Transport Beyond 2021

Diane Edwards

Zuri Limited / CILT National Vice President

A little about me

A little about me

MAERSK

P&O Nedlloyd

TE MANATŪ WAKA
MINISTRY OF TRANSPORT

PORTS OF AUCKLAND
TĀMAKI HERENGA WAKA

What We'll Cover Today

- Why thinking about the future outside our industry is important
- Example of innovation for infrastructure.
- A possible innovation for fuel
- The next generation of robotics and automation for logistics and vehicles
- A possible disruptor for freight
- How IoT is already impacting roads and cities

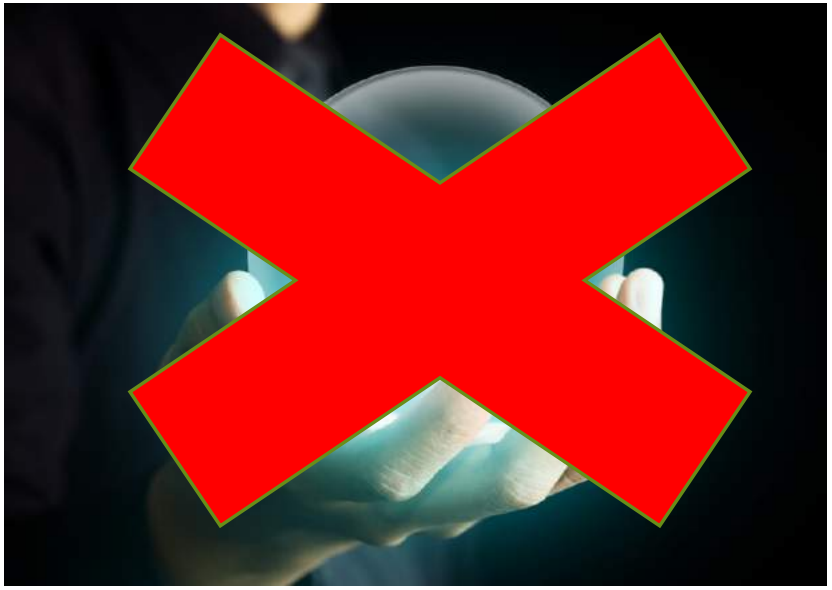
Let’s start with a question

Think about your own organisation

How far ahead do you typically plan?

1. Planning – what's that?
2. One year - we have an annual business plan that is mainly about goals, targets and project completion.
3. Two - three years. We regularly scan our business environment and ensure we know what is happening in our industry.
4. More than 3 years but less than 10. We do a lot of longer-term planning as many of our goals will take a while to achieve.
5. Beyond 10 years. Long term planning is part of our DNA and we are doing constant projections about our future beyond 2030.

What a Futurist Does Not Do!



We do not predict the future!

What a Futurist Does

- Scans and collates what is new in the world.
- Does cross-disciplinary research to identify innovations in one sector that many disrupt another.
- Validates data through the examination of multiple data sources
- Analyses identifies signals from within the interplay of trends across different domains, extrapolating what this could mean for the future.
- Creates scenarios of different possible futures and the triggers that may signal which future is being realised.
- Assists others to create agile companies that can flex as the future becomes today's reality.

How a Futurist Works

S ociological

T echnological

E conomic

E nvironmental

P olitical

Cross-disciplinary approach

Scanning and Revising

Signals not trends

Planning Backwards

How The World Responds to STEEP

An example

Warm mix asphalt (WMA) has been developed in response to the demand for roading construction to be more eco-friendly and sustainable. It reduces energy consumption while simultaneously minimising vapours and greenhouse gas emissions during the production of asphalt mixtures (in comparison to conventional asphalt).

Think about your own organisation

How widely do you research when you are creating your strategic plans?

