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Future Focus:
Travel

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The word 'recession' is on everyone's lips, yet already there are quiet murmurs of recovery. Exactly when the economy will grow again is unclear. But recovery is certain.

Equally certain is the fact that some companies will emerge very strongly from the current economic problems. Part of their success will be down to reorganisation and improved efficiency. But most of this rapid success will be due to strategic decisions taken now.

Future Focus is a multi-media programme organised by the Telegraph Business Club to help senior personnel within medium-sized UK businesses to make inspired strategic decisions that will drive business success during economic recovery.

The highlight of the Future Focus programme is a series of full day business conferences around the UK and Ireland taking place to:

- **INFORM** – Give an expert insight into future products and technologies that are just about to have a major influence on our life and work.

- **INTERACT** – Allowing you to meet and talk with fellow business professionals and expert speakers.

- **INSPIRE** – Provide the opportunity to discuss and explore how they can be used to drive business success in the coming months and years.

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GETTING THE SMARTER PICTURE

"The train now standing at platform four will call at several stations and then X. At X, Mr Jones, turn left out of the station and catch the number 17 bus towards Y (there's no need to hurry as it's running four minutes late). Alight at the seventh stop, cross at the zebra and go down Z Street..."

Wouldn't travelling be easy if all the announcements were so detailed, personalised and up to the minute? In future they could be - not over the station Tannoy, of course, but direct to our mobile phones, satnav systems or public information kiosks.

"Information will be more joined up, so that when we plan a journey we shall not have to worry about how we're going to travel, just where we want to go, when and why," says Nick Illsley, chief executive of Transport Direct, the Department for Transport's online travel planning website.

A personalised information portal could present us with the various options and routes, via public and private transport, with predicted timings and costs (both financial and environmental), leaving us to make an informed choice. When we've decided, the route information could be transmitted to our phone, satnav or other mobile device.

The system won't always suggest the same route for the same journey. If we're travelling on business it may assume we want to travel quickly rather than cheaply, and be sure of getting a seat on the train and a WiFi connection so we can do some work. Or it may know that our firm has a strict environmental policy and that we'd prefer the lowest-carbon route.

The system could know which roads are likely to be congested and when, either from past experience or by intuition (so it won't route us past a school gate at 3.30pm). And it could take account of known variations to the regular pattern - rail engineering works, say, or a big soccer match - rather than slavishly following published timetables.

So far, so good. But what if there are problems on the day? Don't worry, says Howard Wilson, business development director for transport at Mastek, a software company that works with Transport for London. "Travel information could become your information about your particular journey. So the system

could contact you if there's a problem that affects you and suggest an alternative route, whether it's your regular commute or a one-off trip."

"Part of the intelligence will be in making sense of the data and filtering out what's not important," says Illsley. "If my train is two minutes late I don't want to know. If it's 10 minutes late I do, and I want to know what that means for my connections."

Ultimately, says Robin Mannings, resident futurologist at BT, pre-booked individual journeys could become part of a master plan that deliberately divides travellers between different routes or even different modes of transport in an attempt to reduce congestion. If there's an unforeseen problem, the system could automatically re-book us onto a later flight if it knows we'll be delayed, or advise us to park and continue by train if our road becomes jammed.

Ticketing could also be revolutionised in the coming years. Joined up travel networks should enable us to purchase one ticket covering several different travel companies and modes of transport. Instead of wasting time queuing up to buy a paper ticket we could be using a smartcard such as London's Oyster card, or an electronic ticket pre-loaded onto our mobile phone and read at the ticket barrier using near field communications (NFC) technology.

"People are nervous about changing their travelling habits, so if we want to encourage them to use public transport we need to make it an easier decision," says Conrad Haigh, director for smarter travel at transport planning specialists MVA Consultancy. "Offering new ways of buying a ticket and providing a lot more real-time information on the street and on the internet could be an important part of this process."

For joined up travel and personal journey planning to function, says Mannings, they must be supported by several kinds of data. This could include detailed digital maps, accurate timetables, historical information about usage and congestion patterns, details of planned but temporary factors such as road works or major events, and real-time information on current congestion. We shall also need a crystal ball that predicts the near future (you don't want to know that the motorway is jammed 20 miles ahead, you want to know whether it will still be jammed when you get there).

