# Knowledge Management @ Arup

**Ricky Tsui**

**R&D Leader, East Asia**

ARUP

# About Arup

Xicui Entertainment Complex, Beijing, China

Established in 1946

Today we have over 10,000 people

operating in more than 90 offices

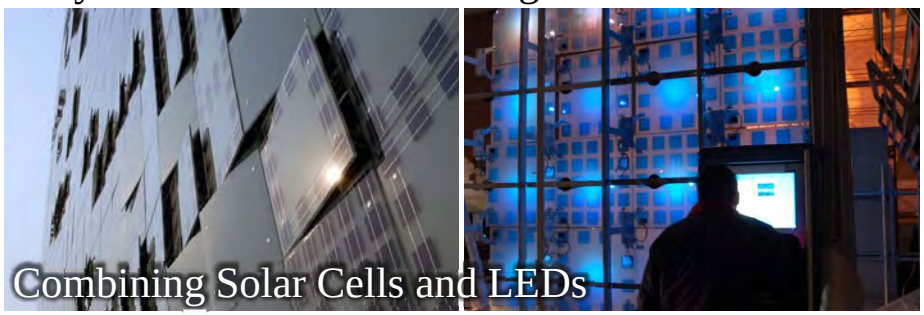
Hong Kong office opened in 1976

having about 1,500 staff

Totally 2,200 staff in East Asia

Day-time

Night-time


Combining Solar Cells and LEDs



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We are a global firm of engineers, designers, planners and business consultants providing total design, planning, engineering and business solutions



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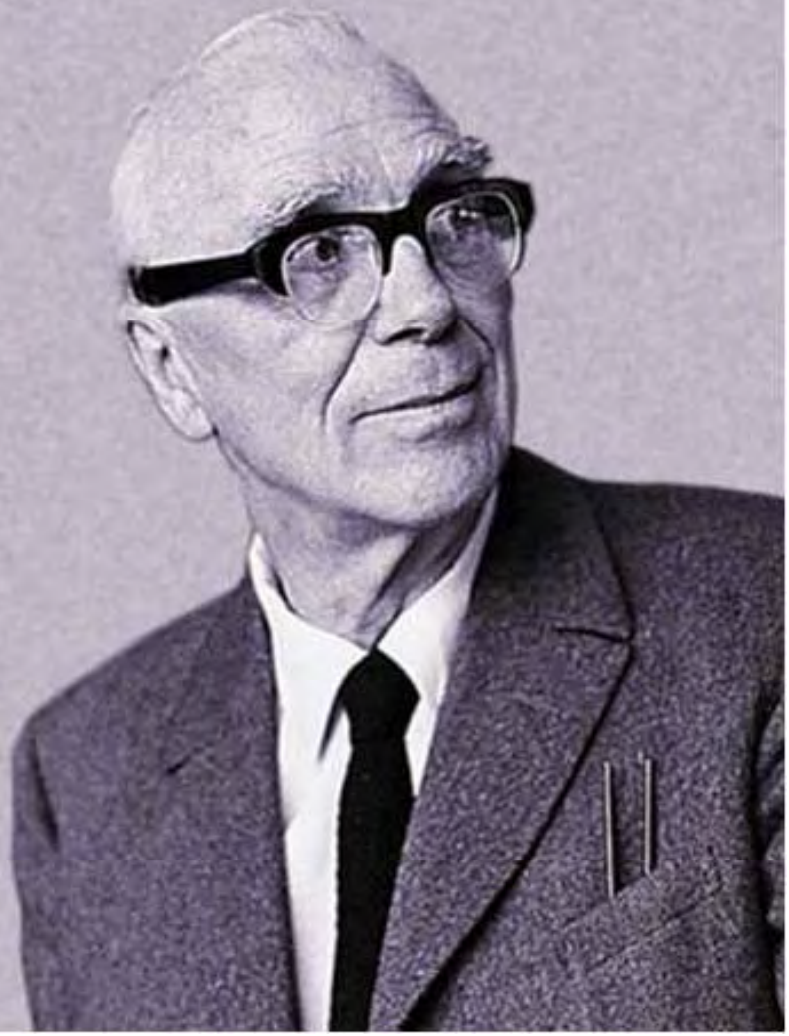
# We shape a better world

We foster a strong culture built on the values and ethos of our founder

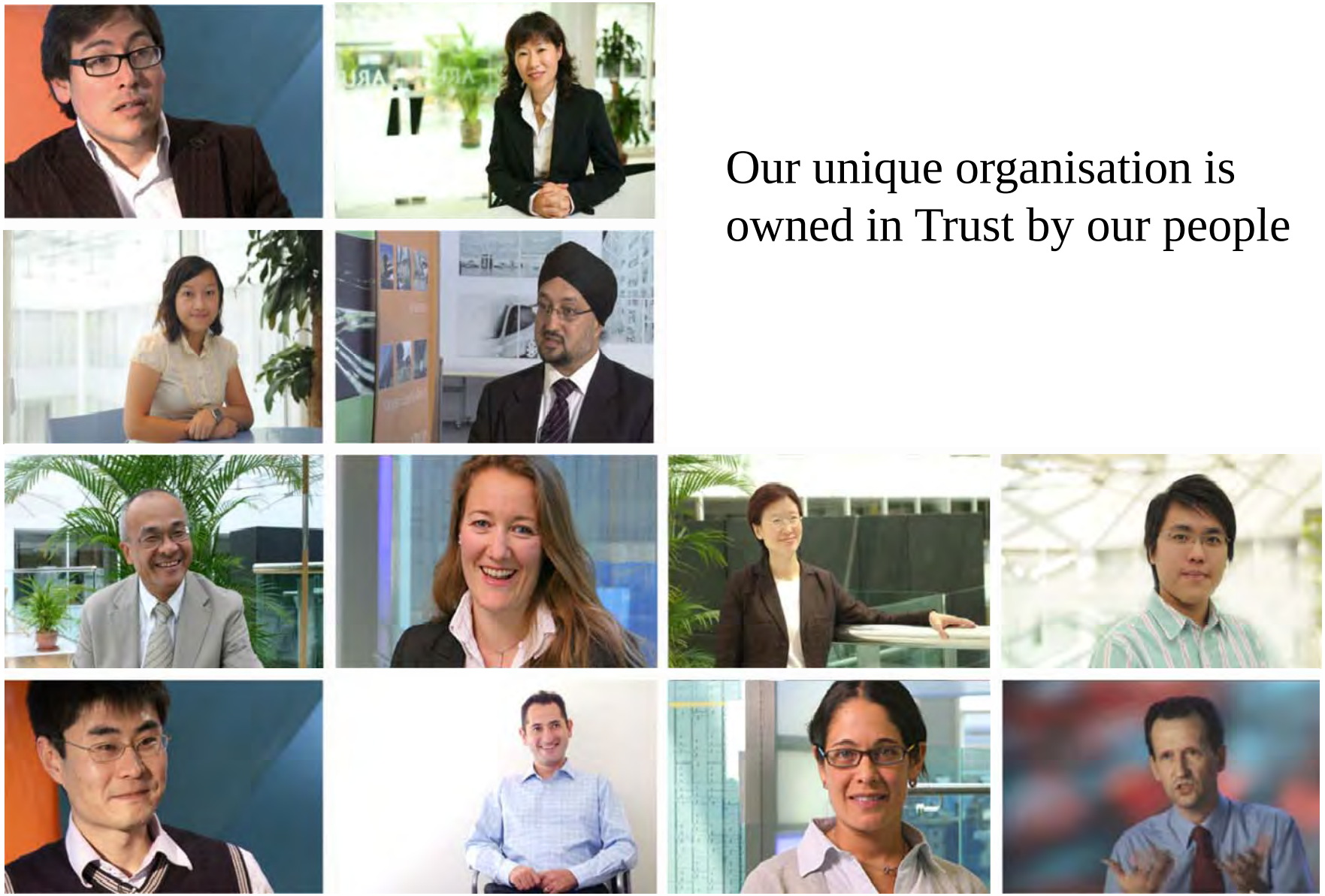
- To enhance prosperity and quality of life
- To deliver real value
- To have the freedom to be creative and learn



Sir Ove Arup (1895-1988)



ARUP



Our unique organisation is owned in Trust by our people



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# We have been delivering iconic design for over 60 years

**Beijing National Stadium & National Aquatics Centre**



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We are able to tackle the most challenging projects

**Stonecutters Bridge, Hong Kong**



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Hong Kong-Zhuhai-Macau Bridge, China

Samsung Green Tomorrow, South Korea

Hundreds of landmark structures and remarkable consultancy projects

Osaka Maritime Museum, Osaka, Japan



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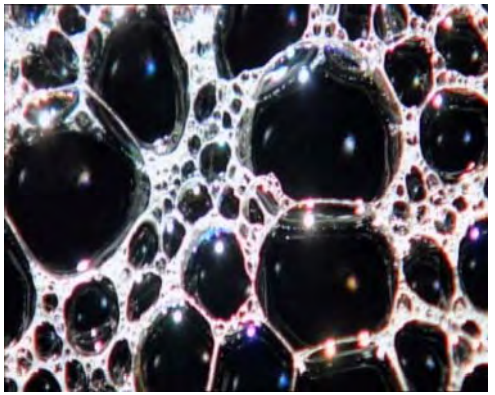
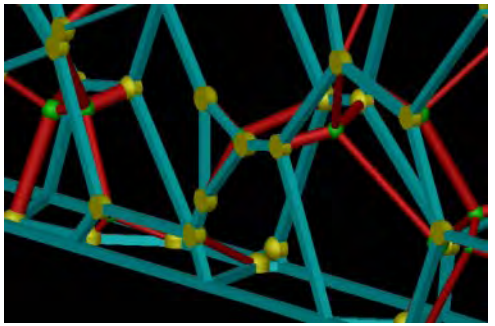
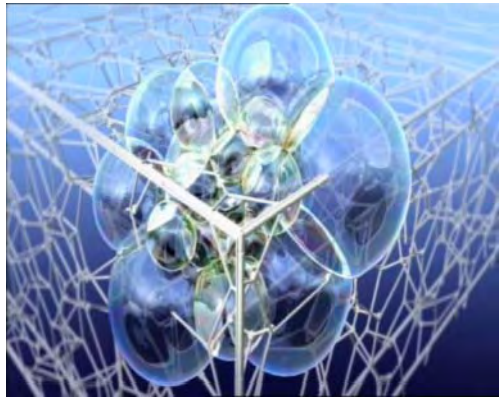
- **Collaboration with external partners**
- **Multi-disciplinary skills**

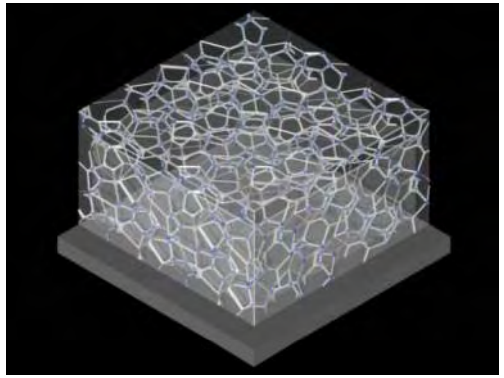


**Concept & Design**

**Structure**



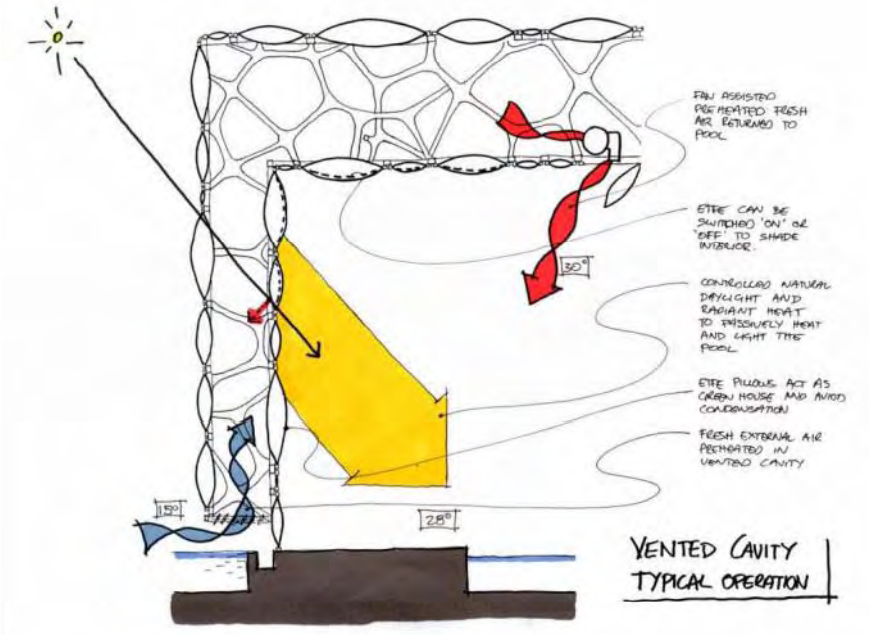


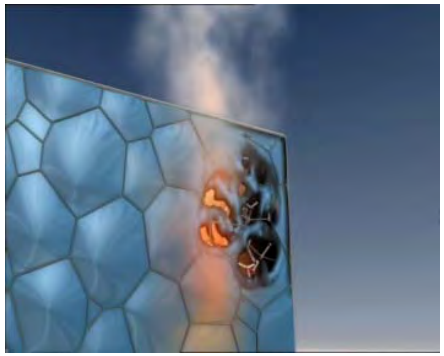


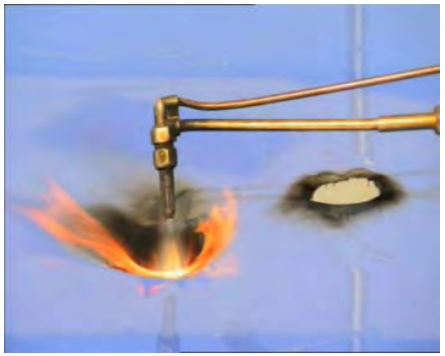
## Collaboration Parties

- Arup
- PTW Architects
- China State Construction Engineering Corporation(CSCEC)
- China State Construction International Shenzhen Design Consulting Co

