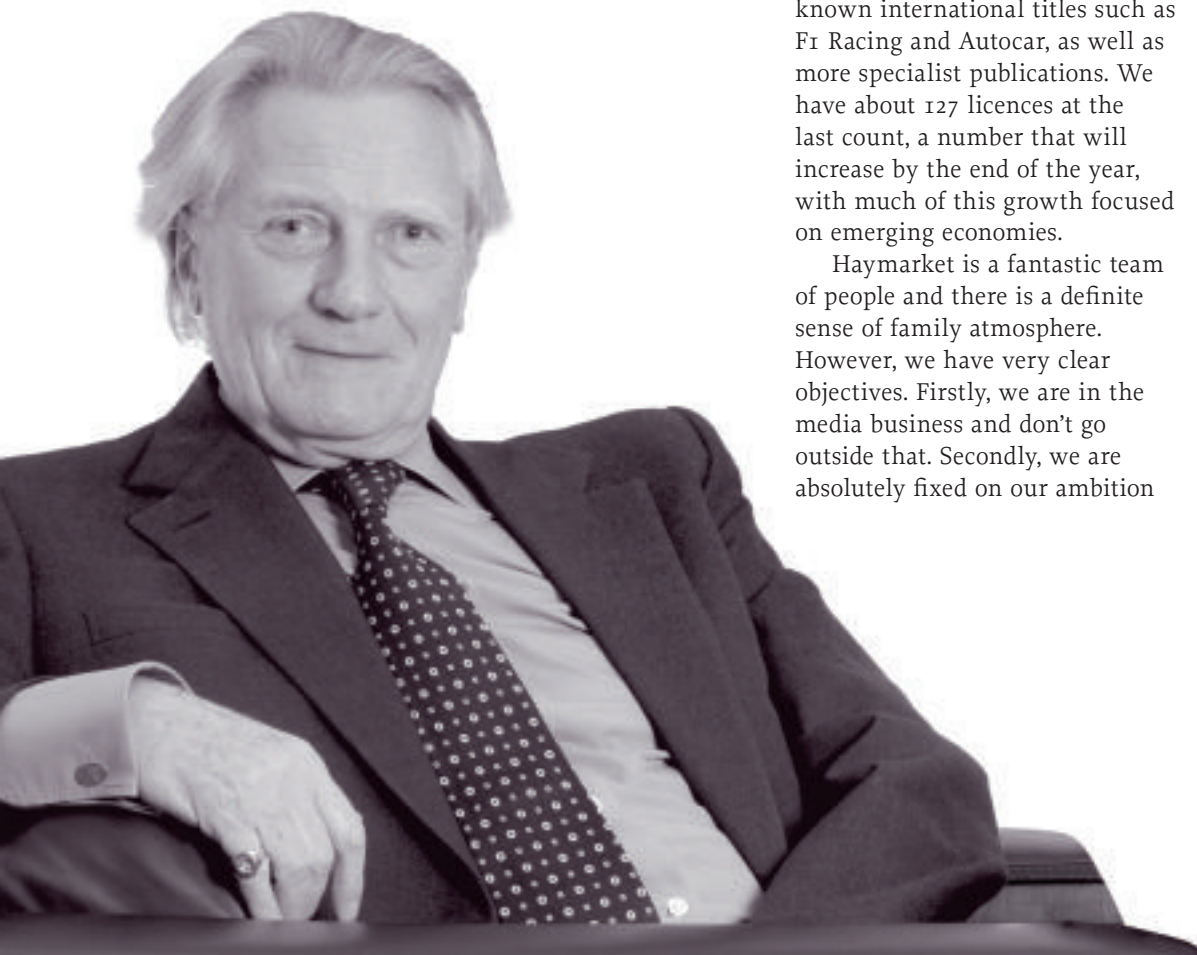
changes driving the industry.

Adopting a roadmapping approach ensured that the resulting research programme recommendations obtained industry endorsement. Two workshops were held involving 29 delegates from a broad range of industry backgrounds, including clients, funders, consultants, contractors, vendors, suppliers and academia. Outputs from the workshops were analysed to consolidate and prioritise the 'super-roadmap' and create the National Platform ICTA Strategic Research Programme. The roadmap will be used to influence the research programmes identified by organisations such as the European Construction Technology Platform, and to broker research projects in the recommended areas.