Much of this information is already in existence or being created. Transport Direct has mapped all of the UK's 350,000 train stations, bus stops, ferry crossings etc, and has even completed a database of 20,000 car parks. Satnav and mobile phone companies are recording millions of pieces of data from individual journeys to calculate typical speeds on individual roads at different times of day. In downtown Singapore, IBM has developed software that can predict traffic jams up to 45 minutes ahead of time with 90% accuracy

The next big step could be to develop a means of fusing all these disparate pieces of data to create a unified picture spanning multiple modes of transport, enabling the kind of real-time, personalised services outlined above. "The individual parts of the data exist, now we need to develop the glue to bind them together," says Illsley.

In the meantime, collecting and sharing travel information doesn't always require expensive technology. A taxi firm in Cannock sends customers a text message when their cab is 10 minutes away, based on real-time ETAs from its TomTom satnav system. Meanwhile in rural Hampshire IBM has a 'tweeting' staff minibus that uses Twitter to inform would-be passengers of its precise whereabouts and whether it has seats available.

Social networking technology (such as Facebook, Twitter etc) could increasingly be used by travellers to share real-time or near-time journey information, perhaps facilitated by municipal transport authorities. We could also see online communities of truck drivers swapping notes on good-value greasy spoons, or parents on where to find baby-changing facilities.

Better, more personalised travel information will take much of the pain out of getting from A to B (or, more usefully, from A to F via B, C, D and E). But the expected potential benefits are much more wide ranging. Many of us use cars because we're nervous of taking public transport on unfamiliar routes; with reliable information and a real-time, electronic guide we might take the bus instead of driving, or walk instead of hailing a taxi.

Joined up data about the movements of vehicles and passengers, both in advance and in real time, will enable public transport operators to respond better to demand, so that a bus driver could wait a few minutes for a delayed train, or a larger vehicle could be provided when more passengers are expected.

On the roads, reducing congestion would save money, the environment and even lives. Transport accounts for around a quarter of all the world's CO2 emissions. Yet Americans waste more than four billion hours a year sitting in congested traffic (up to eight working days each in the worst affected areas) while burning more than 13 billion litres of fuel. German drivers waste another 11 billion litres in traffic jams, generating 25 million tonnes of CO2. Congestion costs the UK economy £20 billion a year, and robs the EU of 1% of its entire GDP. And across Europe it's estimated that 2,500 lives could be saved each year if emergency vehicles weren't delayed on congested roads.

Creating the information infrastructure to make all of this a reality won't be cheap, and it will require a good deal of political willpower and much co-operation between a multitude of travel companies and transport authorities. But as the number of travellers continues to grow, and the number of roads and rail tracks doesn't, the question is not whether we can afford to make the investment and effort, but whether we can afford not to.

MAKING SMARTER TRAFFIC, NOT MORE ROADS

"More than half the world's population now live in cities," says Bharat Bedi, an emerging technology consultant at IBM. "We don't have room to build more roads, so we need to make more intelligent use of the infrastructure we've got."

There is already a considerable amount of intelligence in vehicles themselves, and infrastructure such as traffic lights, CCTV cameras and vehicle counters. Get them to talk to each other and we could significantly increase the capacity of our existing roads and cut congestion.

There's talk of 'green waves' of vehicles travelling through cities at a set speed without ever seeing a red traffic light. When lights are about to turn red, the driver could be warned to slow down early and conserve fuel, then given a countdown before the lights turn green again so they're ready to pull away as soon as it's safe.

The number of vehicles that can safely use a section of road in a given time depends on their speed and the distance between them, says Neville Jackson, group technology director at automotive consultancy Ricardo. It's potentially possible to increase this capacity by a factor of three or four by eliminating

the discrepancies of human driving behaviour (for example the tendency to play safe and brake a little harder than the vehicle in front).

This could be achieved using wireless communications linked to a variant of the adaptive cruise controls already being fitted to some up-market vehicles. It would be theoretically possible to restrict a driver's speed to the legal limit (perhaps averaged to allow for the occasional burst of overtaking), or reduce it to 15mph when passing a school at going home time.

"The technology for all this is pretty close to being available," says Jackson. "The issue is public acceptance and implementation."

City planners are increasingly using smart technology to help reduce congestion. In Kyoto, Japan, IBM has developed software that can simulate the movement of millions of vehicles to analyse their impact. It can optimise traffic lights to reduce jams and predict the effect of a new shopping centre or traffic regulation on a community's traffic.