- **Collaboration with external partners**
- **Multi-disciplinary skills**



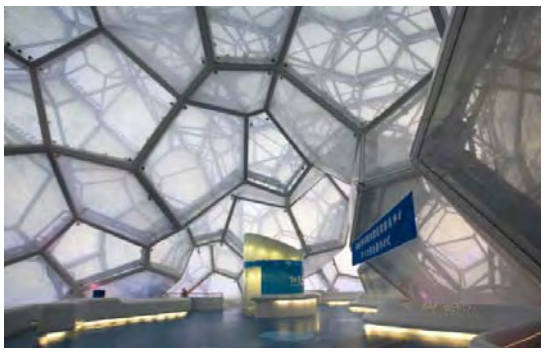





**Sustainability**

**Fire Engineering**

**Construction Management**





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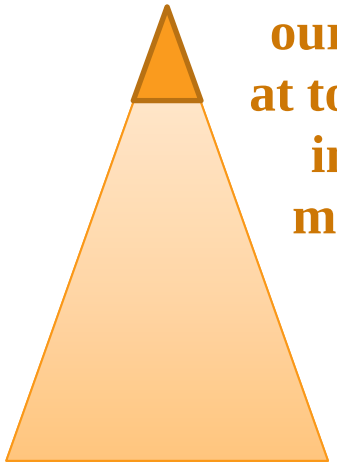
# Need of Knowledge Management

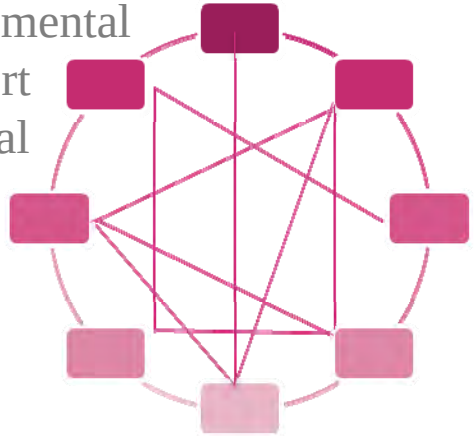
## Demand of High-end Technology



**Arup position ourselves at top 10% in the market**

## Multi-disciplinary Skills

Structural
Geotechnical
Mechanical
Environmental
Transport
Electrical
Civil …



**Skills mapping diagram**

## Drive Innovative Design



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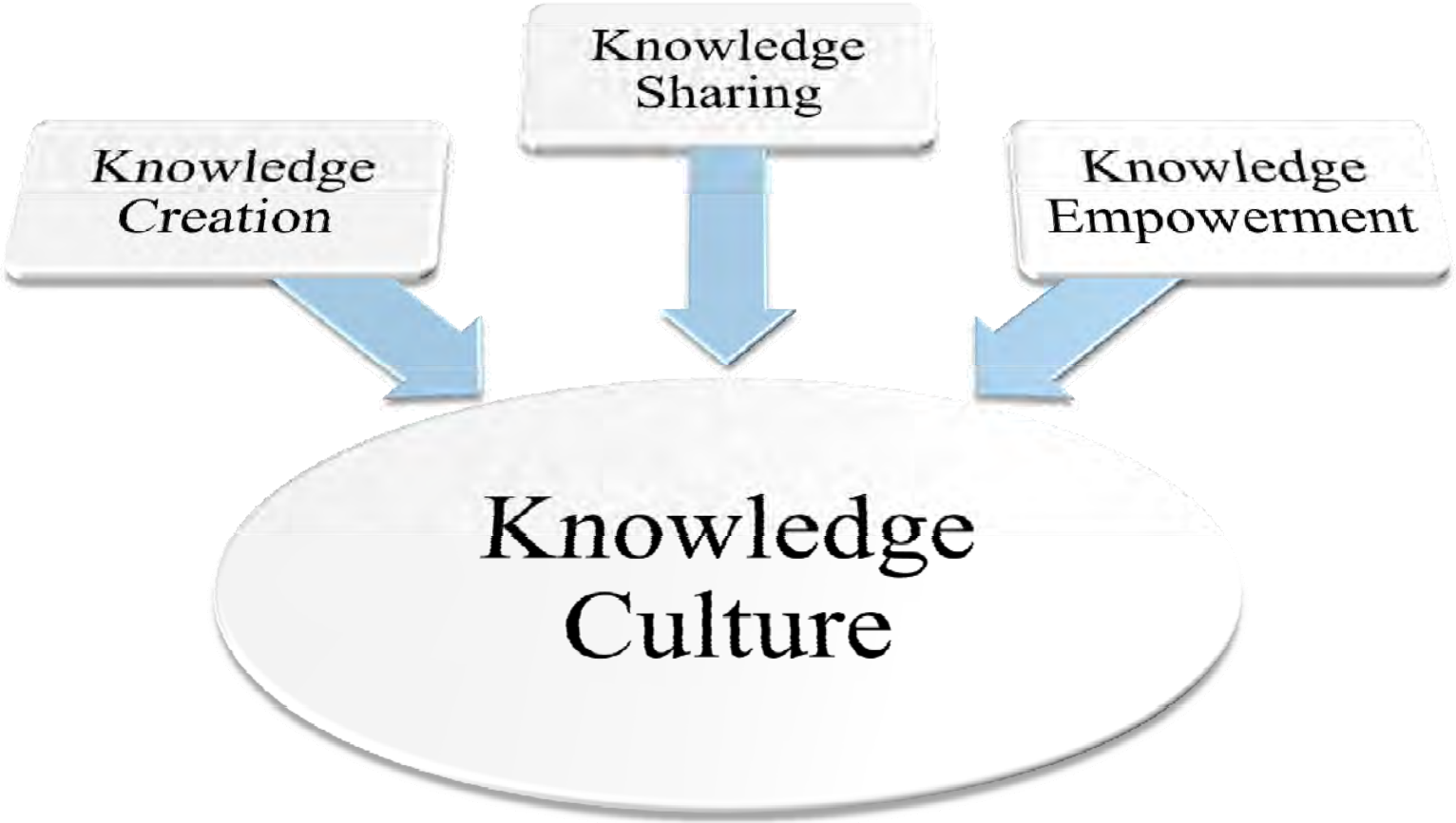
# Arup Knowledge Culture



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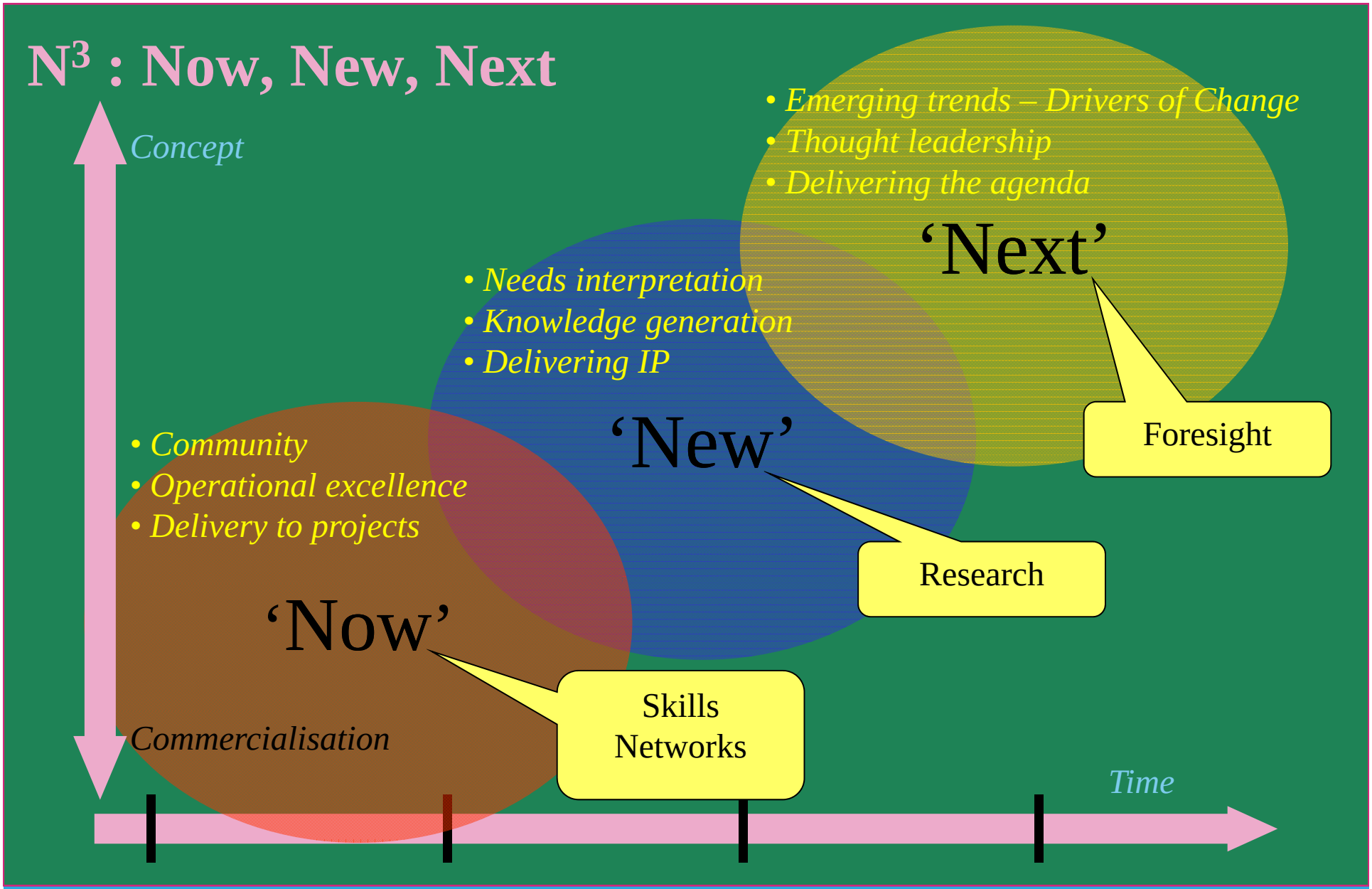
## Proactive knowledge creation in parallel with knowledge harvesting on client projects



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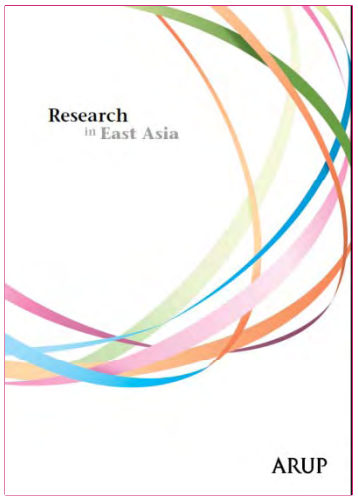
# Research & Skills Development

- Roadmapping
  - Drivers, Business Opportunities & Research Elements

risk & disaster

| | | 2012 SHORT-TERM (t < 3yrs) | 2019 MID-TERM (3yrs < t < 10yrs) | 2039 LONG-TERM (t > 10yrs) |
|---|---|---|---|---|
| DRIVERS | | 1. Natural disaster (earthquake, flood, wind, fire, typhoon, landslide, etc.) (Manila/Bangkok/Tokyo) | | |
| | | 2. Safety in high-rise buildings (Bangkok) | | |
| | | 3. Diseases (Bangkok/Beijing/Tokyo) | | |
| | | 4. Terrorist attack (Beijing/Tokyo) | | |
| | | | 5. Critical system failure (Beijing) | |
| | | 6. Food safety (Tokyo) | | |
| | | 7. Tighter security requirement (Tokyo) | | |
| RESEARCH ELEMENTS | | Efficient seismic/structural evaluation & retrofit design [SS] (Manila/Beijing/Japan) | | |
| | | FRP for seismic retrofit of existing RC buildings [RT] (Manila) | | |
| | | Efficient structural systems for medium- to high-rise buildings [RT] (Manila)* | | |
| | | Seismic design technology [RT] (Beijing) | | |
| | | Study of seismic zoning for planning purpose [RT] (Beijing) | | |
| | | Seismic control device & system database [RT] (Tokyo/Bangkok) | | |
| | | Establish an after-earthquake survey team [SS] (Beijing) | | |
| | | Cost study of base isolation for buildings locally [RT] (Manila) | | |
| | | Cost study of green retrofitting locally [RT] (Manila) | | |
| | | | Progressive collapse research [RT] (Beijing) | |
| | | | | Demolition method studies [RT] (Beijing) |
| | | Study on previous typhoon path, frequency, maximum wind speed, maximum rainfall and size of affected area [RT] (Manila) | | |
| | | Identification of environmentally critical geographical areas [RT] (Manila)* | | |
| | | Risk assessment for extreme events (earthquake, typhoon, flood, fire) [RT] (HK)** | | |
| | | | | Underground water extraction technology [SS] (Tokyo) |
| | | Research for slip-rate of active fault system [RT] (Manila) | | |
| | | | City flooding protection & prevention solutions [SS] (Bangkok) | |
| | | | | Develope a method to explore the earth beneath [RT] (Beijing) |
| | | | Data-plotting of information for GIS [RT] (Manila)* | |
| | | Smoke control analysis [SS] (Bangkok) | | |
| | | Study on material flammability & flame dispersion pattern [RT] (Bangkok) | | |
| | | | Specific fire size determination [RT] (Beijing) | |
| | | | Research on fire spread for high-rise buildings [RT] (Beijing) | |
| | | | Research into fire performance design to structure [RT] (Beijing) | |
| | | | Study new clean agent for fire suppression [SS] (Bangkok) | |
| | | | Fire smoke dispersion modelling [RT] (Bangkok)* | |
| | | | | Lift evacuation of buildings [RT] (Beijing) |
| | | X-ray, ultra-sonic and other checking technologies for security [SS] (Tokyo) | | |
| | | Bio-gas diffusion protector in public space [SS] (Tokyo) | | |
| | | | "Arup shelter" design [RT] (Tokyo) | |
| | | | Self-electricity supply in buildings after disaster [RT] (Beijing) | |
| | | | | Study of airborne diseases spreading in buildings [RT] (Beijing) |
| | | Indoor air purification method assessment [RT] (HK)* | | |
| | | Personal air quality monitoring systems [RT] (HK) | | |
| | | | Fire resistant materials [SS] (Shenzhen) | |