1. We create a preferred scenario for the future, and then build our plans around this.
2. We look at what we have done in previous years and then extrapolate what that means for the next year or two.
3. We methodically research wider than our industry and use this to create our plans.
4. We just add a percentage to this year's targets and add a couple of other things we know we want to do.
5. We research our industry widely (in NZ and overseas) and use this adjust our plans, so we keep up with the play.

Why We Look Beyond our Industry

Neobanks

Autonomous cars

How biology has triggered innovation in roading infrastructure

Nanobots and Microbots

Nanobots emerged from the biological sciences where molecules are programmed to turn on and off, move and perform programmed actions.

In medicine they are used to seek out pathogens and are showing promise as a potential treatment for some cancers.

0.000001mm

The Rise of Nanobots

Plan led by Prof. Kiril of Sheffield University, to use micro-robots to inspect and repair roads. The Micro-robots will have 2 roles:

- Inspection bots to navigate, explore and report in roading conditions – autonomous bots about 1cm long
- Worker bots carrying cement and adhesives to make repairs – remote controlled (potentially autonomous in the future) 2.6 cm long

The Rise of Nanobots

Prof. Kiril has £7.2M funding from government to develop and test the microbot prototypes. Why?

UK has 1.2M road excavations each year.

That cost circa £6.3 billion.

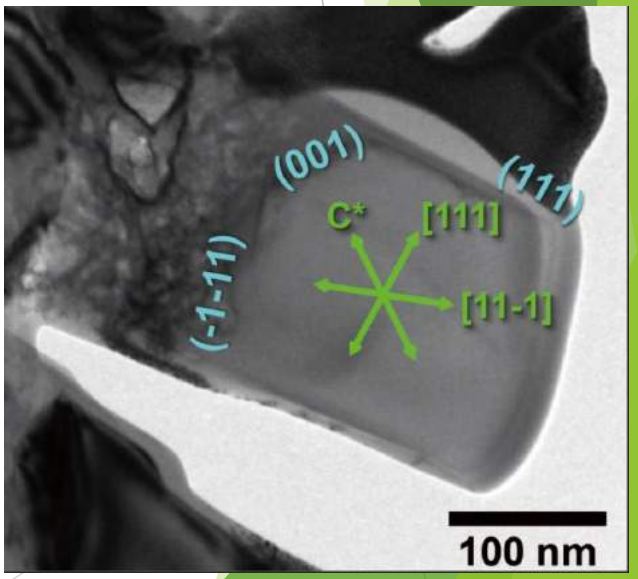
If successful, field trials will be starting next year.

Innovations in geology and physics could revolutionise fuel

Microdiamonds (Nanodiamonds)

Microdiamonds in metamorphic rocks are important minerals because they form in continental collision zones and show that the crust has penetrated deeper than 120 km below the surface.

Nanodiamonds or diamond nanoparticles are **diamonds with a size below 1 micrometre (0.001mm)**