"Roadmapping gives organisations space for strategic action," concludes Schooling. "In the face of drivers such as climate change – the effects of which we're already seeing – businesses will be lucky to succeed without strategic planning. With it, they have the potential to create opportunities from change."

LORD MICHAEL HESELTINE

Lord Heseltine is founder and Chairman of the Haymarket Media Group, the largest privately-owned publishing company in the UK. He was a Member of the Parliament in Britain from 1966 to 2001, and a Cabinet Minister in various departments, including Secretary of State for the Environment and President of the Board of Trade, between 1979 and 1986 and between 1990 and 1997. He was Deputy Prime Minister from 1995 to 1997.



What do you make of the current economic situation?

There is a great deal of unease and uncertainty, and it is now blindingly obvious that there was an ill-disciplined credit explosion which very few people did anything about except enjoy. However, there are still huge areas of great wealth. I wouldn't be surprised to see some of that beginning to flow from Russia, China and the Middle East into acquisitions and investments in the parts of the world that are suffering the credit squeeze.

How is your own company responding?

Haymarket is trading at record levels – our web business is growing at 70% year-on-year, which is phenomenal – but we are watching the situation carefully. We have the advantage of being very diversified, managing a broad portfolio of publications, websites and exhibitions across a range of geographic regions. In effect, we are an accumulation of lots of specialist businesses and run well-known international titles such as F1 Racing and Autocar, as well as more specialist publications. We have about 127 licences at the last count, a number that will increase by the end of the year, with much of this growth focused on emerging economies.

Haymarket is a fantastic team of people and there is a definite sense of family atmosphere. However, we have very clear objectives. Firstly, we are in the media business and don't go outside that. Secondly, we are absolutely fixed on our ambition

“The greater the local community's response, and the more exciting the investment proposal they put forward, the more Government funding you award them.”

to become the number one in the fields we operate in. The obsessive pursuit of quality is deeply engrained in the business, and every part of the company is incentivised to grow. Product-by-product annual reviews ask the direct managers: “What next? How do you improve on this?” This creates a wealth of ideas and proposals.

In your political career, you were pivotal in the UK's regeneration movement – do you think that progress has continued?

The pioneering of urban renewal in the UK took place in the 1980s and 1990s. The Labour Government has broadly adopted the strategies from this time but there is more still to be done. As Chairman of David Cameron's policy group, I have recently produced a report which outlines what I believe to be the way forward. The first step is to have leaders in localities, directly elected Chief Executives in the major permanent authorities. The second step is to restore local ownership, discretion and experimentation rather than imposing a series of centrally-devised solutions. The third step is to take those ideas and incorporate them at authority level; and involve the major players – the drivers of change – in those communities, for example the big industries, universities, the health services. And the final step is to redirect the £10bn of central Government money going through the various agencies to help pay for the steps above. The greater the local community's response, and the more exciting the investment proposal they put forward, the more Government funding you award them.

I learnt much of this in Hokkaido, in Northern Japan. It had suffered terribly and yet had the most progressive ideas to help rebuild its communities. They used companies like Arup to generate progressive, deliverable ideas and ensured that business, community and government worked together to deliver them. Those ideas were all alive in the 1990s with City Challenge in the UK. As a Government we invited 31 local authorities to compete to be one of the ten winners in a scheme that offered each of them £35m over five years in order for them to achieve self-sustaining regeneration of deprived communities. The effort to rebuild the Hulme Estate in Manchester showed what could be done by getting the local leader of the council to draw the private sector into partnership with the public one. City Challenge produced the dynamic of public money that enabled redevelopment.

Of the successes you've had, which stand out most in your own mind?

The sale of the council houses in the UK in the 1980s was a social revolution. The number of people who bought their own home and who were affected by this was huge, but I don't take personal credit for it, I just happened to be there at the right time to put it through.