* High priority





Roadmapping Exercise

Research & Innovation


See all research reports

See all categories of funding

- Application by related leaders – to ensure meeting business needs (***top-down***)
- Allowing for blue-sky research from all colleagues (***bottom-up***)

**Capture global research findings to avoid reinvent the wheel**

# Research & Skills Development

Creation | Sharing | Empowerment

- More than 450 research projects per year

**Slope Monitoring using Optic Fiber**

**Fire test for Quake Resistance Facade**

kit 국립금오공과대학교 Kumoh National Institute of Technology

UNIVERSITY OF CAMBRIDGE

KOGEI TOKYO POLYTECHNIC UNIVERSITY

KANAGAWA UNIVERSITY

KOREA INSTITUTE OF CONSTRUCTION TECHNOLOGY

The University of Hong Kong

東北大学 TOHOKU UNIVERSITY

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學

中國建築科學研究院 China Academy of Building Research

瑞安房地產 SHUI ON LAND

FUDAN UNIVERSITY 1905

同濟大學 TONGJI UNIVERSITY

香港城市大學 City University of Hong Kong

UCL

香港科技大學 THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

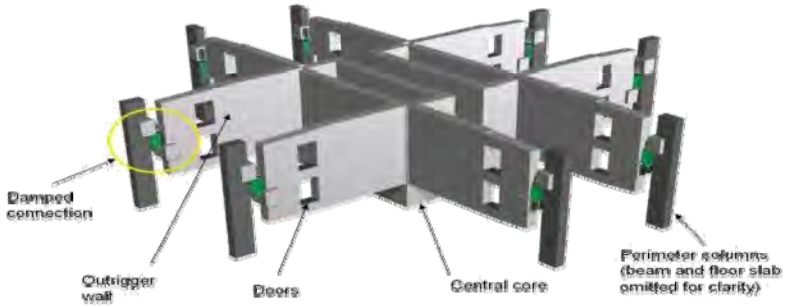
WASEDA University

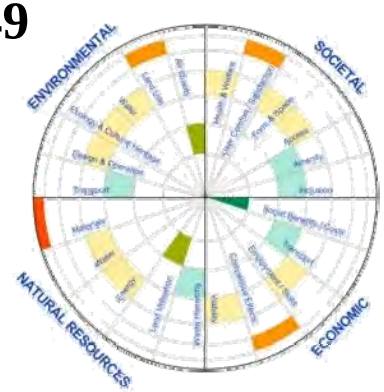
東京理科大学 Tokyo University of Science

# Intellectual Property



- **Intellectual Property Executive to oversee the development of our IP globally**
  - **Patents (incl. all in patent families): 40**
    - Damping systems for high-rise
    - Pocket habitat for green roof
    - Balustrade systems
  - **Trademarks: 49**
    - SPeAR



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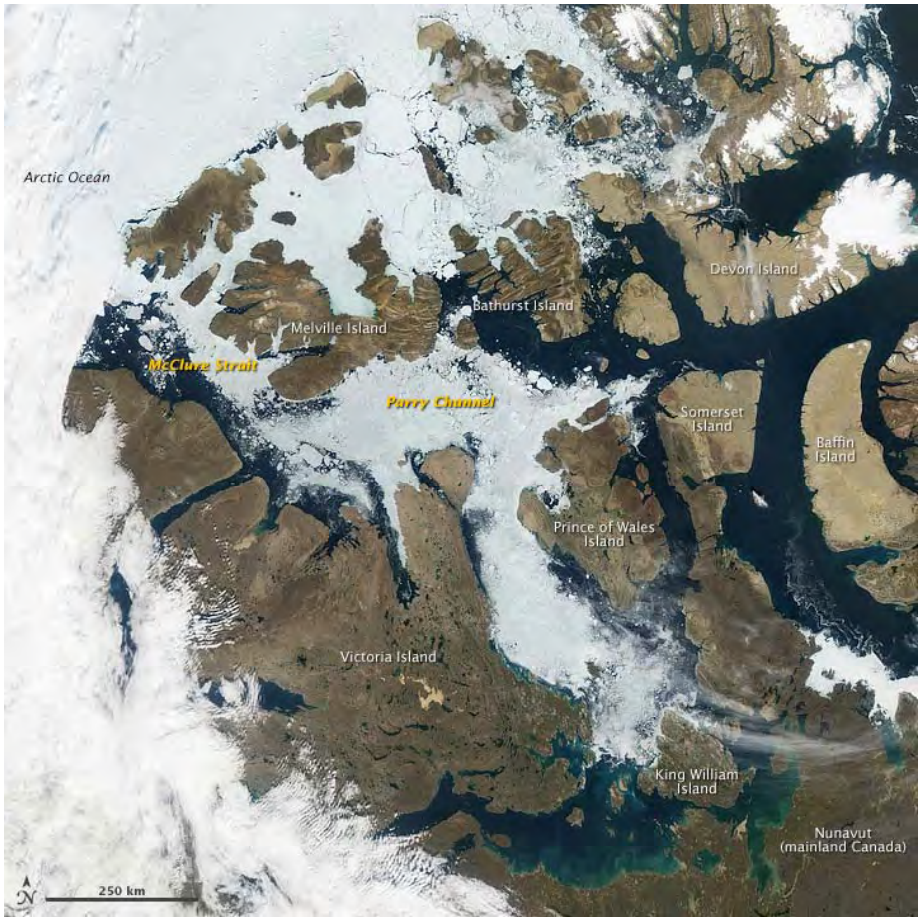
# Foresight – Knowledge of the Future?

*Shaping (Y)our strategy*


*Threat or Opportunity?*

# Foresight

## Arctic Passages – Implications




*Northwest Passage, Late August 2009*
*(http://earthobservatory.nasa.gov/IOTD/view.php?id=40046)*

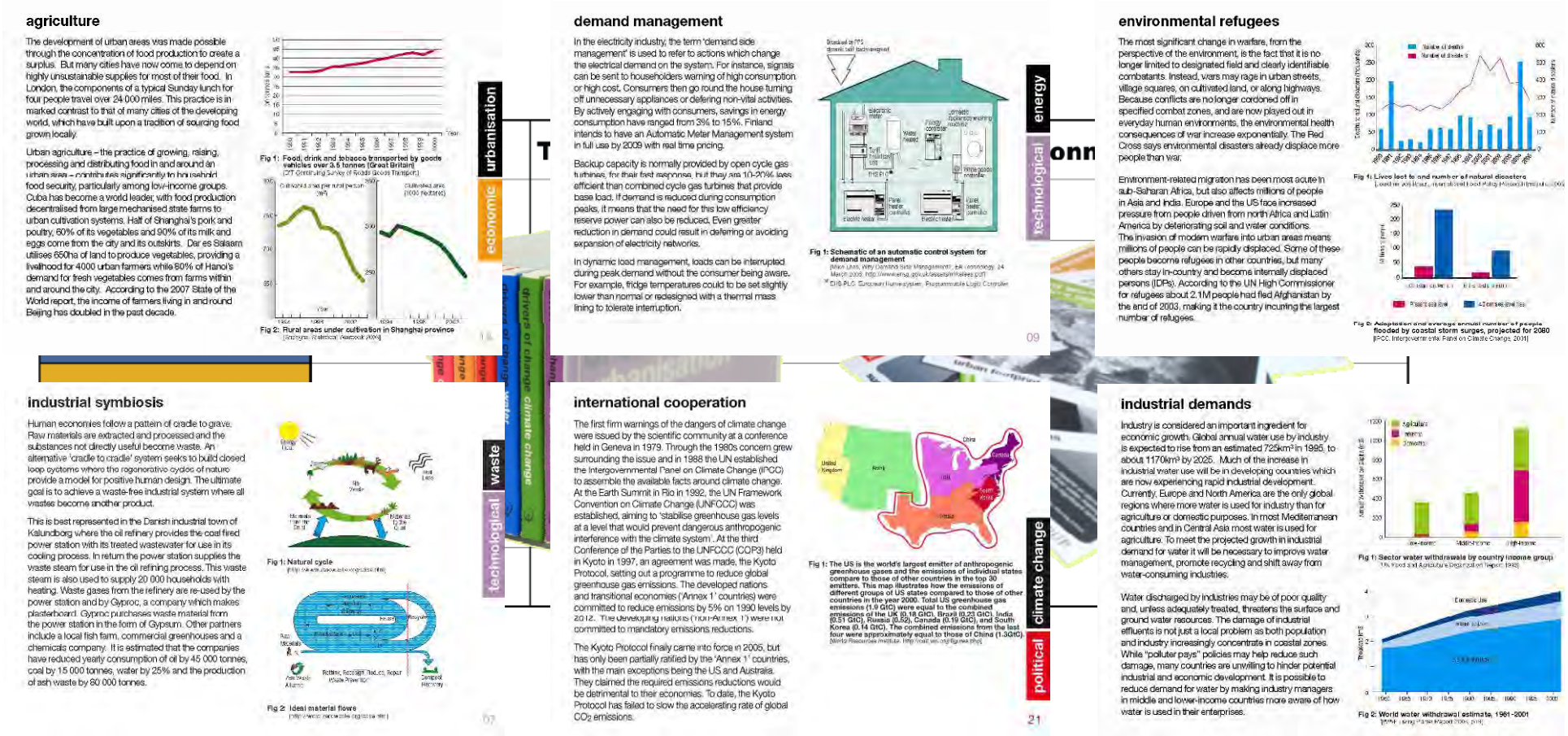
**Current world shipping lanes**

- Fuel efficiency and $CO_2$ emissions
- Panama Canal Expansion
- Untapped resources in Northern Canada


*Threat or Opportunity?*

# DRIVERS OF CHANGE

World-leading research disseminated to every employee



# Thought Leadership

- Drivers of Change




Foresight Research



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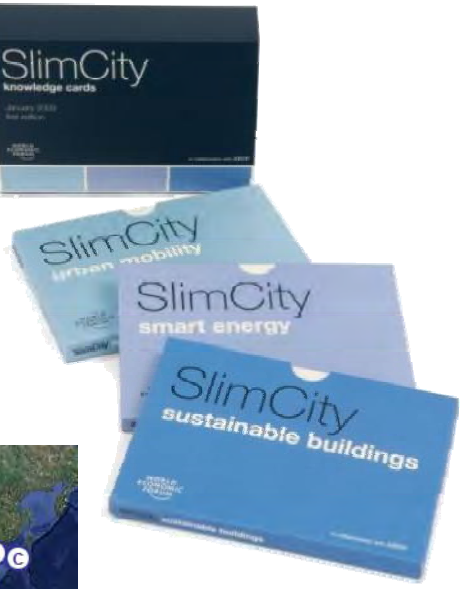
# Thought Leadership

Creation | Sharing | Empowerment

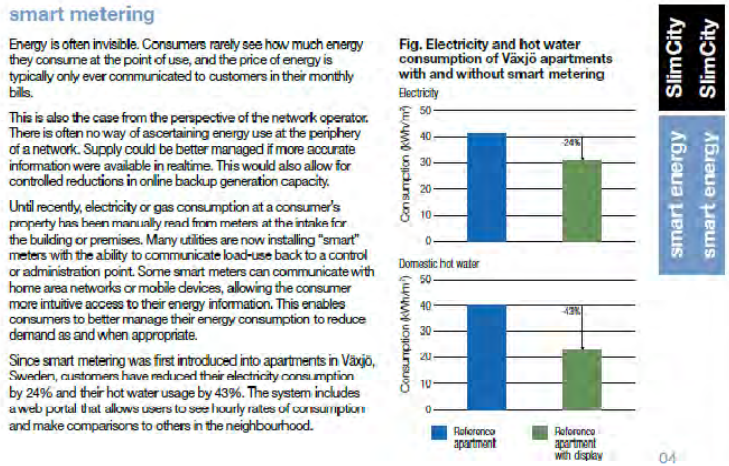
- E.g. SlimCity Knowledge Cards (C40 Partnership)


WORLD ECONOMIC FORUM
COMMITTED TO IMPROVING THE STATE OF THE WORLD




CLINTON FOUNDATION | CLINTON CLIMATE INITIATIVE

*Smart Energy*



smart metering

Energy is often invisible. Consumers rarely see how much energy they consume at the point of use, and the price of energy is typically only ever communicated to customers in their monthly bills.

This is also the case from the perspective of the network operator. There is often no way of ascertaining energy use at the periphery of a network. Supply could be better managed if more accurate information were available in realtime. This would also allow for controlled reductions in online backup generation capacity.

Until recently, electricity or gas consumption at a consumer's property has been manually read from meters at the intake for the building or premises. Many utilities are now installing "smart" meters with the ability to communicate load-use back to a control or administration point. Some smart meters can communicate with home area networks or mobile devices, allowing the consumer more intuitive access to their energy information. This enables consumers to better manage their energy consumption to reduce demand as and when appropriate.

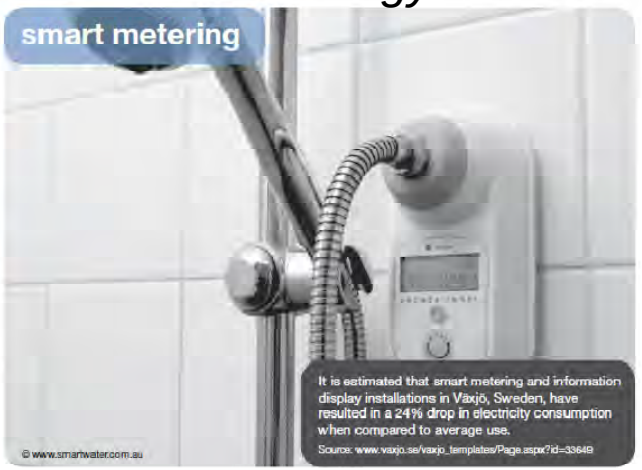
Since smart metering was first introduced into apartments in Växjö, Sweden, customers have reduced their electricity consumption by 24% and their hot water usage by 43%. The system includes a web portal that allows users to see hourly rates of consumption and make comparisons to others in the neighbourhood.