THE FUTURE OF SATNAV

The first generation of route finding and satellite navigation systems were little more than electronic map-readers that took little account of the kind of vehicle you were driving or when you were driving it. They'd gaily send articulated lorries along single-track lanes and recommend roads that were almost bound to be jammed at peak times. By stubbornly favouring motorways and trunk roads over alternatives that were often emptier and more direct, they may even have added to congestion by funnelling everyone into the same bottlenecks.

Satnav needs to get a lot smarter - and it is. A major breakthrough was the realisation that the vehicle can help the satnav as much as the satnav helps the vehicle. The best way to analyse traffic flows is to track the movements of the vehicles that compose them. So satnav vendors are collecting time and location information from GPS, mobile phones, fleet management systems, motoring organisations etc to log thousands of actual journeys, enabling them to build up an increasingly detailed picture of how speeds and congestion patterns on actual roads vary according to the time of day.

"It's like having a taxi driver's local knowledge of which roads are busiest and when, but extended into areas where you've never been," says John Holland, chief executive of satnav software specialist Journey Dynamics. If a road hasn't yet yielded enough data, clever modelling software could work out the likely congestion patterns by comparing it with similar roads.

Understanding time variations enables the navigation system to recommend different routes for the same journey at different times of day. Adding real-time data, from moving vehicles and static sensors and cameras, lets the system potentially warn drivers about unexpected congestion as it happens and offer them alternative routes. As software becomes more sophisticated it could calculate the likely effects of the congestion on surrounding roads so it doesn't just divert you into another traffic jam.

In future, says Jeremy Gould, UK country manager at satnav vendor TomTom Work, it could also be possible to include data on temporary obstructions such as roadworks, and on sporting events, parades, demos etc that could affect road traffic. Modelling software could also be able to predict the build-up of congestion in the immediate future, as IBM is already doing in Singapore.

Road speeds and optimum routes can vary a lot depending on the type of vehicle (in fact when cars and trucks start travelling at the same speed, navigation software uses this as evidence that the road is becoming congested). Some navigation systems already have separate versions for light and heavy vehicles that take account of cruising speeds, road widths etc, and these are becoming increasingly granular - avoiding low bridges or left-hand turns for articulated lorries, for example, or knowing that taxis can use bus lanes.

The personality of the driver (and their car) also has an effect, says Holland. "Do they habitually obey the speed limit, how fast do they accelerate between junctions, do they drive a Morris Minor?" This can affect not only their overall journey time but even the optimum route, so in future your navigation system will analyse your personal driving style and suggest the best route to match.

New features are being added to satnav all the time. It can calculate your business mileage. It can tell you where you can buy the cheapest fuel. It can even work out how the weather forecast will affect your plans. Above all, the vendors claim, it can reduce the effect of traffic congestion on your journey - and help to reduce congestion itself by making sure you're not part of it.

"Satnav is no longer just about directing you from A to B," says Gould. "It's about giving you real-time information to get you to your destination in the smartest possible way."

WHAT PRICE FREEDOM?

Would you use your car less frequently if you had to pay for every journey? And would you take the trouble to find less congested routes or travel at quieter times of day if this reduced the cost?

Questions like these are political dynamite. But governments that have dared to ask them are finding that the answer to both is yes. And road pricing, or pay-as-you-drive, is increasingly being seen as a potential solution to burning issues such as traffic congestion, pollution and global warming.

In Stockholm, a road charging system developed by IBM, that charges drivers more for entering the city at peak times than off-peak, has reduced traffic volumes by 20%, cut waiting times by 25% and lowered emissions by 12%. Average traffic speeds have increased so much that the city has had to rewrite its bus timetables - despite the fact that thousands more people are using public transport every day.

The Netherlands government is going even further, scrapping its existing vehicle tax and purchase tax regime in favour of a pay-per-mile system that will be introduced for lorry traffic by 2011 and for all vehicles by 2018. Driving at peak hours and on congested roads will cost more than off-peak jaunts on quiet roads, and high-polluting vehicles will pay more than greener ones. The name of the project - Paying Differently for Mobility - says it all. In the UK, the Highways Agency is trialling several possible road pricing technologies.