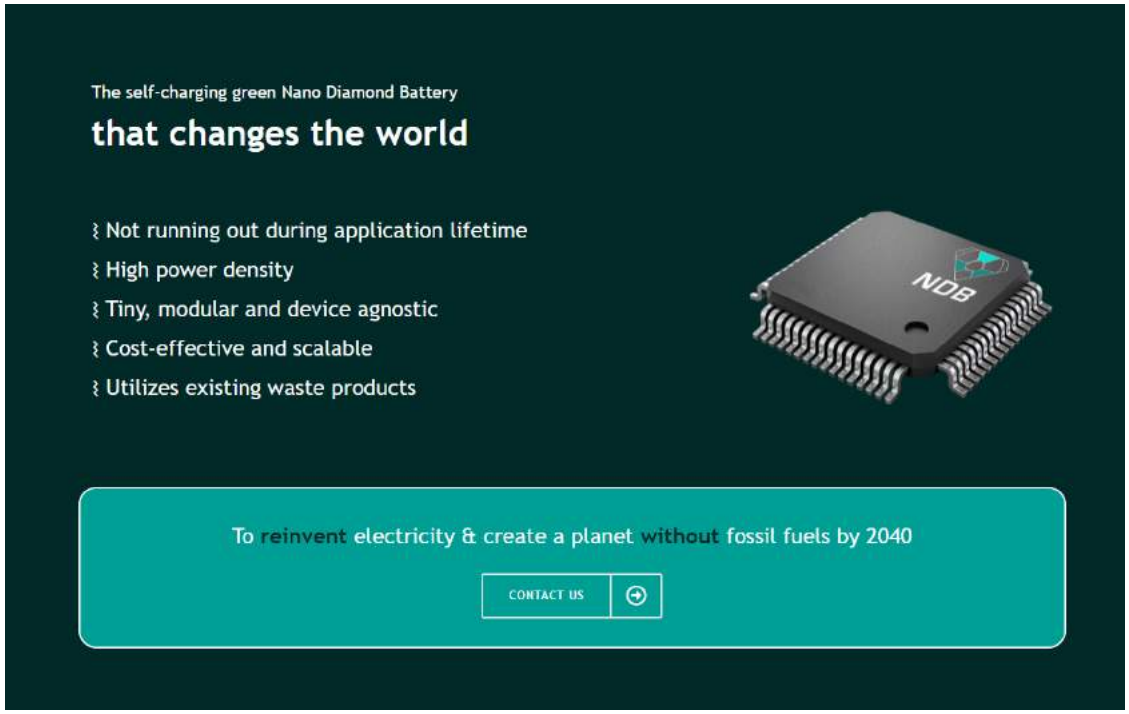
Nano-diamonds

Compression diamonds also form as the by-product within nuclear reactors and are radio-active.

Generating a virtually inexhaustible source of energy from radioactive material has long been discussed and is already employed in a variety of non-diamond-based technologies.

“Micro-diamond batteries” are a theoretical application of this technology but current developments suggest the reality is closer than first thought.

Nano-diamond Technology



Wang has a useful summary of use cases under development including development of nano-diamond batteries. Nanodiamonds for energy - Wang - 2019 - Carbon Energy - Wiley Online Library

The next generation of automation for transport and logistics

Levels of Autonomy

0. Human controls all driving.
1. Some computer functions replace human (e.g. cruise control and lane alarms).
2. Car does its own driving, but human stays alert to take over in new and emergency situations.
3. Car does own driving and driver can take eyes off the road but may be called on to take over if the AI needs help.
4. The driver does not need to do anything. The car drives itself but a human can still choose to drive it.
5. The vehicle operates without a human – the car may not have controls like a steering wheel or pedals so can't be driven by a human except by remote control.