Fig. Electricity and hot water consumption of Växjö apartments with and without smart metering



04

SlimCity SlimCity smart energy smart energy




C40 CITIES CLIMATE LEADERSHIP GROUP
Participating cities

**Foresight Research**

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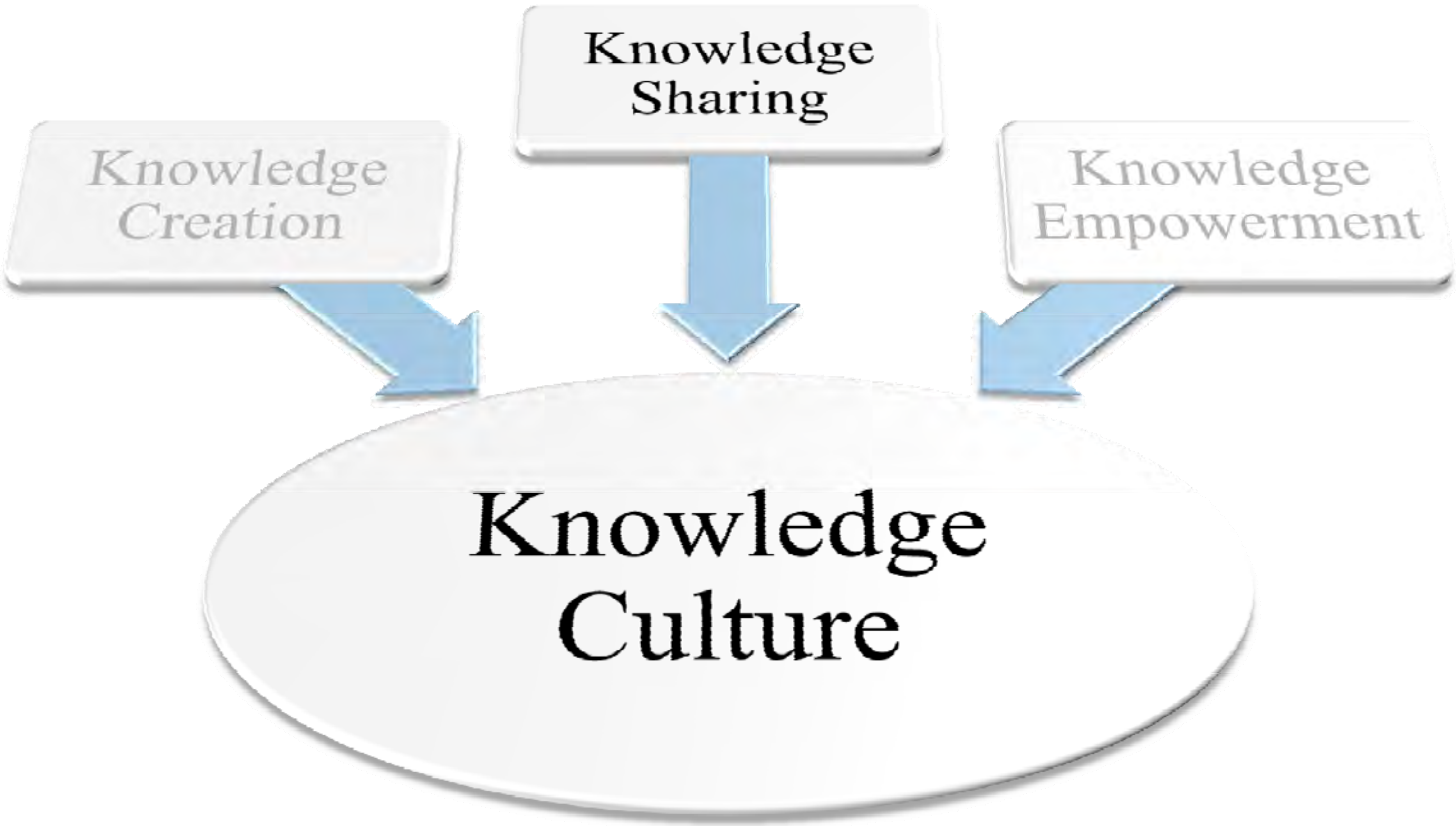
# Arup Knowledge Culture



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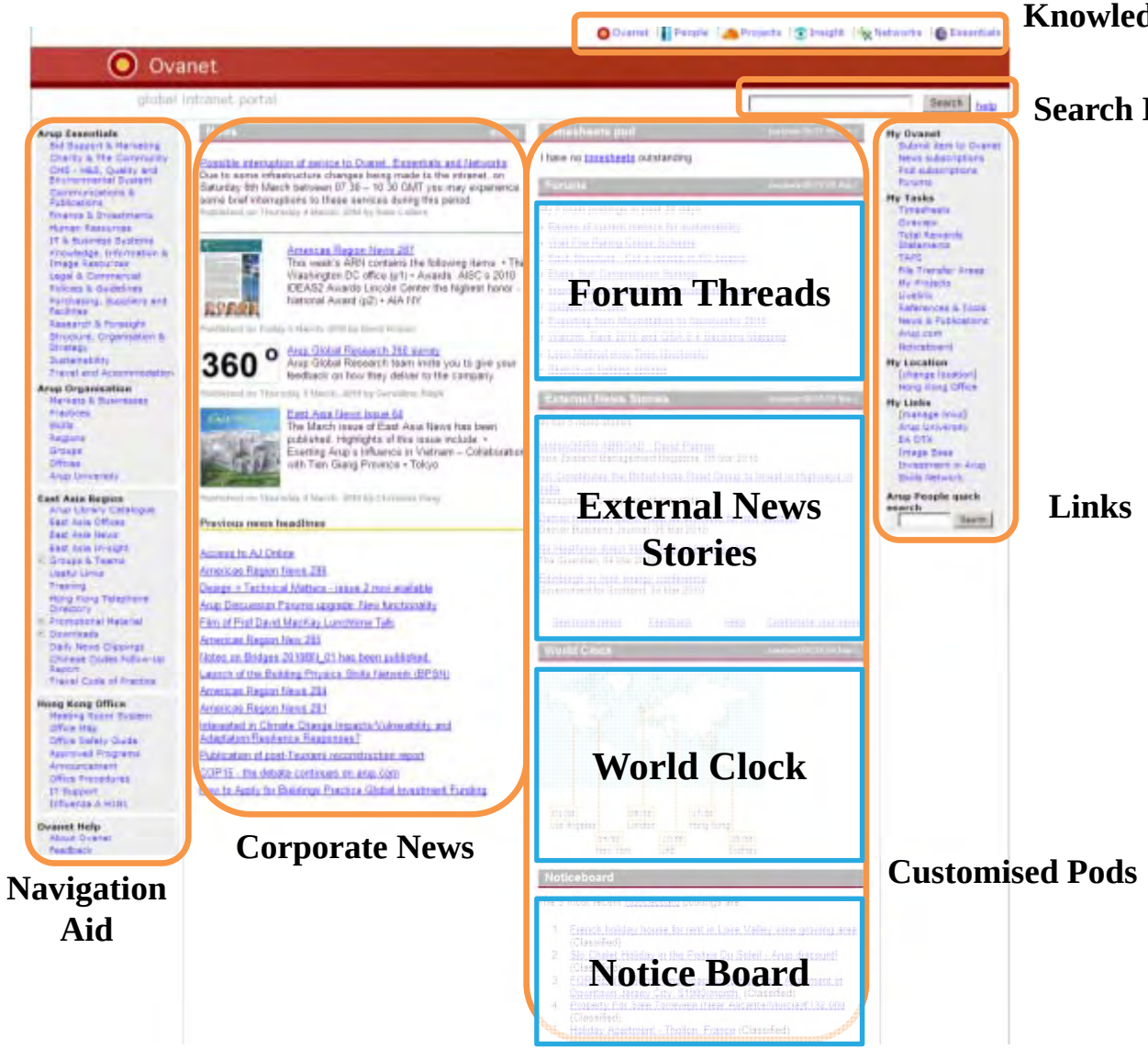
# Arup Portal



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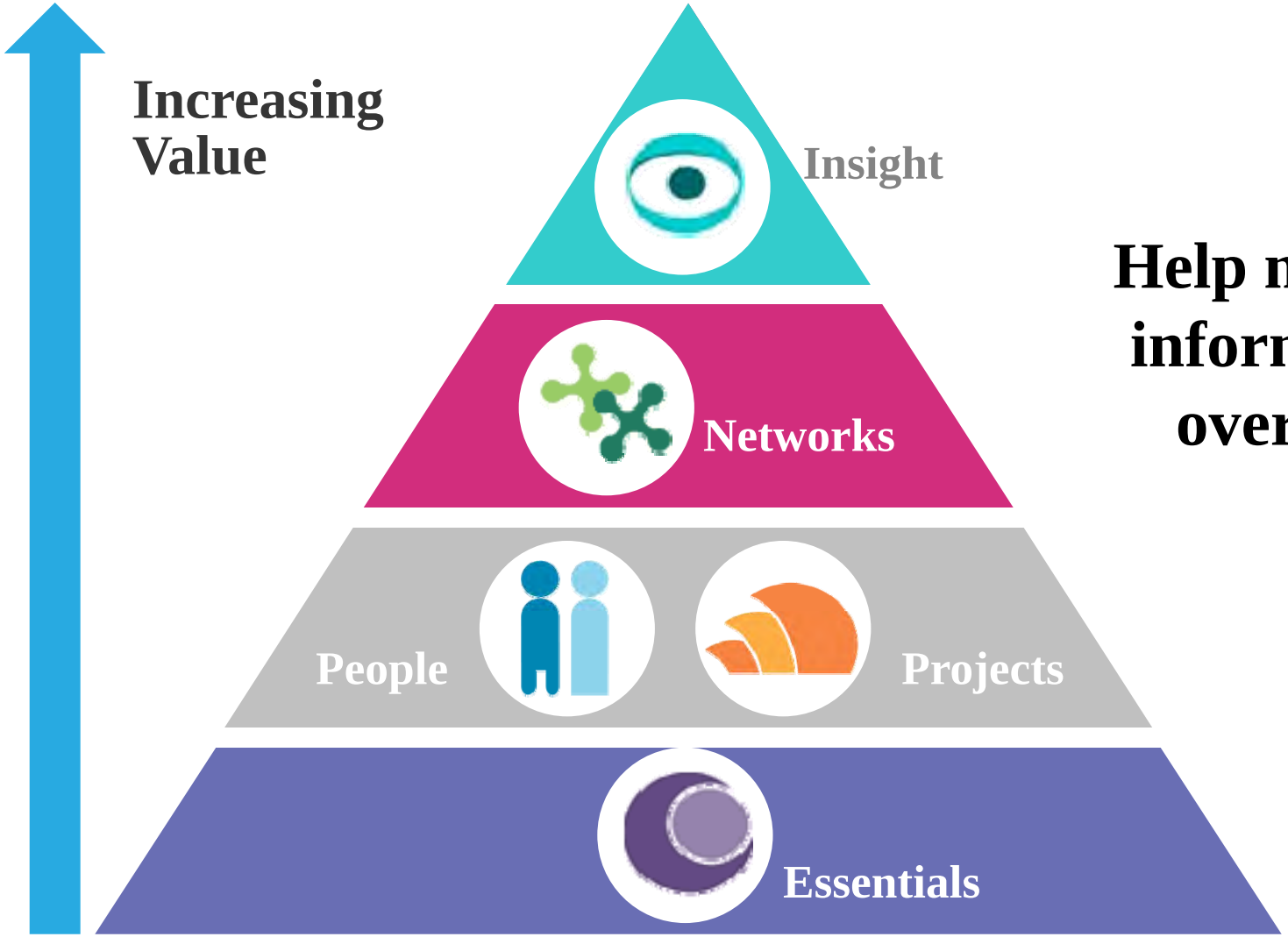
# Knowledge Brands




**Help manage information overload**



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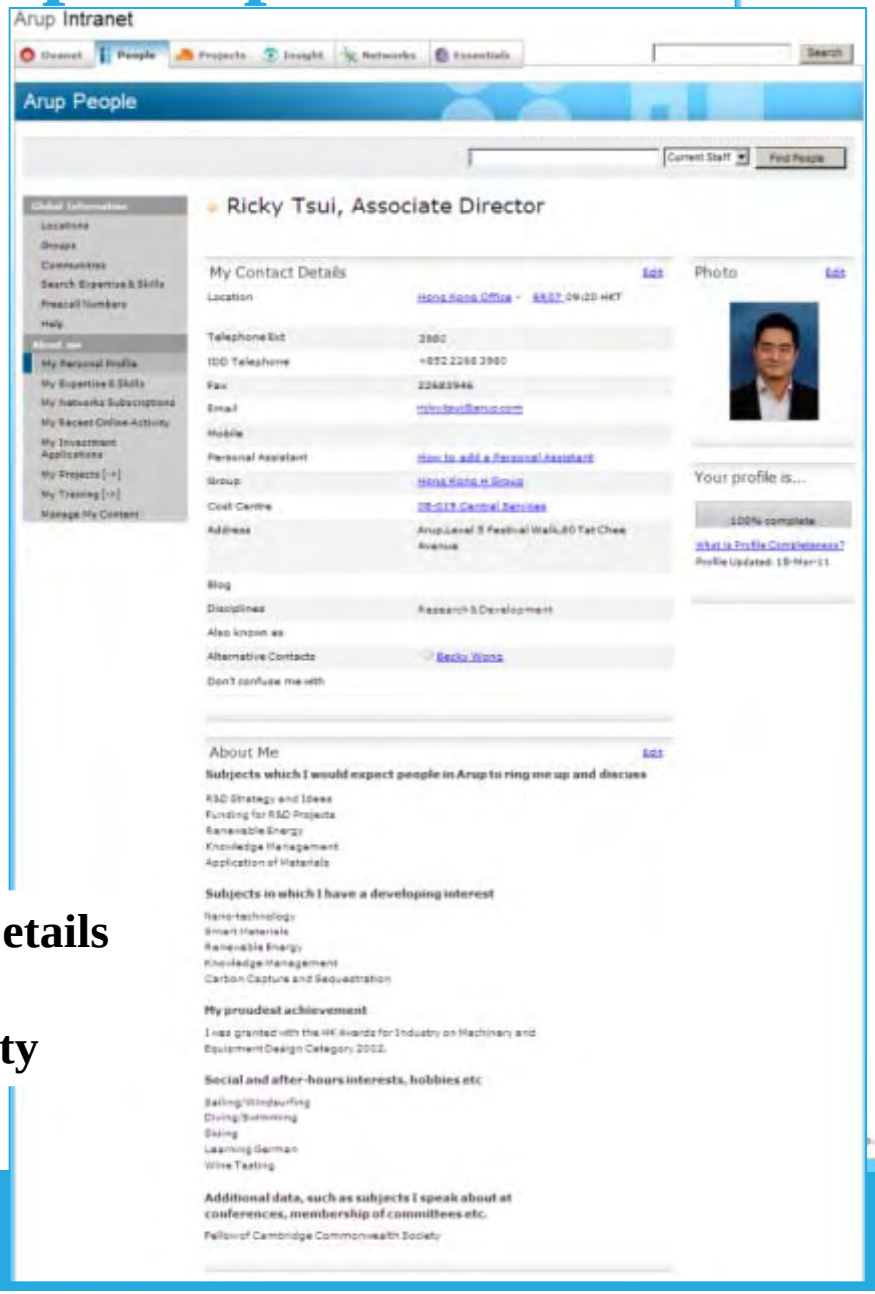
# Arup People