Perhaps one achievement that I believe has positively changed the UK was the competitiveness agenda under the Department of Trade and Industry (DTI). This looked at how we could enhance the competitiveness of the UK in order to increase the nation's wealth and meet the aspirations of its people. The competitiveness agenda was counter-cultural to politics because what I tried to do was to be objective, to look at the ingredients of the success of the national economy and to set out the reality of the situation as objectively as we could.

The Daily Telegraph City Editor once asked me to identify the three big things that have come out of the competitiveness agenda. There was a look of disbelief when I told him he was missing the point – competitiveness is about a million different tiny things accumulating into excellence. This is the lesson of the Japanese success, and to some extent the German economic success – they are obsessed with the detail, every input is maximised, reviewed, improved and enhanced.

Creating the Audit Commission – the independent body in the UK responsible for ensuring that public money is used effectively – was part and parcel of the same sort of approach; the methodical analysis of fact as opposed to just perceptions and words. I wanted to turn the Audit Commission to cover not only local authorities but also central Government departments, but this hasn't happened.

“Governments today need to create conditions in which their economies can compete and thrive globally.”

Do you feel the balance of power is shifting in the global economy?

In a competitive global economy, the masters are the controllers of economic wealth. Whether they are managers who go where the money is, or investors who go where the profits are, you can be sure that they will only go where the conditions are favourable to their success. Governments today need to create conditions in which their economies can compete and thrive globally.

Their progress in doing so is ever more visible. Television has had a profound effect on sharing information across international borders and has been incomparably the most important educator in every field. People may feel that

they left education at 16 – that's absolute nonsense. Live television broadcasts inform the world as quickly as every government. So you and I as viewers know what's going on before the governments react. That's a transformation in the power of governments.

You once mentioned in an interview that there are no visionaries – are you still of the same opinion?

Yes, we don't do visionaries in the UK. It's very interesting if you look at some of leaders of the huge projects in the East End of London, for example: Canary Wharf took a Canadian, Excel took from the Malaysians, and O2 took an American. Only City Airport was developed by Mowlem, a British company. Of course, I think it's also fair to give Arup credit as a firm that had the vision to re-route the CTRL link in to London from the East.

How do you spend time outside of work?

I've always been a keen gardener since I was knee high. Inspired by a visit to the Hillier arboretum in Hampshire 30 years ago, my wife and I have built up an arboretum of 70 acres and 3,500 of different types of trees and shrubs. It's probably the largest private arboretum of its kind in post-war Britain.

How would you describe yourself today?

I'm a restless person, fascinated by opportunities and determined to retain Haymarket as a family-run and privately-owned company. My frustrations are those of time and resource. We can only go as fast as we can go and I see a world which is so full of opportunities.

Is there anything that you regret not having had the chance to do?

Of course, I would have liked to have been Prime Minister. It would have been a fascinating experience, but it wasn't to be.

“In a competitive global economy, the masters are the controllers of economic wealth.”

A GOOD DEAL BETTER

Steven Lloyd profiled for A²

Steven Lloyd is leader of Arup's FSA-regulated Transaction Advice business. The group combines engineering and technical expertise with operational management experience and financial know-how to provide advisory services throughout the business and project lifecycle. His position gives him a unique insight into the challenge of delivering projects and businesses that are economically, as well as socially and environmentally, sustainable.

The solution, he believes, lies in integrating financial advice, commercial strategy and economic policy with great design and engineering. "Business's response to drivers of change such as urbanisation, climate change, waste, energy, water and demographics are affected by issues of affordability and financial uncertainty – whether it's the credit crunch or longer-term concerns," he explains. "To be confident that you'll get a good return and that you're investing effectively, you need to consider these drivers and issues together."

Combining technical know-how with corporate finance and investment banking capability enables Arup's Transaction Advice group to ensure that complex sustainable schemes can be designed, engineered and delivered effectively. It's an approach that helped steer Nanjing Automobile Corporation through their acquisition of MG Rover's assets after it collapsed with debts of £1.4bn, helping the company transfer some production capacity to China after guiding it through the deal.

Lloyd believes that the approach which helped Nanjing could also address three major challenges that are required to respond to drivers of change: transport integration, urban regeneration and infrastructure retro-fitting. "Instead of funding and regulating modes of transport differently, we need to change our collective mindset and view it as one system," he explains.