Robotics and Autonomous Vehicles

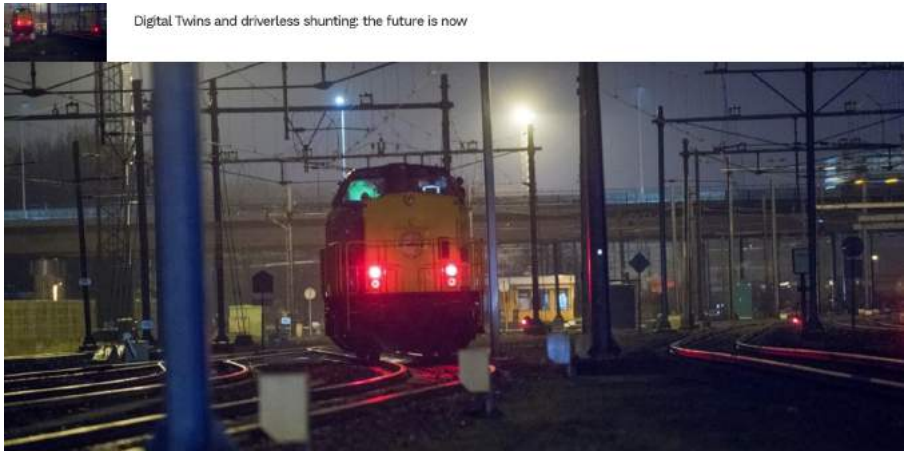
Launched 2018 Australia & USA

Launched 2020 Norway

Launched October 8, 2020 in Pheonix, Arizona

Launched 2021 Houston to Fort Worth

Robotics and Autonomous Vehicles



Robotics and Autonomous Vehicles

Autonomous Vehicles - Next Generation

Why fully autonomous vehicles are not already common.

1. Social acceptance
2. Ethical programming
3. Sensors
4. Limitations of machine learning
5. Political inertia around regulation

Robotics and Autonomics

Robotics and Warehouses

Autonomous Delivery

Autonomous Delivery – Major Freight

More on autonomous vehicles

https://hbr.org/podcast/2021/03/engineering-a-driverless-future

Additive Manufacturing (3D printing)

- **3D printing**, or **additive manufacturing**, is the construction of a three-dimensional object from a digital 3D model through processes, controlled by computers. It involves depositing, joining or solidifying materials to create a three-dimensional object. Material such as plastics, liquids or powder are fused together, typically layer by layer.

Discussion

How might 3-D printing impact transport business models?

Perhaps the dominance of the container may be nearing its peak

How IoT is already impacting transport and cities

Internet of things - IoT

- The **Internet of things** - (**IoT**) describes physical objects (or groups of objects) that are embedded with technology such as sensors, processing ability, software, and other, and that connect and exchange data with other devices.

Smart Transport and Logistics
Real life IoT Example

Real Time Traffic Management Systems

- Manage traffic behaviours in real time by utilising a network of technologies including sensors, smart cameras, GPS and Bluetooth/Wi-Fi.
- Used to efficiently reduce congestion, bottlenecks, parking and other traffic issues. Also has the potential to improve public transport reliability.

Inrix – Kirkland Washington, USA

Smart Transport and Logistics
Real life IoT Example

Real Time data on driver behaviour and road conditions:

- Utilises sensors to analyse driver behaviour such as speed, tailgating, braking, different reactions during day and night driving, etc.
- Can also analyse driving in relation to weather and road conditions and provide data on collisions and near misses.

Concirrus – London, UK

Smart Transport and Logistics
Real Life IoT Example

Real Time Monitoring and Prediction

- Monitors fuel consumption, predictive maintenance, pinpoints repairs and analyses impact of driving habits on these.
- Can proactively locate suitable shop and mechanic for maintenance and repairs.

Dash – New York, USA

Smart Transport and Logistics

Freight Monitoring

- Internal sensors gather and broadcast real-time data on everything from temperature and humidity to CO2 levels.
- Real-time 24/7 GPS tracking of containers, provides automatic notifications that keep cargo owners aware of any deviations in temperature or pull-down rates, enables cargo rerouting and improves security.

Maersk – Copenhagen, Denmark

Smart Cities - Examples

- Adapts the lighting in an area to the traffic and light conditions.
- Monitors number and location of people needing public transport and send approprate sized vehicle to exact location.
- Monitors litter bins and street litter and triggers clean up as required.
- And so on ….

“The future is already here – it's just not evenly distributed.”

William Gibson

One person's disruption is another's innovation.

The best way to predict the future is to invent it."

Alan Kay, American Computer Scientist

Reflection

Some questions to consider in the context of your own company?

- How well informed are we about the technologies that are changing our future?
- What might we do differently about the way we plan?
- What is the most important thing I learned today?

What To Look Out For

Educated Incapacity

Closing Thoughts

“The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn. ”

Alvin Toffler

Futurist

Questions?

Feel free contact me

E: diane@zuri.co.nz
M: 021 123 2540

linkedin.com/in/diane-edwards-9943581

#didikiwi2