The Dutch system will pose a number of technical challenges, says Lars Reger, vice president of automotive business development at NXP Semiconductors (formerly part of Philips), which is bidding for the contract. NXP's proposed solution would use GPS to establish a vehicle's location and the mobile phone network to transmit this data to the charging system. The successful solution will have to protect drivers' privacy, and also prevent the tracking unit being switched off, disabled or transferred to a different vehicle. "The beauty of our approach is that it uses existing technologies and we haven't had to invent anything that needs to become a new standard," says Reger.

Road pricing may be politically unpopular. But as well as being a major weapon in the fight against congestion and pollution it may be unavoidable as a means of funding road maintenance, says Howard Wilson, business development director for transport at Mastek, which wrote the software for London's congestion charge system. The US may be facing a $25 billion shortfall in road funding as early as next year - the ironic result of many Americans abandoning their traditional gas-guzzlers for more economical vehicles and so paying less fuel tax. If electric and hybrid vehicles become more popular, petrol and diesel tax revenues could fall and road pricing may have to fill the gap.

Apart from smoother roads, less congestion and cleaner air, there may be additional compensations for motorists. The Dutch reckon that two thirds of drivers could be better off under road pricing. And the compulsory in-vehicle technology required could enable the delivery a number of other services, from smart route planning with real-time traffic information to pay-as-you-drive insurance.

THE VIRTUAL DRIVING INSTRUCTOR

The vehicle that badgers its driver to slow down or sneers at their slip-ups used to be the stuff of science fiction or nightmare, depending on your point of view. But advances in technology are making it a potential reality (without the sneering, of course), and helping to teach motorists of all ages how to be greener and safer drivers.

"As vehicles become increasingly intelligent and sophisticated, the driver is the last great variable in driving," says Aidan Rowsome, European general manager at technology firm GreenRoad. So GreenRoad has developed a "virtual driving instructor" that uses a three-dimensional accelerometer and GPS satellite positioning to measure 60 different kinds of manoeuvre and provide instant feedback to the driver.

It can tell if you turn too tightly, accelerate and brake too violently between junctions, or brake too sharply into a turn. It makes a note if you exceed the speed limit or have to abort a lane-change at the last moment. An on-board computer then runs some clever software algorithms to analyse the raw data and create a simple "traffic light" score of the driver's performance - and warn them on the spot if they've done anything daft.

The system is being taken up by fleet operators, bus companies and even the Ministry of Defence to encourage safer, more economical driving among their employees. Staffordshire Council is also piloting it to improve the driving skills of 17 to 25-year-olds, who are four times more likely than average to be killed or seriously injured on the roads.

Rowsome says that just six hours with the system is enough to modify someone's driving behaviour, or alert their manager that they need retraining. Drivers aren't always overjoyed at having something they perceive as a cross between a spy in the cab and a nagging wife. But the on-the-spot feedback means there are no nasty surprises at their next performance review, and the objectivity of the system means there's no subjective criticism or chance of being blamed for damage or wear and tear that weren't their fault.

"The effects can be quite dramatic," says Rowsome. "One of our early customers, PHS Datashred, has seen a safety improvement of more than 60% and fuel savings of 10%, with a full return on investment in less than eight months."

Similar features could soon be built into large commercial vehicles using their on-board telematics technology, says David Cussans, UK operations director at truck manufacturer MAN. "Telematics is evolving from simple track-and-trace to ensuring the vehicle is being driven in a safe and economical way. The big win for fleet operators is to get real-time visibility of what's happening to their vehicles."

The technology could measure things such as harsh braking and acceleration, gear changing and use of cruise control, speeding and over-revving the engine, lane discipline and junction pre-planning, and either store the information in the vehicle or transmit it instantly back to base via the mobile internet.

"A 10% reduction in fuel consumption is perfectly realistic if the vehicle's being driven as it was designed to be driven," says Cussans. Reduced wear and tear on suspension, steering, tyres etc could save half as much again, and the number and seriousness of accidents are also likely to fall, Cussans adds.

SAFETY NEXT

If you've ever wondered why a 20-year-old jumbo jet can autopilot itself from Heathrow to JFK, tarmac to tarmac, while your brand new car can't even drive itself to Sainsbury's, consider this. To a pilot, 100 metres represents a near miss; to a driver, it's an open road.

