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The cement Industry and innovation: a new approach

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The business environment is in a state of continual flux driven by factors including changing demographics, technology development, swinging market perceptions, ongoing environmental degradation and the rapid flow of global financial capital.

To cope with continual change the cement industry will inevitably like every other industry need to be able to reinvent itself and prepare for opportunities for both failure and success. This requires a degree of entrepreneurship and the cautious investigation followed by and adoption of new technologies.

The customer and market competition

Cement or concrete is rarely purchased by customers in order to maintain a company's profitability or to support an industry. It is usually acquired to fill a structural, mass or bonding requirement.

From slag to foam, fibre to fly ash, a wide range of cementitious composites is available. More and better alternative materials are also being developed to satisfy increasingly sophisticated customer specification requirements.

To maintain market share in a world with so much choice the industry must innovate and respond to what the customers of both today and the future will want. For example, strength as in traditional ready mix concrete need not necessarily denote a heavy material. Likewise, high thermal capacity need not necessarily mean low insulation capability. A mix of hydraulic cements with non-traditional reinforcing materials and aggregates will result in concrete products that exhibit a wide range of properties able to optimally fulfil the needs of customers.

The sustainability imperative

The mining of raw material and disposal of waste face limits. Concrete is the major material used in construction and probably constitutes 20% to 30% by mass of all material flows across our planet. Partly due to environmental and social pressures, the political limits associated with these activities are becoming real today and will only increase in future.

There are also resource limitations, especially in heavily populated countries like India and China, where cement manufacture is accelerating at a phenomenal rate, purer grades of limestone are starting to run out and magnesium contamination during the clinkering process is becoming an issue.

At the other end of the lifecycle, waste is the issue. In Europe particularly, governments are getting serious about environmental sustainability, and an obvious focal point is waste. For example, in the UK, 60 million people on a small island produce more than 470 million tonnes of waste, with about 140 million tonnes (30%) coming from, in one way or another, the construction industry. European

regulations and progressive taxation on landfill are clear signals that society demands a new paradigm of resource flow.

In a traditional recycling paradigm, wastes are sorted for their molecular value rather than their general class of properties. If wastes were sorted in accordance with their properties rather than their molecular constitution then they would become a cheap resource to make various cementitious composites.

With over two tonnes of concrete per person on the planet produced annually on a global basis, it is an obvious move for the cement industry to look at how to incorporate both more, and a wider range of, waste to make cementitious composites.

Australian R&D firm TecEco Pty. Ltd of Glenorchy, Tasmania is investigating innovative and very promising new calcium-magnesium blended binder materials with their tec-cement, eco-cement and enviro-cement experimental products.

Ongoing technology evolution

Cements and concretes are changing to better meet the needs of customers ahead of the competition. The construction industry is conservative and the changes have been slow, such as the increase in the alite/belite ratio over the last twenty years and the incorporation of supplementary cementitious materials and various fibres. Cements and concretes probably need to change much more quickly to meet the challenges of the future.

Challenging the traditional construction paradigm is robotics. In the USA and elsewhere in the world researchers are looking at using robots to literally print buildings. It is all quite simple from a software, computer hardware and mechanical engineering point of view. The difficulty is in developing new construction materials with the right Bingham plastic rheology so they can be squeezed out like toothpaste, yet retain their shape until hardened.

TecEco believes its cement concretes have the potential of achieving this kind of rheology. The one material fits all purposes approach will increasingly have only limited relevance. Concretes will need to evolve from being just a high strength grey material, to a smorgasbord of composites that can be squeezed out of a variety of nozzles for use by a robotic workforce for the varying requirements of a structure.

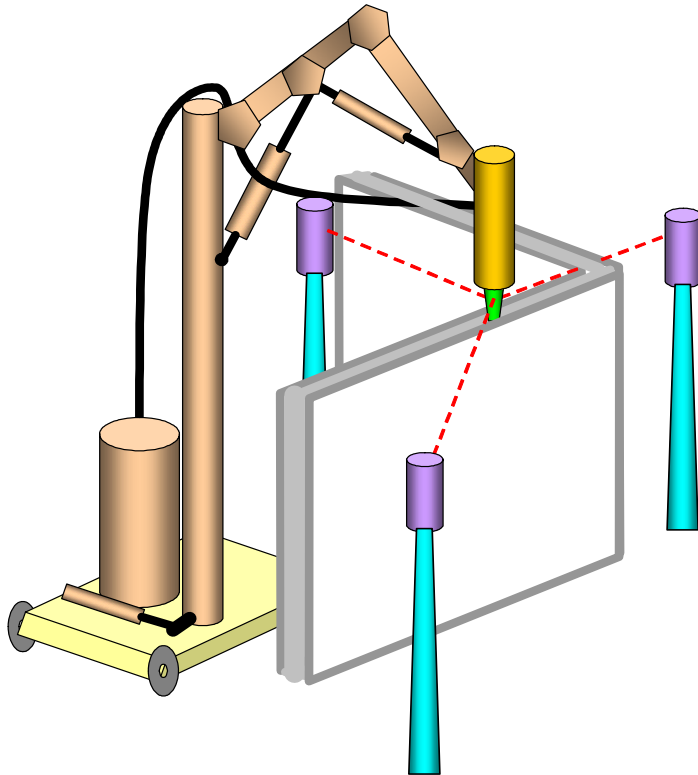


Figure 1 - Robotic Construction of Cementitious Composite Walling (this is being used)

The main inhibitors to evolution in the industry is the formula-based approach to standards which grew out of the industrial environment of the early twentieth century. Standards are important for society's protection, but to allow creativity and innovation, standards would be a much better servant to society if they were performance based rather than formula based.

Adjusting the sails to suit the wind

The cement and concrete industry has some inherent problems that restrict the rate of adoption of new technologies to meet these challenges. These include:

- expensive manufacturing infrastructure
- low margin product
- proliferation of formula based technical standards
- industry culture tied to the belief that "it has always been done this way"

These excuses will not impress an institutional investor which has a myriad of investing opportunities to choose from and is ready to move millions of dollars of capital to anywhere in the world at the press of a button. Neither is a user trying to overcome a problem such as cement shrinkage or corrosion or a politician who is being pressured by community concern over environmental degradation going to be interested in the problems of the industry. Cement manufacturers need to ask themselves the same questions.

Properly identifying the business a company is in uncovers opportunities for growth through the production of goods and services more in line with the changing needs of customers and other stakeholders.

What level of thinking is required to effectively bring your organisation and industry into the new century? What are the developments occurring of which you should be aware and supportive? This article is meant as a challenge to industry and to the individuals who comprise it.

Robert Cameron and John Harrison are employees of Tec Eco Pty Ltd, of Glenorchy Tasmania.
TecEco is researching a variety of alternative binder materials under the names Tec-cement, Eco-cement and Enviro-cement.