Major Projects Association

The application of technology in managing demand

Seminar 131 held at the Royal College of Pathologists, London
30th January 2007

Summary

Key conclusions

- It is vital to take a total systems approach otherwise an improvement in one area will be cancelled out by a detriment in another.
- Avoid big technical leaps. Move forward by degrees, pushing the boundaries in every direction.
- Good process models, forecasting models, pilots and simulations are the key to reducing project risk.
- There is a natural tendency for ‘rationing by technology’ to progress from a means of conserving a scarce resource to a means of raising revenue. This in turn creates a need for much higher levels of reliability and support.
- Ensure that the business case deals sufficiently well with the anticipated call on technology, proven or otherwise.
- Prioritising and selection processes are essential. Opportunities to invest in technology always exceed available funds.
- Beware of unproven technology.
- Do not embark on a degree of change that is beyond your capability to manage.
- Collaborate with your suppliers and jointly create follow-on business.
- In selecting technology be sure to understand the difference between a technology push and a requirements pull: technology push is usually much more risky.

Introduction

The application of technology in managing the demand for finite resources is increasing all the time. Since needs cannot be met simply by increasing supply, a more sophisticated approach is required, whereby modern technology is used to limit demand for a service or to increase the yield of an asset. This need to manage demand applies not only to scarce resources such as raw materials, but also to public services such as roads, rail and health.

Presentations included case studies featuring the application of technology in managing and influencing demand in a range of different projects and industries – rail, waste management and air traffic control, and an overview of the scope and scale of IT when brought to bear on demand.

The power of technology

Capita Symonds provided an insight into technology driven projects which influence demand, such as the Central London congestion charging scheme, and the types of technology used to manage demand, for example programme management tools for delivery of the London Games 2012.

The configuration management database (CMBD) developed by Capita Symonds as a version of the ‘single source of truth’ programme accesses the IT infrastructure through a single interface, ensuring a consistent approach to maintaining IT processes. The CMBD impacts on the London Games in a variety of ways. For instance, creating a repository of information for anyone involved in the Games, such as consultants, contractors and other stakeholders, and linking it with delivery software solutions enables:

- Programme office – ‘single source of truth’
- Security infrastructure
- Games communications
- Ticketing
- Legacy for London

The potential of new communications technology was discussed, such as GIS (geographical information system), a computer system capable of integrating, storing, editing, analysing, sharing and displaying information. GIS allows users to create interactive queries and can be used for resource and asset management, environmental impact analysis and urban planning. Combined with a ‘single source of truth’ it was explained how GIS can be used with specialised software to manage the demands of major events such as crowd management and security.

Optimisation of rail capacity

In the case of the railway, the scarce resource is the capacity of the rail system. The forecasting of demand is a key requirement for the identification of problems and the prioritisation of options to deliver an increase in capacity. The Department for Transport (DfT) explained how they forecast, rank the options and establish priorities.

The modelling requires the identification of a number of drivers or influences, which are classified as exogenous (outside the DfT's control) or endogenous (within the DfT's control).

Main influences on demand

Exogenous

- Employment
- GDP per capita
- Population
- Competition from other modes
- Fares

Endogenous

- Journey times
- Crowding
- Frequency
- Interchange

A new network modelling framework tool (NMF) has been set up which enables an assessment of options detailing passenger load, levels of crowding and safety and reliability over a five year period. It comprises the entire rail network and involves timetables and train capacities, train operating and infrastructure costs, safety and performance output and an indication of environmental impact. NMF provides a comprehensive tool for:

- Identifying problems
- High level ranking of value for money (VfM) options
- Testing affordability
- Other key metrics

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optimisation continued

The DfT described two investment projects to illustrate the choices to be made in working up the business case:

- The InterCity Express programme, which involved a detailed consideration of flexibility of train configurations and motive power (diesel or electric or a combination of the two), taking into account factors such as axle weights and balanced against carbon emissions.

- The Thameslink scheme, which was developed in response to increasing levels of crowding on existing cross London services, and the track and station capacity constraints which ruled out any simple solution. The scheme utilises the 19th century tunnels that cross London, thus easing the bottleneck through the centre, and involves using 12 car trains instead of the usual 8 car configurations, lengthening platforms and termini to accommodate them and reconfiguring the route.

The general aim in both these projects was to apply appropriate existing technology and push it to the limit, rather than introduce anything radically new.

Dealing with the UK's landfill problem

Domestic households in the UK send more than 26.8 million tonnes of rubbish to landfill sites every year – about half a tonne per person, and more than any other European country. Following the introduction of European and UK legislation there are now increasingly tight restrictions and disincentives on the use of landfill, requiring alternative solutions.

The options include:
- Incineration
- Reduction
- Recovery
- Recycling
- Mechanical biological treatment (MBT)

The best way to control waste is to:
1. Avoid it
2. Reuse materials directly
3. Recycle and reprocess materials
4. Burn it to recover energy prior to disposal

It is better to see the waste stream as a resource rather than a fuel source since the energy liberated by burning is often only a fraction of the energy used in producing the product.

Biological treatment (anaerobic digestion) to produce methane as a fuel source is an efficient way of treating green or food waste.