Creation | Sharing | Empowerment





**Contact Details**
**Expertise**
**Community**



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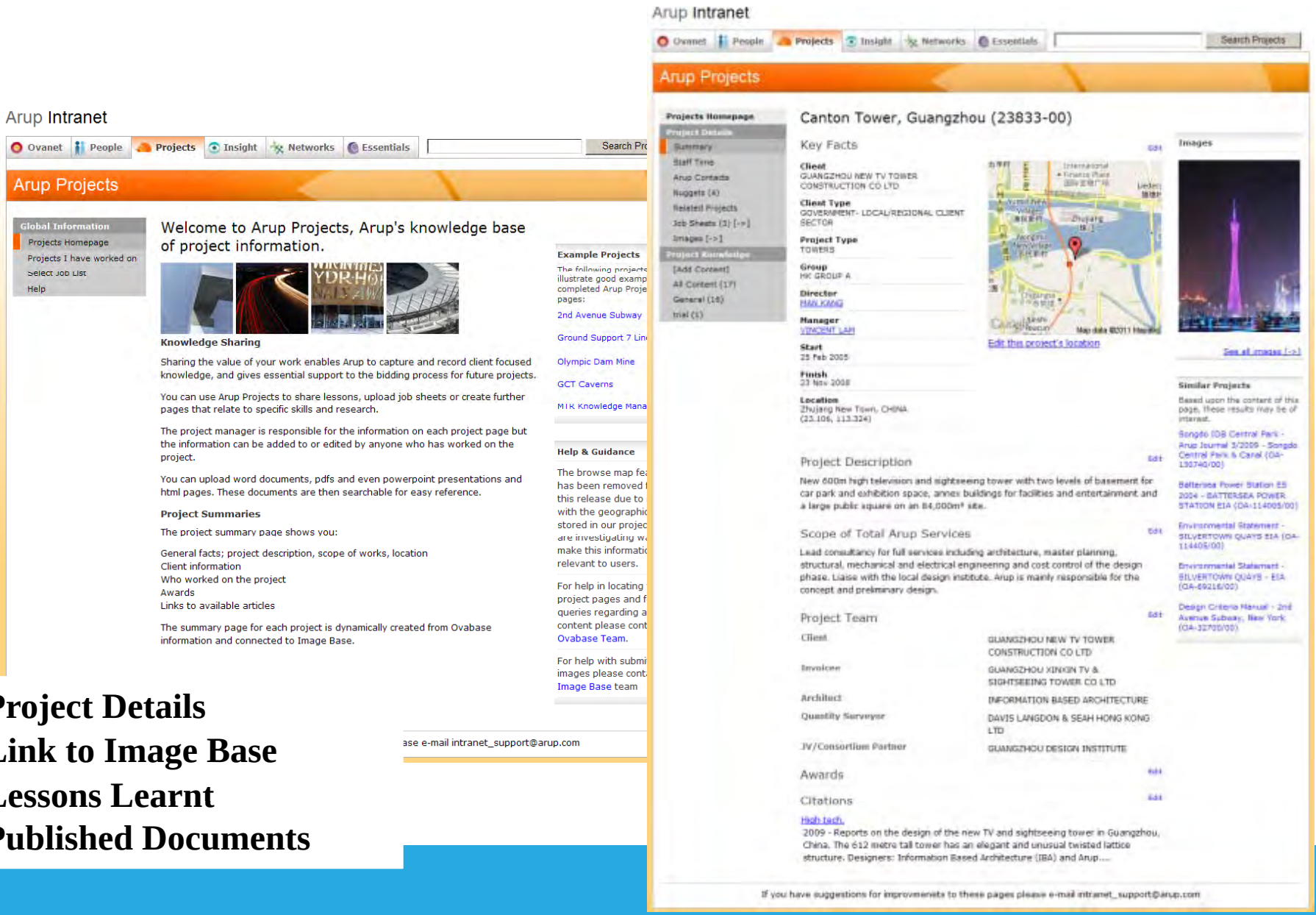
# Arup Project

Creation | Sharing | Empowerment




**Project Details**
**Link to Image Base**
**Lessons Learnt**
**Published Documents**

# Project Knowledge

Creation | Sharing | Empowerment


**Project / Close-out Review**

## Dinghe Tower: Shenzhen's Newest Green High-rise

Jane Zhang and Qian Chen, Shenzhen

After 10 years intensive construction, the 413ha Shenzhen Futian CBD has been almost completely filled with square high-rise blocks. The Dinghe Tower is one of the last to be built in this district and, unlike its predecessors, which emerged from empty land, it sits in a complex urban landscape where it has an important role promoting the identity of a new commercial area and reintroducing intimacy and a 'human touch' to a rigid urban landscape.

Invited by China Southern Power Grid, Arup took part in the influential design competition for the headquarters of the Dinghe Insurance Company. After two rounds of competition, we were finally placed as one of the three winners! Led by the Shenzhen Architecture and Planning team, for the first time, architects and engineers in the Shenzhen office worked together with Arup Associates in London, gaining experience from this exciting and fruitful collaboration.

Dinghe is a 200m high tower, providing 100,000m² of headquarter office and rental office space together with 6,670m² of conference and retail space. In our design, space planning was undertaken with a climate strategy and a creative structural design. Our integrated design logic has shaped the building to a unique form, bringing out the building qualities in various dimensions.

### Reacting to Shenzhen climate

This is where the inspiration begins. The form of the tower starts from a square shape at the ground with the four corners twisting and enlarging as they climb. The form is very much like a blooming flower, the upper portion becomes four fingers projecting out and this helps to enable natural ventilation and natural lighting. The form also enables the upper part of the tower to have sky gardens on the east and west faces, bringing the advantages of micro-climate such as self shading and indirect daylight. Vertical fins have also been introduced to the four twisting corners. With a special design of their profile, the fins provide shading subject to the direction and height of the tower, consequently creating better lighting quality and energy saving. Dinghe is custom-made for Shenzhen's sub-tropical weather.

### Respecting the urban context and improving urban identity

With respect to the existing urban context, the tower has a square footprint and its four façades align with the streets at ground level. An intimate landscape garden has been placed at the northwest of the site creating a welcoming entrance to pedestrians coming from the metro station. A grand headquarters lobby has been placed to the south facing the main road. The entire ground floor is penetrated with urban routes, making the building, and even the site more accessible and creating a social space at a human scale in the heart of the CBD. »



**Internal Newsletter**



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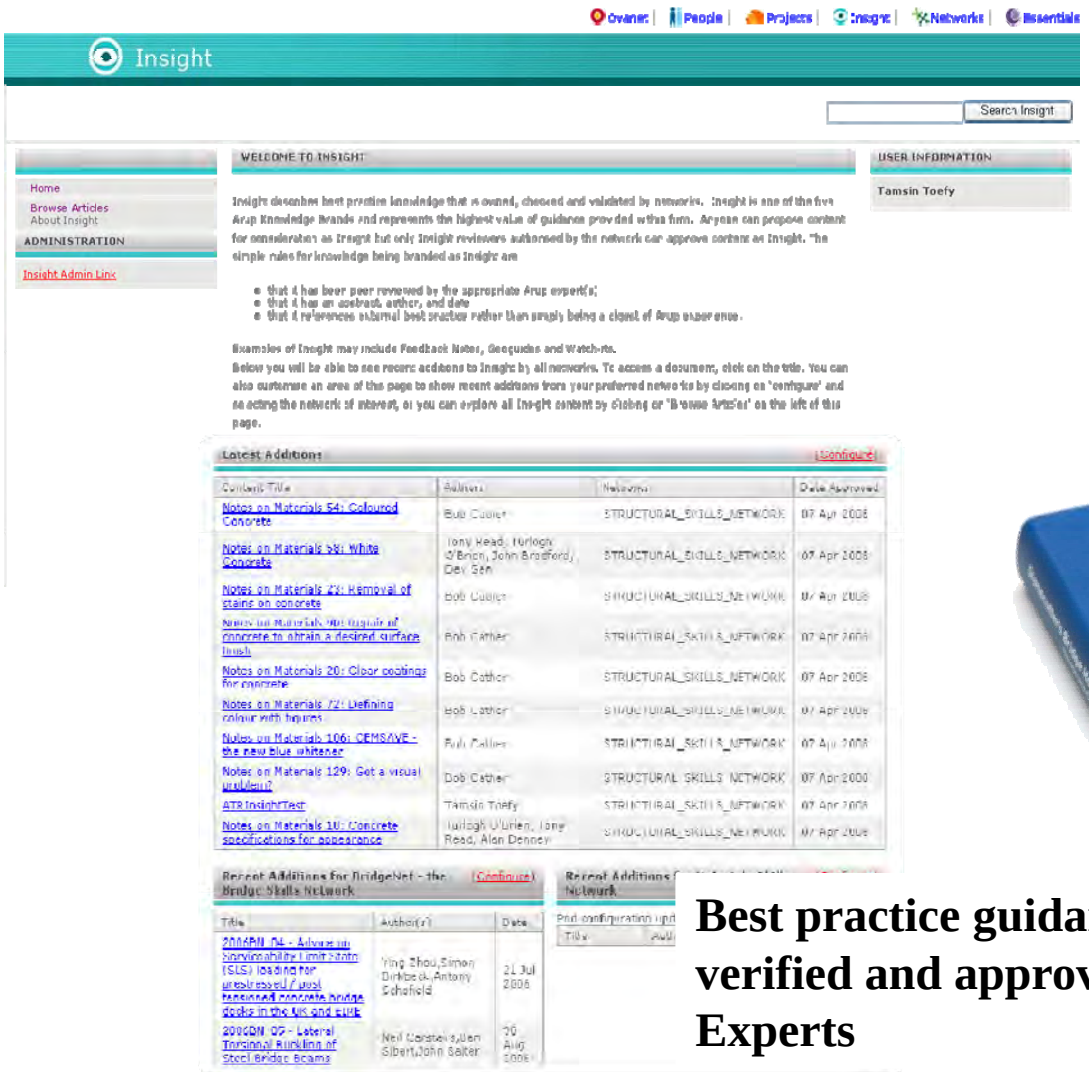
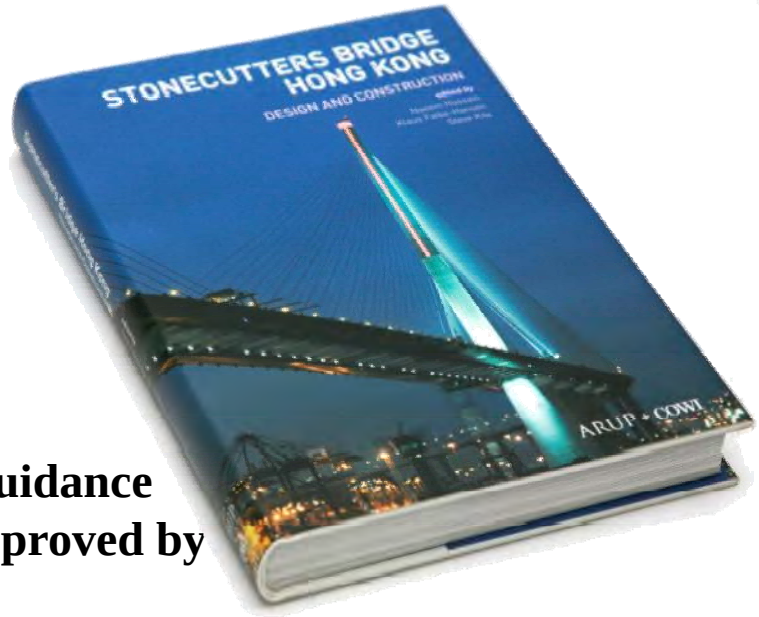
# Insight