Building a car that drives itself is relatively easy. The tricky bit is not bumping into other road users. Trucks and upmarket cars are already being equipped with a multiplicity of electronic eyes - radar, lasers, microwave and infrared sensors, video cameras etc - that potentially enable them to cruise at a safe distance from the vehicle in front, warn the driver if they drift out of their lane or some idiot is chugging along in their blind spot, and even park the car unaided.

These capabilities could gradually be extended, says Marc Winterhoff, a director of automotive and manufacturing at consultancy firm Arthur D Little, so that within a decade you could be able to work in your car while it drives itself in slow moving rush hour traffic. Wireless communications between cars could enable them to pass information and warnings along the chain, decelerating safely and economically if the traffic slows down and warning drivers about unexpected hazards, like an oncoming vehicle taking a corner too wide.

Nearside visibility is a particular problem for drivers of commercial vehicles, who could soon be assisted by ultrasound sensors that sound an alarm if there's a pedestrian or other hazard within a two metre radius, says David Cussans, UK operations director at truck manufacturer MAN. Similar technology could keep a look out when the vehicle is turning left.

Much effort is now being focused on "sensor fusion", pooling the capabilities of visual sensors, forward and sideways motion sensors, intelligent braking systems, stability controls etc, to predict impending accidents and either take evasive action or minimise the impact. By about 2012 these will have 20-30 times the processing capability of today's braking systems, says Wayne Lyons, global director for automotive solutions at semiconductor company ARM.

This could enable the creation of an "expert driver" that can take control of steering and braking in an emergency, says Lyons. It should make a much better job of things than the human driver, who could have almost no experience of emergency situations and little idea of what to do (and who may not be paying attention at the critical moment).

It's already beginning to be used, as in the electronic stability programmes that use selective braking to prevent an oil tanker rolling over if it starts to go out of control. But the addition of steering control - and in-car safety features such as pre-tensioning seatbelts and deploying airbags a few moments before a crash - could significantly enhance its effectiveness.

"We need to take ultimate control away from the driver if there's an emergency or he makes a genuine mistake," says Neville Jackson, group technology director at automotive consultancy Ricardo. It's tempting to envisage a kind of rules-based system, with hundreds or thousands of pre-programmed instructions saying 'if x happens, do y'. But this is unlikely to be enough, says Jackson. You might not be willing to endanger your own safety if a fox runs into your path, but you almost certainly would if it was a child.

So it will probably be necessary to develop some sort of "adaptive" artificial intelligence that can learn, remember and work things out for itself - and then make decisions based on this knowledge in a fraction of a second. It's just as well technology is getting smarter.

KEY TO THE WORLD

You've driven to a strange town, you've walked for miles, and now you've completely forgotten where you parked the car. Today you'd be faced with a desperate attempt to retrace your steps or an embarrassing visit to the local police station. But tomorrow you may simply be able to ask your car key.

Wireless keys that can unlock the doors from inside your pocket are nothing new. But in future they could also be able to receive information back from the car, says Kurt Sievers, automotive general manager at NXP Semiconductors, which has developed a prototype of such a key in partnership with BMW. The smart key could know whether you've locked the car properly, and be able to tell you the exact mileage (handy when you're buying petrol). If you share the car with other drivers it could store your personal settings for seats,

mirrors, air conditioning, even your favourite radio station, so the car adapts automatically before you get in.

The key could be used for small electronic cash payments, for example at parking meters or filling stations, and because it contains the same circuitry as a credit card it could save you carrying a separate credit or debit card. If you forget where you've parked, says Sievers, the key could be able to give your mobile phone the car's exact grid reference (obtained by GPS from the satnav system), so your phone can guide you back. To make things even easier the technology could be built into the phone so you wouldn't need a separate key at all.

You might not even need your own car, according to Marc Winterhoff, a director of automotive and manufacturing at consultants Arthur D Little. A scheme is being piloted in Germany that would allow subscribers to pick up a pool car on the street, using a smartphone or chip card to prove their identity, and hire it by the hour or even the minute. "We think car sharing will grow and we're already seeing interesting technologies to enable this," says Winterhoff.

The secret behind smart keys and shared cars is near field communications (NFC), a souped-up version of RFID technology that's already used in smart ticketing systems like London's Oyster card, and which many experts predict will revolutionise the way we interact with the increasingly intelligent world around us. With NFC chips embedded in everything from advertising hoardings to hotel rooms, your smart car key may open more doors than you ever imagined.

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