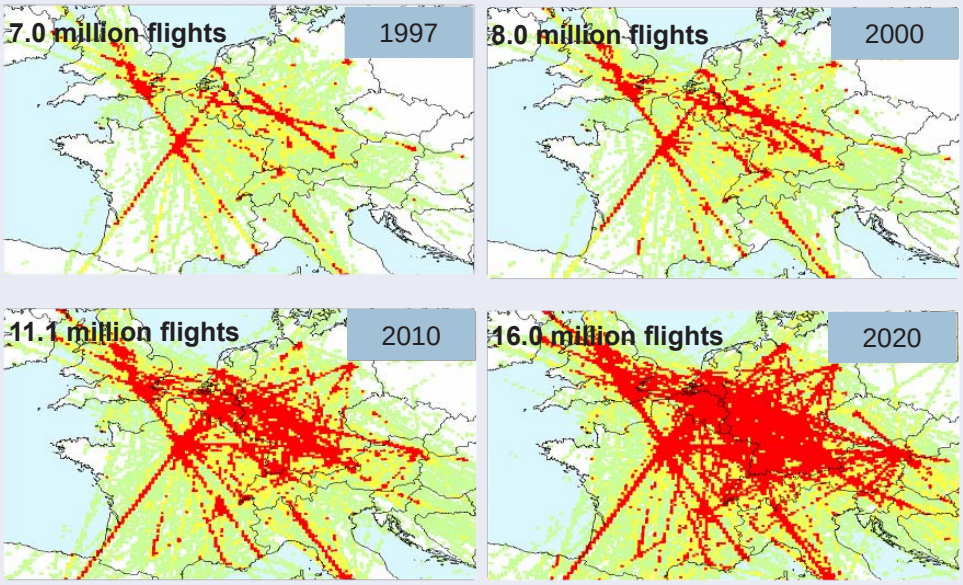
The Lancashire waste PFI project

Bovis Lend Lease are involved with two state of the art waste treatment PFI projects in Lancashire, at Leyland and Thornton, each of which will process 170,000 tonnes of waste per annum and divert a significant amount of waste from landfill.

Waste will be hand sorted to remove hazardous and incompatible materials, followed by treating the shredded waste stream with highly automated separation techniques. Paper, plastics, ferrous and non-ferrous metals will be extracted for recycling, and the shredded waste sorted for particle size. At the percolation stage soluble organics will be separated for anaerobic digestion and what remains sent for further refining and composting. Final screening and separation of inorganic materials will result in an end product with soil-like properties for use as a soil improver in the remediation of land. 44,000 MWh of renewable energy will be produced.

The growing demand for air traffic control

The international demand challenge



The illustration above shows the relentless growth in flights across Europe. The demand on air space is unconstrained, with crossing routes potentially conflicting with each other. Though commercial air traffic is separated from other kinds of aviation, peak demand imposes an increasing workload on the UK National Air Traffic Service (NATS) operators. Airspace over the UK is a finite resource, and it is the human operators who are the bottleneck. New technology is one way for NATS to address this.

European regulation controls air traffic and if it is predicted that the air traffic demand is exceeding the capacity (generally in the region of 40–50 aircraft per hour) aircraft must be held on the ground, which then causes bottlenecks. The problem could be solved by diverting aircraft, but airlines on the whole are intolerant of this approach because it places a constraint on their commercial activities which they cannot plan for.

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One way of coping with the demand is to add more flight paths, though expanding the air space available to commercial traffic needs a fair amount of negotiation with other air space users. The free areas of airspace are being squeezed as demand increases and dividing the airspace into more sectors needs more operators. Increasing the number of air traffic controllers requires lengthy training so the service is looking to technology as a way to increase capacity and decrease the human workload.

The Civil Aviation Authority (CAA) ensures that all airspace users have an equal opportunity of access. NATS must consult with the airlines over investment in technical innovation as all solutions must comply with international standards and protocols. In general a great deal of integrated data flow is necessary, which requires the appropriate technology. A typical project life cycle time for products is eight years and there has to be seamless integration into the continuous control requirement in a safe manner with minimum impact on customers.

A successful project that went live in 2006 is the NATS Oceanic operation. NATS controls the air space to roughly halfway across the Atlantic Ocean, at which point the Canadians take over the service. The new air traffic control operation, which will handle 400,000 flights per annum, was evolved from the Canadian system, with significant changes in terms of links with the aircraft via satellite and operator interface with the equipment.

The next generation of new technology is designed to increase air traffic control capacity. It will manage all flight data electronically and rapidly perform calculations to predict where flight path conflicts might occur, providing controllers with a more advanced decision making capability. The project is a bespoke development using leading edge system engineering and software development techniques and when completed will be the most advanced controller system in Europe.

Conclusions

Major projects which make demands on scarce resources will stand or fall as commercial enterprises on the accuracy of forecasting. Computer modelling is vital for success in this respect, but it is also important to take a whole system approach to know that an improvement in one direction is not detrimental in another. This is especially pertinent for environmental considerations. Gradual technological innovation and implementation is better than a ‘big bang’ approach.

Participating organisations

Advance Consultancy Ltd
Amey
Atkins plc
BAA plc
Balfour Beatty plc
Bechtel Ltd
Bovis Lend Lease
British Energy
British Telecommunications plc
Capita Symonds
CMS Cameron McKenna LLP
CSE International Ltd
Denton Wilde Sapte
Department for Transport
Emcor Rail Ltd
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