Creation | Sharing | Empowerment




**Best practice guidance verified and approved by Experts**



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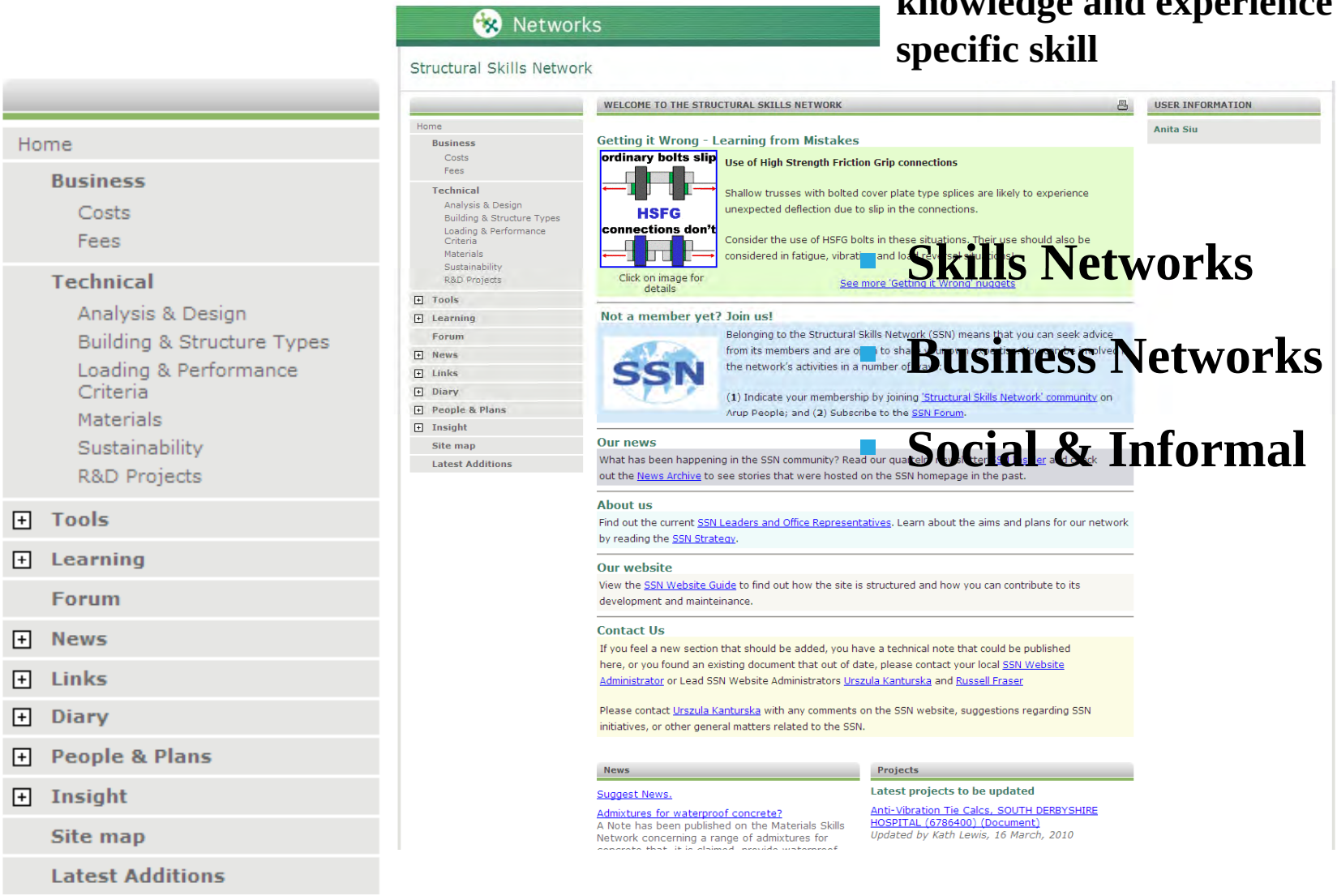
# Networks

Creation | Sharing | Empowerment

**Platform for colleagues sharing knowledge and experience of a specific skill**




**Skills Networks**

**Business Networks**

**Social & Informal**



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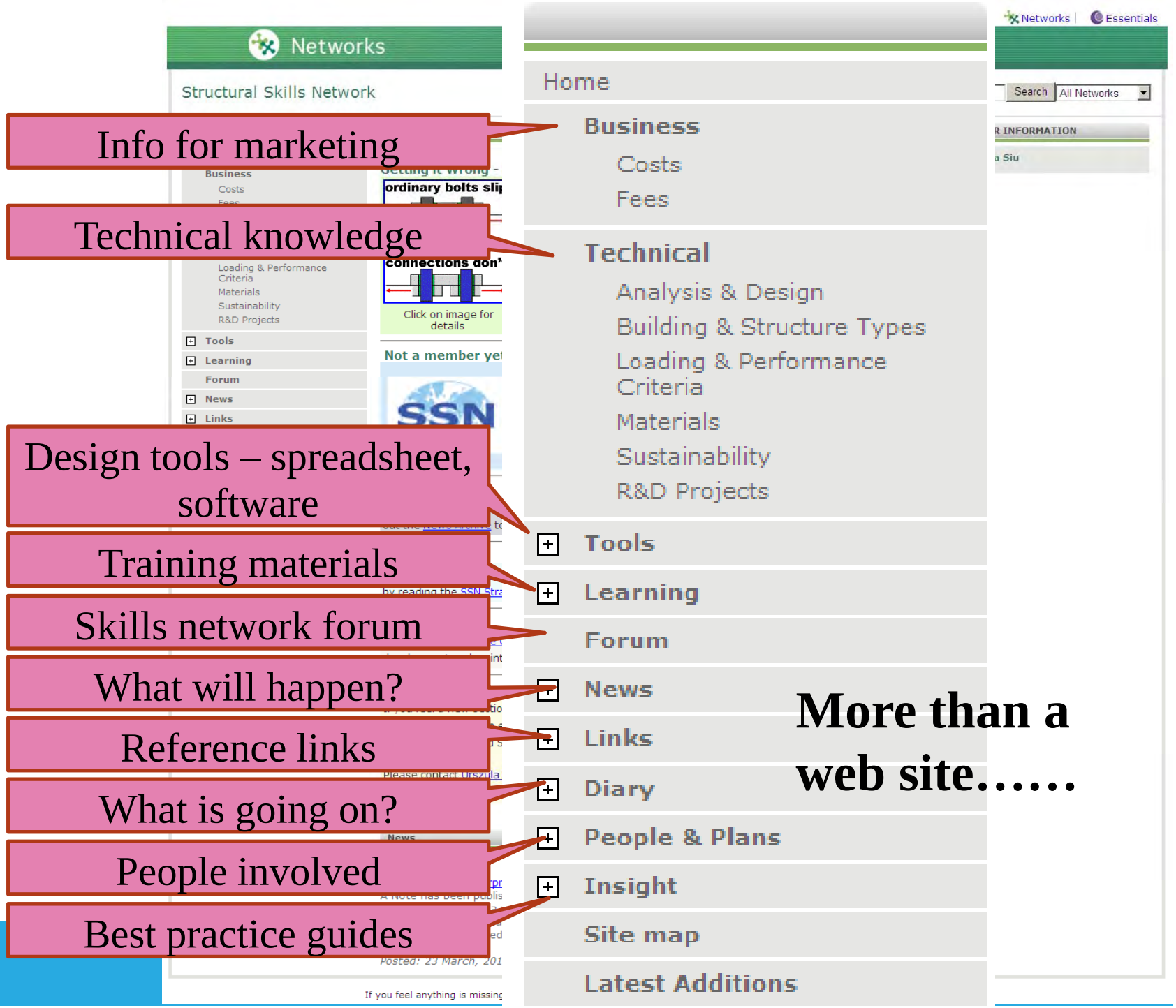
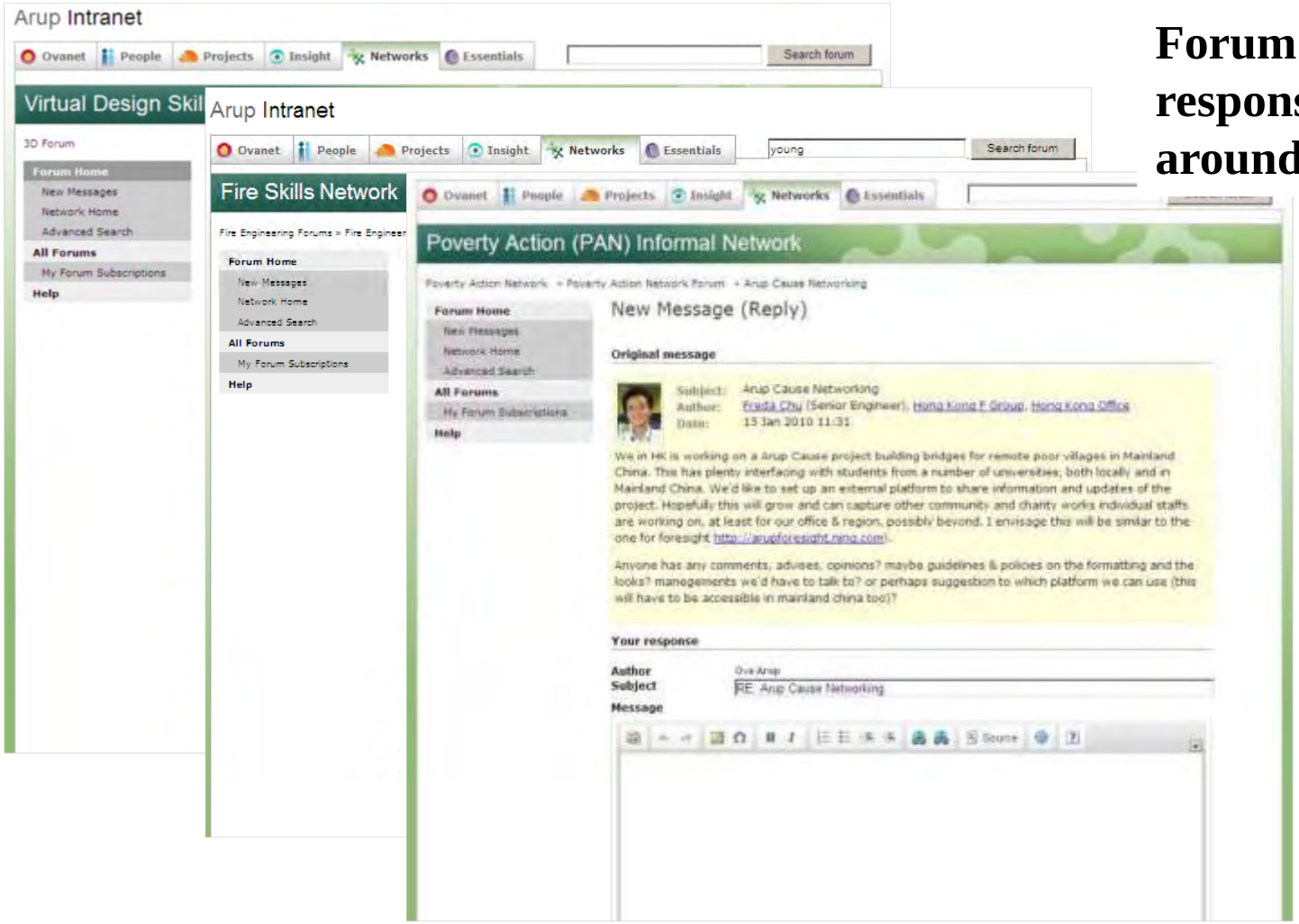

Networks
Structural Skills Network
Business
Costs
Fees
Technical
Analysis & Design
Building & Structure Types
Loading & Performance Criteria
Materials
Sustainability
R&D Projects
Tools
Learning
Forum
News
Links
Diary
People & Plans
Insight
Site map
Latest Additions
Info for marketing
Technical knowledge
Design tools – spreadsheet, software
Training materials
Skills network forum
What will happen?
Reference links
What is going on?
People involved
Best practice guides
More than a web site……

# Networks






**Forum allows instant response from offices around the world**



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# Using Network Forum for Work

## Study on Measures to Reduce Excessive Packaging of Consumer Products in Hong Kong

- During the initial stage of the Study, forum was used to collect overseas views in respect of the excessive packaging.
- Fruitful findings in terms of environmental, economic and social perspectives were obtained.



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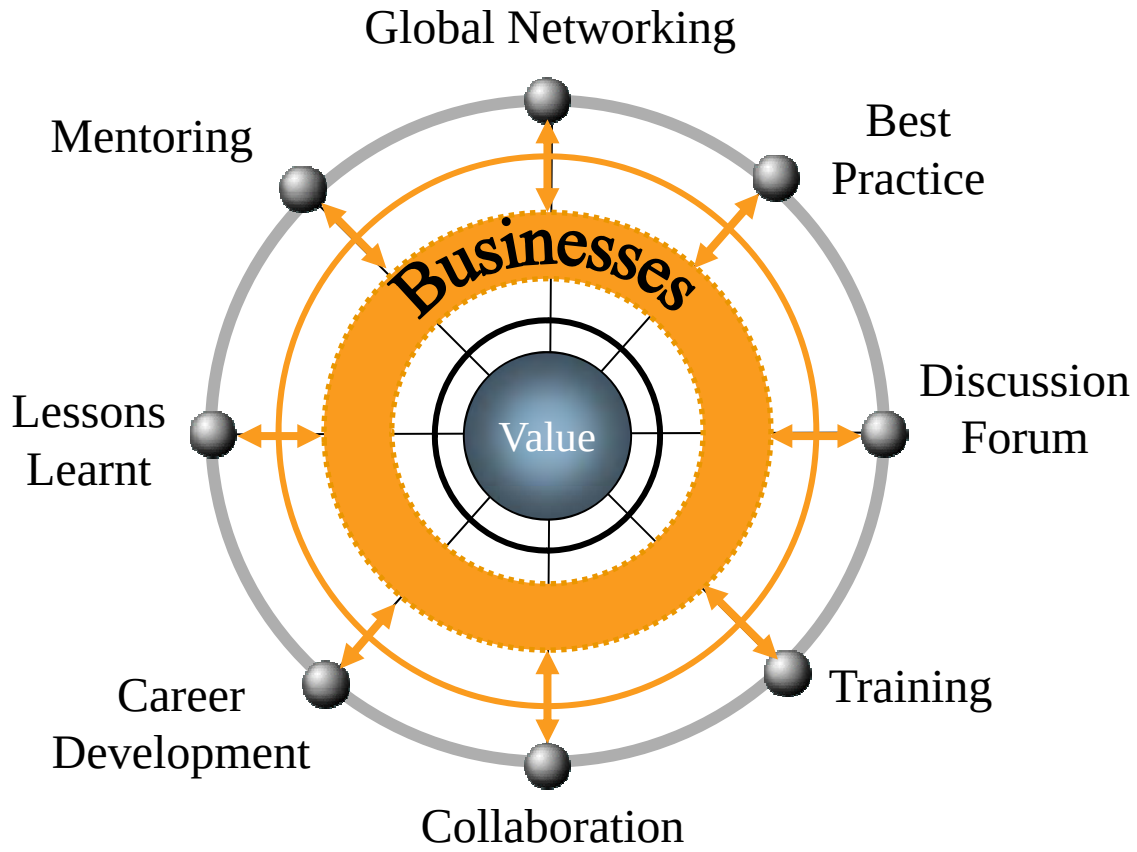
# Networks