Successfully upgrading infrastructure by integrating great financial advice with great design will, Lloyd argues, be a vital first step in the sustainable masterplanning that's required to address the drivers of change. "Public bodies need to access private finance through better business cases and more effective delivery partnerships," he says. "Existing provision uses tools such as Section 106 planning requirements but it doesn't work as well for big schemes. We need to find solutions that will help deliver sustainable solutions on a broader scale."



1 Steven Lloyd.



2 Nanjing Automobile's acquisition of MG Rover's assets was guided by Arup's Transaction Advice group.

Retro-fitting existing infrastructure will be an essential part of any sustainable future. Here too there are challenges of affordability as well as capacity that financial advice can help address. "From Victorian sewers to ageing pipelines and distribution networks, a lot of infrastructure is reaching the end of its life," Lloyd explains. "Upgrading them will require technical solutions that are affordable in the long term encouraged by a favourable regulatory regime and enabled by sound long-term funding structures."

Examples are emerging of solutions that combine innovative technical and financial approaches. Lloyd highlights local partnerships delivering district energy and heating through Energy Service Companies (ESCos) as a step in the right direction. But he's adamant we can do more, finding sustainable solutions that not only make creative use of engineering design and technology but also offer businesses the opportunity to invest confidently, maximising their returns whilst reducing their risk.

Name:

Steven Lloyd.

Position:

Leader of Arup's Transaction Advice group.

Biggest challenge:

Making sustainable projects commercially viable and delivering them on a wider scale.

Most innovative work:

Combining investment banking with technical knowledge to help Nanjing Automobile Corporation acquire the assets of MG Rover and save 200 jobs in the UK.

Future aspirations:

To ensure high-quality financial advice is fully integrated with great design and sustainable solutions, improving the places we live and work.

For more information about Arup's Transaction Advice group, please email a2@arup.com.

NEW AUDIENCES

Embracing technology to attract a younger audience



1 Multimedia walls incorporating gesture recognition blur the boundaries between auditorium and lobby, interacting with visitors to provide an holistic, immersive entertainment experience.

David Taylor, leader of Arup's Performing Arts Team in New York, says the firm's repurposing of the Sony Centre in Toronto to attract a younger demographic is a sign of things to come. Attended and funded largely by older generations, the days of conventional performing arts venues could be numbered unless they can attract younger audiences. "With major arts organisations paid for by the older demographic, there's already a missing generation of audiences," Taylor explains. "This gap could widen unless venues can start engaging with younger people."

Taylor argues that if venues can explore and exploit the experiences offered by media such as video gaming, there is potential for them to reinvent themselves. But what does a generation that's more likely to experience music via 'Grand Theft Auto' than a grand piano want from performing arts venues?

When Dan Brambilla, CEO of the Sony Centre, asked for Arup's help to attract younger audiences, Taylor and his team held focus groups with the people they wanted to get through the doors. "We found that traditional venues are not addressing the kinds of personal experiences provided by video gaming," he explains. "People running cultural institutions tend to underestimate its impact."

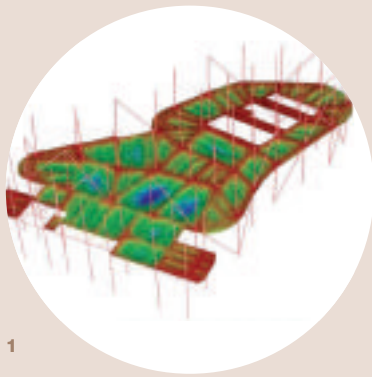
Drawing on Arup's expertise in acoustics, theatre planning, IT and communications, the design for the Sony Centre will radically change the way people engage with the building. Aimed at involving them fully before, during and after the event, it includes giant digital screens on the building's façade in place of traditional posters. Gesture recognition will allow you to interact with the screen; and outside, free wireless internet access will encourage young people to interact with the building.