- Coordinated by Network Leaders



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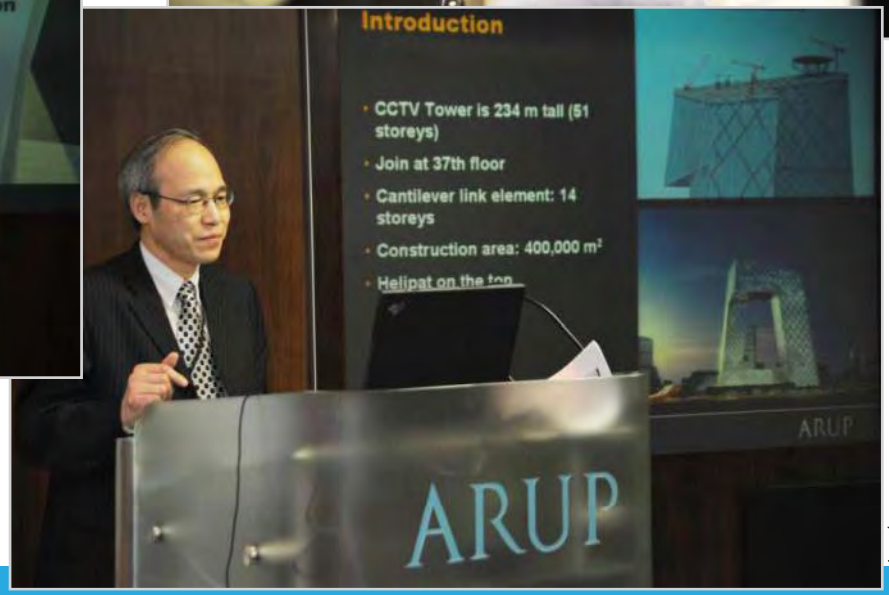
# Network Activities

Tall Building Education Workshop: CCTV - a multi-disciplinary workshop

More than 200 skills training activities in 09/10


Structure


MEP




Fire



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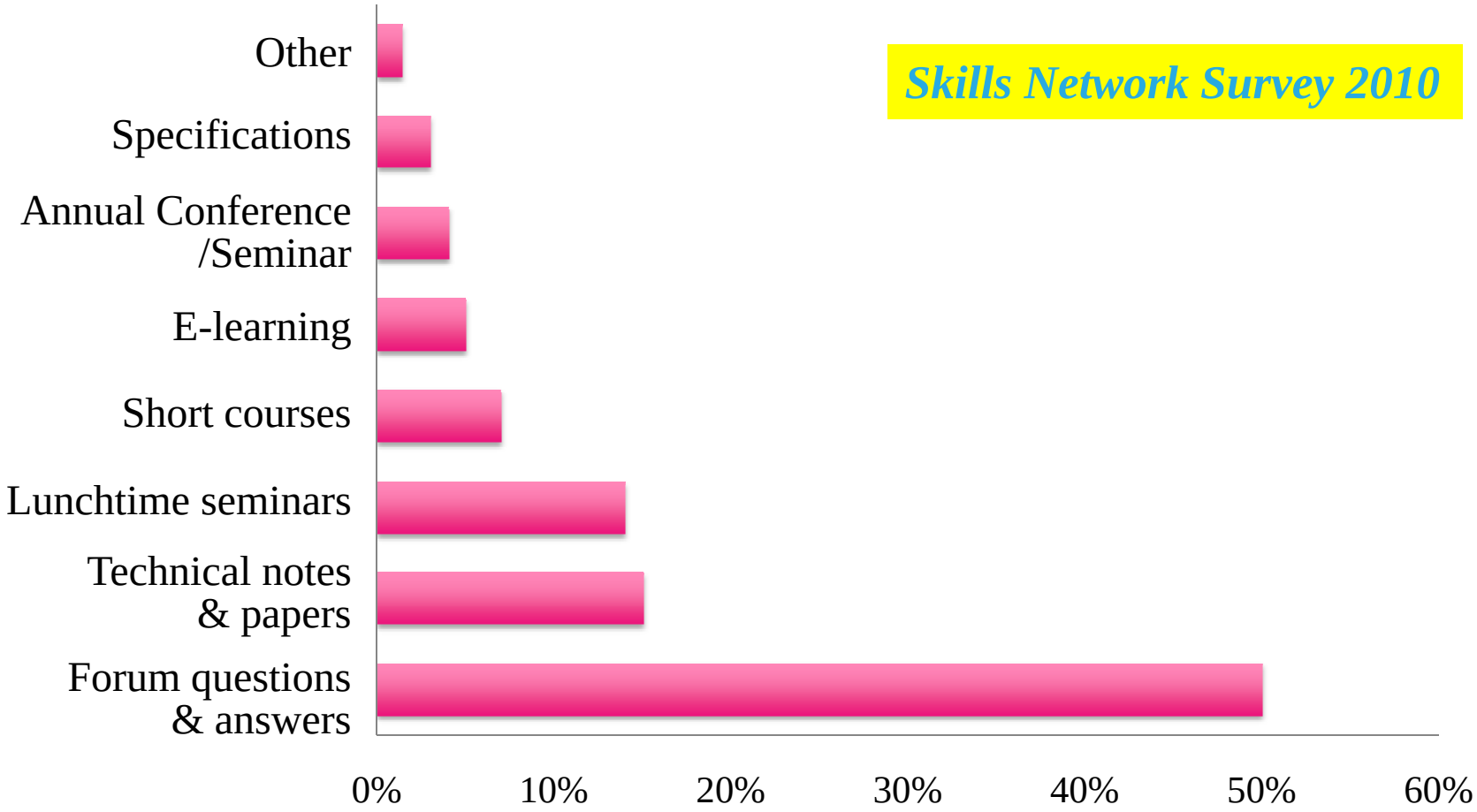
# Networks






***Skills Network Survey 2010***

**Which learning activities facilitated by your network do you find most beneficial?**



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# Technical Publications



Arup Technical News

ATN Archive Issue 484, 25-Jan-11.

**Technical Nuggets**

NEW GLASS IS STRONGER THAN STEEL
A new glass with a strength and toughness stated to be beyond that of any known material has been developed by the US Department of Energy (DOE)'s Lawrence Berkeley National Laboratory (Berkeley Lab)and the California Institute of Technology.
posted by Su-fern Tan - ext 40460 - email - arup people page

SMARTS FOR SOLAR ARRAYS
More than a dozen venture-capital-backed start-ups are vying to bring some smarts to solar farms in the hope of boosting photovoltaic arrays' ability to deliver carbon-free energy. Tigo Energy, CA, is exploiting wireless communications to minimize the added cost and complexity of PV arrays' energy-harvesting electronics.
posted by Julian Astbury - ext 23230 - email - arup people page

IEA DOUBLES GLOBAL GAS RESERVES ESTIMATES
The world may have 250 years of gas usage at current levels thanks to "unconventional gas" from shale and coal beds, Anne-Sophie Corbeau, senior gas expert at the IEA told BBC News.
posted by David Brown - ext 23291 - email - arup people page

CROP WARNING OVER CHINA DROUGHT
A prolonged dry spell in parts of northern, central and eastern China is threatening both crops and water supplies, Chinese state media says. Shandong province is experiencing its driest weather for 60 years.
posted by David Brown - ext 23291 - email - arup people page

**Events**

WEBINAR: SAFE - SOLVING GEOTECHNICAL PROBLEMS USING FEA
Online Webinar - 02/02/11 -
Empirical programs are excellent at checking standard problems, but what do you do when you need that little bit extra? Safe is a geotechnical program for solving stress, strain and seepage problems using two-dimensional finite element analysis, whether simple or complex. Join us to see how Safe can help your geotechnical project.
posted by Simon Lister - ext 87595 - email - arup people page

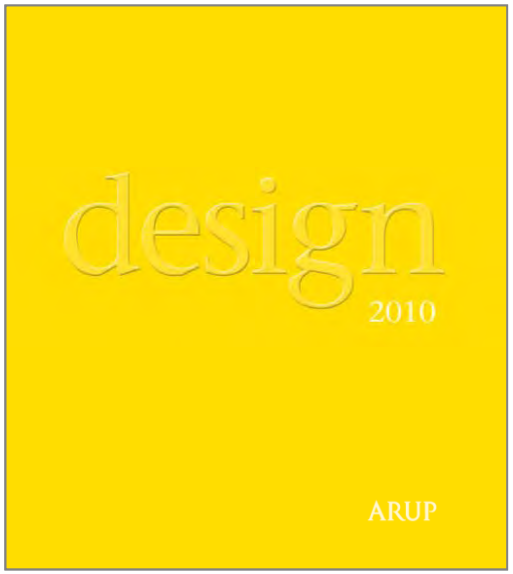
WEBINAR - NON-LINEAR ANALYSIS WITH GSA
- 26/01/11 -
Linear analysis is good only up to a point, but you need non-linear once deflections get large or materials start to yield. Join us to see how to use GSA's powerful ability to analysis structural models with material and geometric non-linearity.
posted by Simon Lister - ext 87595 - email - arup people page

**Publications**

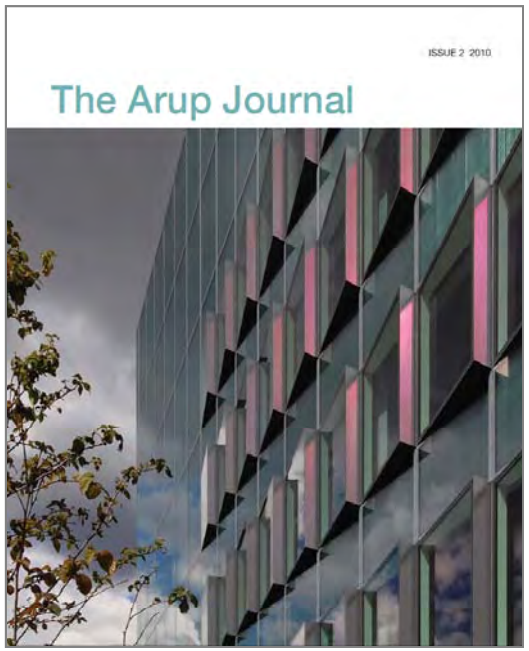
PLANNING FOR SUDS
This new guide from CIRIA, "Planning for SuDs - making it happen", will give help with planning, design and delivery of high quality sustainable drainage systems or SuDs. To request a loan from the London Library, please click on the title.
posted by Andrea Beddard - ext 52120 - email - arup people page

GEOLOGICAL FLUID DYNAMICS: SUB-SURFACE FLOW AND REACTIONS, BY OM PHILLIPS
This book examines the physics and chemistry of sub-surface flows in water-saturated, sandy, and rocky media. It describes scientific concepts and tools for hydrologists, public health ecologists, and geologists. Available for loan from the London library.
posted by Stephanie Emmitt - ext 53816 - email - arup people page

ENVIRONMENTAL GOOD PRACTICE ON SITE GUIDE
The 3rd edition of this CIRIA publication C 650, which is essential reading for site managers and includes checklists to inform on potentially costly environmental pitfalls when working on site. To request a loan from the London Library, please click on the title.
posted by Andrea Beddard - ext 52120 - email - arup people page




Annual Design Year Book




Quarterly Arup Journal



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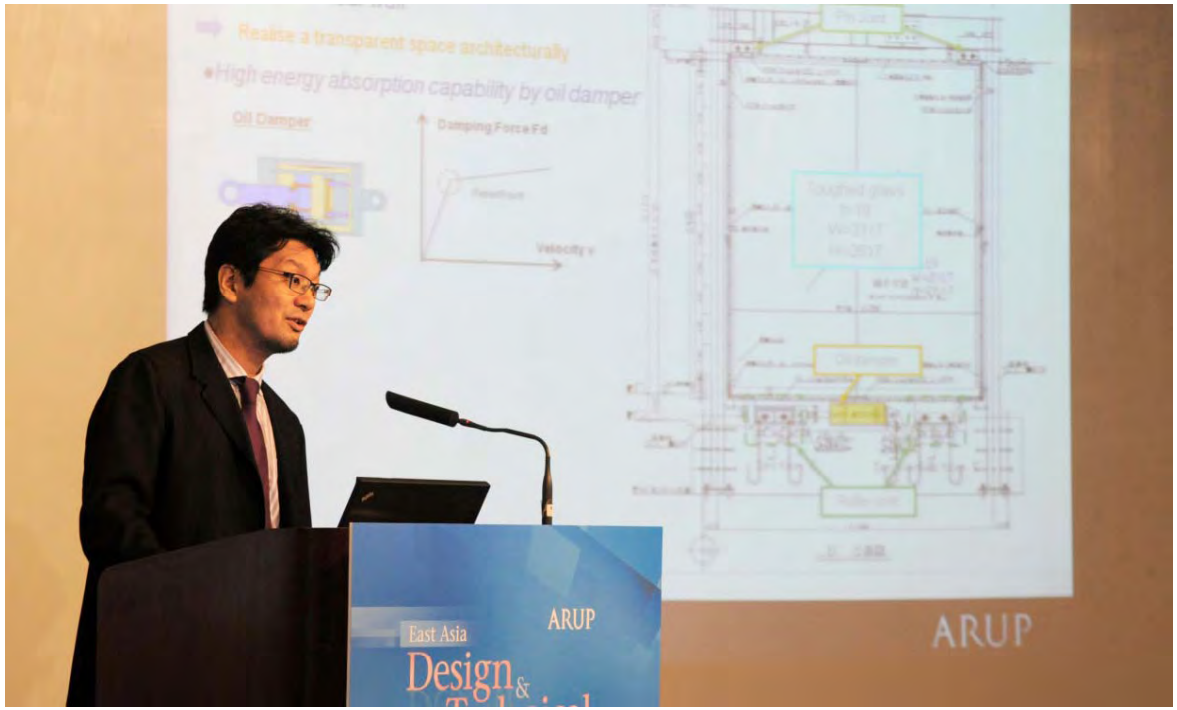
# Design & Technical Excellence Awards 2010