Inside, leading edge audio visual technology will create an experience like no other. Hundreds of loudspeakers, including subwoofers under the seats, will deliver the perfect environment to listen to classical or rock music and watch films. But it will also be great for group gaming – a popular activity with younger audiences that has hitherto been largely ignored by arts venues. Immersive sound can even create the impression of birds flying around your head. Gesture recognition in the main lobby will allow you to paint projected colours on the wall. And the building itself remains an essential ingredient of the experience, albeit adapted to allow audiences to move around more easily rather than being restricted to sitting in rows.

However, interactivity is also about building relationships with a diverse audience, allowing venues to personalise the experience they offer and extend

their brand. For example, the Sony Centre will be able to use the gesture recognition technology to understand how long people spend looking at the various displays. The designers are also looking into USB key technology which would give people discounts or allow them to take away downloads in exchange for letting the venue know more about them. As a result, the venue is able to engage audiences from the time they book tickets, through the show and beyond.

Of course, it's not just the younger audiences of today that need to be designed for but the younger audiences of tomorrow, Taylor explains: "Incorporating leading edge technology – including Sony gaming engines on the media server – means that the Centre will be agile into the future."



1

1 Vertical deflection of the structure of The Pinnacle following exposure to a design fire.



2

2 Diagrid structure of the Swiss Re building.

3 The Pinnacle.



© Eamonn O'Mahony/KPF

Image 2 ©Nigel Young/Foster & Partners

BRACED TUBE STRUCTURES AND FIRE

Groundbreaking research

Detailed numerical models developed by Arup for The Pinnacle – a new 63-storey office building in London designed by Kohn Pedersen Fox Associates – are for the first time shedding light on exactly how perimeter braced framed steel structures behave in fires. With the potential to reduce the amount of fire protection material required, this analysis could help to save costs on the project whilst demonstrating stability and robustness to ensure that buildings can resist compartment fires.

Considered particularly efficient for high rise buildings, perimeter braced framed structures are an effective way of carrying lateral loads placed on the buildings by factors such as wind. The sophisticated structural engineering of The Pinnacle in London makes use of an optimised braced perimeter frame, with similar characteristics to a diagrid, to leave as much space as possible available inside the building.

The full response of this structural form to high temperatures has not previously been studied and engineers had to rely on prescriptive design codes which are based on studies of single element behaviour. But irregular braced tubes are by no means straightforward to model, not least because they are not all the same. “The layout of the bracing members can have a significant influence on the global response in fire,” explains Dr. Allan Jowsey, one of Arup’s Fire Engineers on The Pinnacle project. “An irregular geometry and structural frame, as found in The Pinnacle, creates members that provide locations of restraint and thermal expansion – these features act together to create a response that needs to be acknowledged.”

Understanding the response

of a perimeter braced frame can be invaluable, as it provides data that applies uniquely to the building being modelled. “We’ve taken this approach to insurance companies and their reaction has been positive,” says Jowsey. “In fact, they prefer this approach to relying on working from design codes because it quantifies the response of the building.”

Modelling an irregular braced frame can present significant challenges, as these structural forms can vary from building to building, as well as spanning many floors. The breakthrough in modelling The Pinnacle’s structure was realising that multiple floors could be modelled using a simplified coupling technique that links all the columns together within the structure – in much the same way as floor beams and a concrete slab do in reality.

The finite element analysis carried out by Arup for The Pinnacle helped quantify areas in which fire resistance was over-specified, allowing the structural design to be made more efficient and less costly. The analysis also helped pinpoint any vulnerable aspects of the design so that their resistance to fire could be strengthened.

Dr. Barbara Lane, Technical Leader of Arup Fire, won a prestigious Royal Academy of Engineering Silver Medal for her work on applying complex computer analysis to commercial projects. “It’s been fascinating applying these techniques and creating real building solutions,” says Lane. “But there is still plenty of research to do in order to fully understand how diagrids behave in fires.”

Arup is carrying out the structural, geotechnical, wind and fire engineering for The Pinnacle, which is due to be completed in 2011.



NEXT ISSUE

Interview special | Winter 2008

We are keen to ensure that this publication is enjoyed by our readers and provides interesting, relevant and informative articles. All feedback is welcome, so please send your comments and

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