- **To commend creative solutions**
- **To share the best knowledge**





Marina Bay Sands, Singapore


Integrated Development Plan for Ninh Thuan Province, Vietnam

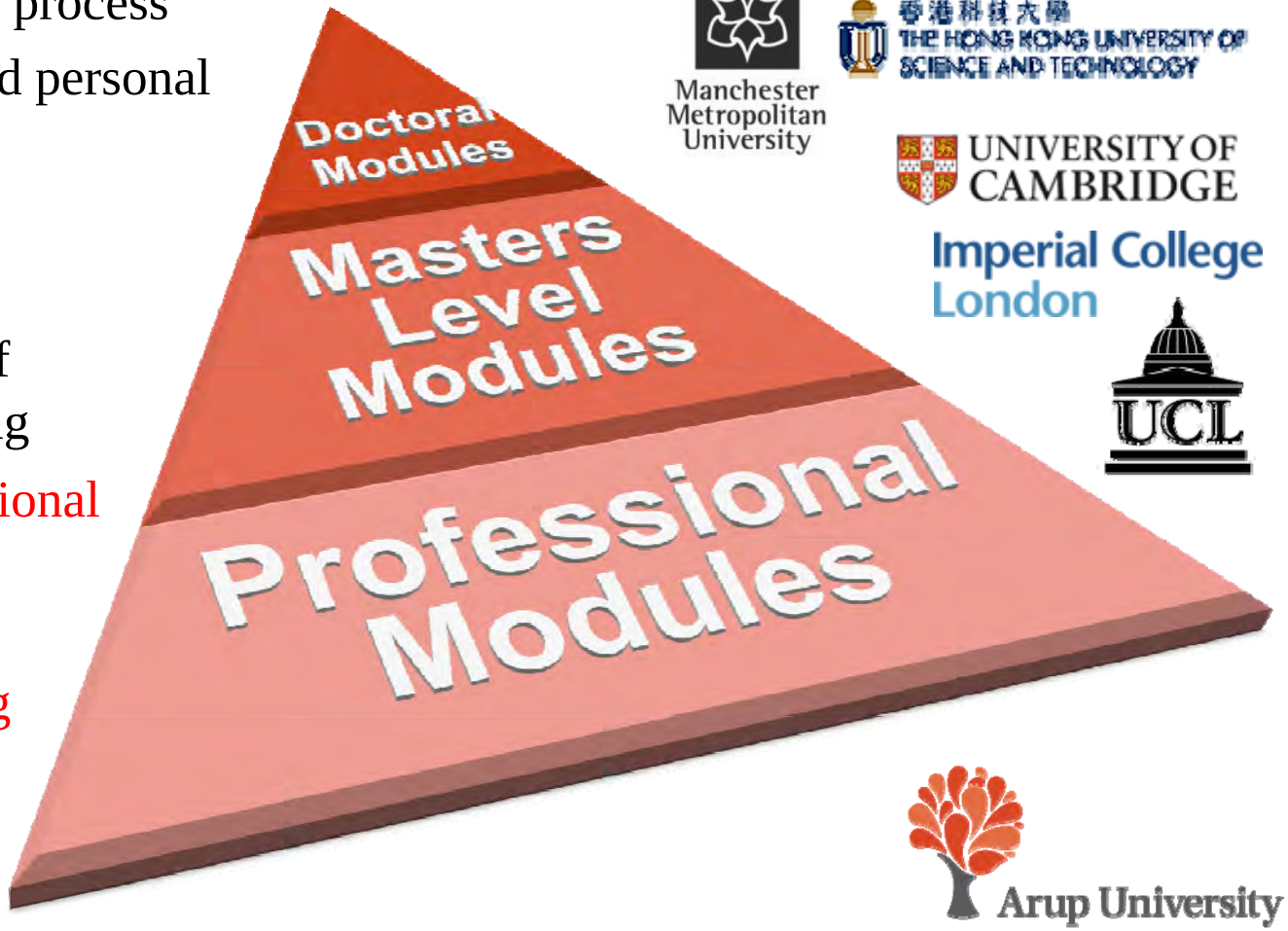

Stonecutters Bridge, Hong Kong

# Arup University

- Cross-discipline training
- Course accreditation process
- Meeting business and personal development needs

Build upon our years of experience in organizing

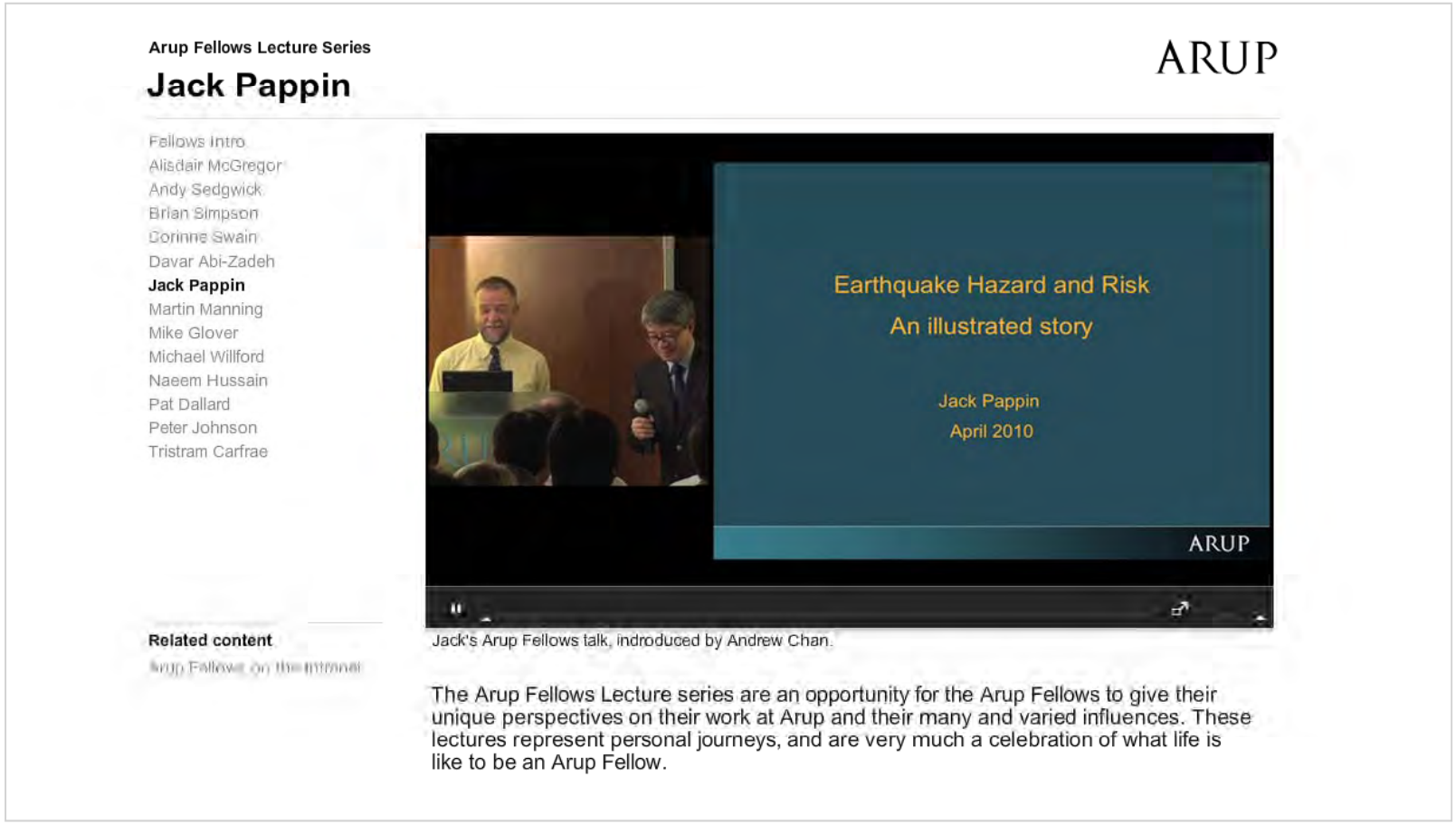
- Continuous Professional Development
- Management and Leadership Training




Kingston University London
Manchester Metropolitan University
香港科技大學 THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY OF CAMBRIDGE
Imperial College London
UCL
Arup University

# Disseminating Knowledge






Arup Fellows Lecture Series

# Innovation



## Design School

- **Annual 3-day event in a hotel focusing on design & innovation**

DESIGN SCHOOL

**Rethinking Design - Antiquity versus Modernity**

The 2008 East-Asia Design School will focus on rethink

## Design Competition

- **Invite wild but feasible engineering solutions**

Two challenges to design and build structures from rapidly renewable materials that can be grown in under a year.



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# Industry/Community Network

Creation | Sharing | Empowerment

**ARUP**

**Community**

- Poverty Action Network (PAN)
- Forums/Workshops

Forum at HK-Shenzhen Bi-city Biennale of Urbanism/Architecture

**Universities**

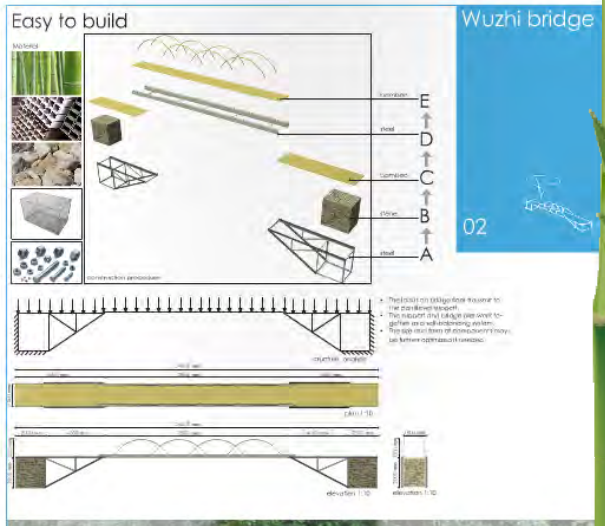
- colleagues as part-time lecturers
- colleagues served as members of industrial advisory boards
- colleagues collaborating with professors in various research projects

**Professional Associations**

Chairmen /Committee members of

- various sub-divisions of HK Institute of Engineers
- The Institution of Highways and Transportation (HK Branch)
- HK Green Building Council
- HK Accreditation Service
- HK Construction Industry Council, etc……

# Using Knowledge for Corporate Social Responsibility


## Wu Zhi Qiao Design
## Competition Winning Design



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# Arup Knowledge Centre


Arup Library Catalogue

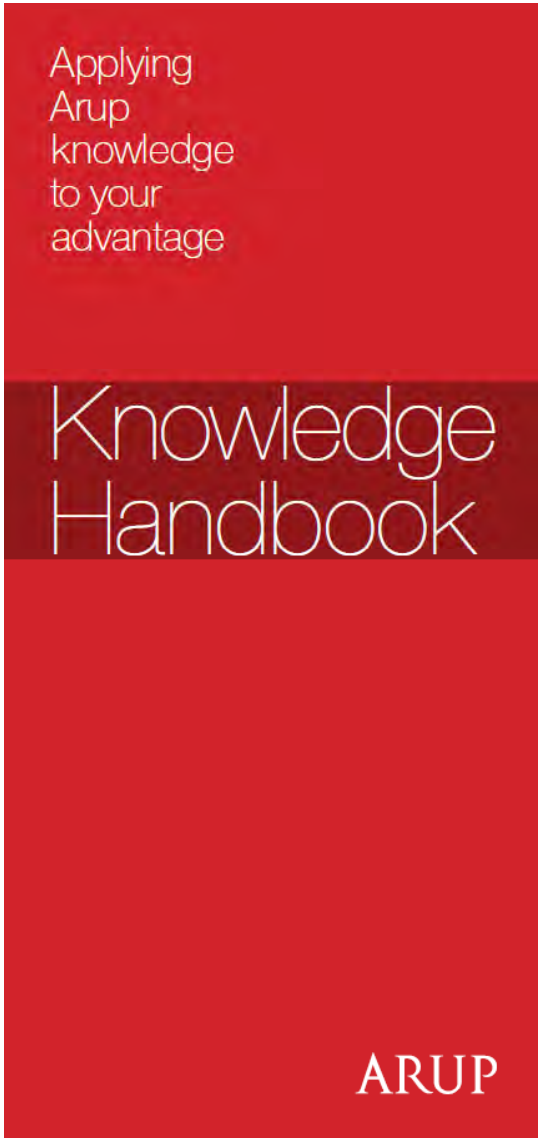
Hong Kong Knowledge Centre
Daily News Clippings

PHOTO LIBRARY IMAGE BASE

- Full-time librarians
- Technical paper
- Publication
- Design codes
- Bidding support
- News Clipping
- Knowledge coaching

# Knowledge Handbook

- **Telling colleagues how to use Arup Knowledge Tools**

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# Knowledge Strategy & Executives

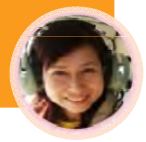
Design & Technical Executive

DTX

Knowledge Team

East Asia Knowledge Activist

East Asia Knowledge Enthusiast



Arup Fellow

Network Leader

Arupian

Together, We develop the Arup Knowledge Culture



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# Selection of Knowledge Management Award

- **Asian Most Admired Knowledge Enterprise (MAKE) Award Winner (2010)**
- **Hong Kong MAKE Award Winner (2010) - Top Winner**
- Managing Partners Forum European Practice Management 'Management of Knowledge' Award (2010)
- Short listed Management Consulting Association Award (2009)
- Innovation in Knowledge Management Award Winner (2006)
- Best Business Partner in Using Communities of Practice to Drive Organisational Performance & Innovation Award (2005)
- Innovation in Knowledge Management Award Winner (2003)
- Knowledge Management Project of the Year Runner Up (2002)



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# MTRC Knowledge Management

## Arup helped MTRC's Projects Division:

- Align Knowledge & Information Management (K&IM) with corporate strategy
- Connect people, enhancing explicit and tacit knowledge sharing
- Capture lessons learnt and avoid reinventing the wheel
- Enable a collaborative working culture across a multi-project organization
- Develop a communications programme to promote engagement
- Ensure K&IM became part of normal activities

***"Overall the project has delivered more than I had hoped for."***
Malcolm Gibson, Head of Project Engineering, MTRC

# Arup Knowledge Management


# Thank You



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