# R&D in a small technology-focused business – Puku Ltd

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## Introduction

Puku is a specialist fastener company which has invested heavily in intellectual property (IP), with a particular emphasis on helically based connections. We focus on developing and licensing great ideas to licensee partners, who are, or want to be market leaders, and who are experts at manufacture, marketing, and distribution.

Puku's family of technologies use two simple mechanical properties, elasticity and friction, in unique ways that connect elements with very reliable 'self-locking' forces.

Puku's technologies are safer, cheaper, and quicker to operate than others. They solve real problems for consumers, and create game-changing opportunities for our licensee partners.

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## Innovative helical devices

Most people know that a spring expands and contracts longitudinally but most don't know that you can change its diameter by pushing or pulling or twisting the spring. A Chinese finger trap demonstrates the same principal. Using a helix to connect things is something that appears to have been almost completely overlooked by engineers throughout history. For this reason we have a very strong IP situation with our Helical patents, so much so that we have managed to patent the Chinese finger trap as a pipe connection mechanism (see Figure 1).

I invested in Puku about two years ago now and it has been quite a journey. Last year we were focused on our golf driver technology – the ability to change loft, lie and face angle of the driver, which is the latest technology. Figure 2 depicts the Titleist take on dual axis technology.

**Dan McElrea** is chief executive officer of Puku Ltd. Dan combines qualifications in economics and marketing with an interest in the point where technology and marketing meet. He has extensive experience in business and IT consulting to a range of industries both in New Zealand and Europe.

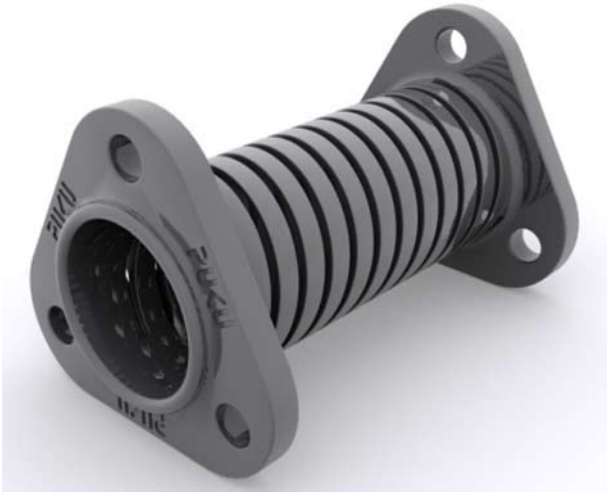

*Figure 1. The twin helix clamp.*

How the incumbent technology works is that the pin at the end of the shaft is bent so the orientation of the head relative to the shaft changes depending on how you put the shaft to the hosel. The cone that the shaft defines translates to a head moving around in such a way that you can adjust to the left and up or to the right and down. Our invention was the addition of an eccentrically bored out sleeve which allows dual axis adjustment.

We looked at the sleeve and realised there was an opportunity to wedge the sleeve into the hosel as a way of connecting the shaft – a three-part dynabolt if you will.

Well, the push and wedge connection system relied on having the angles worked out very precisely. This is where we developed this test rig here, so if the angles were wrong in such a way that we could get the connection but not release it we could unscrew the rig and push the pin and sleeve out. I distinctly remember last November sitting in our second office, Burger King Hillcrest, with Simon and one of our engineers in a great state of excitement almost shouting, 'Oh my God, this could connect almost anything'. We could not think of a connection system that was so simple, so fast to connect and disconnect, and so strong.

The next prototype was for cable connections that water or air could run through. We didn't realise at the time, but this technology could solve a very large problem with the standard pneumatic connections, which invariably begin leaking in a matter of months because the ball bearings wear the metal they press against.

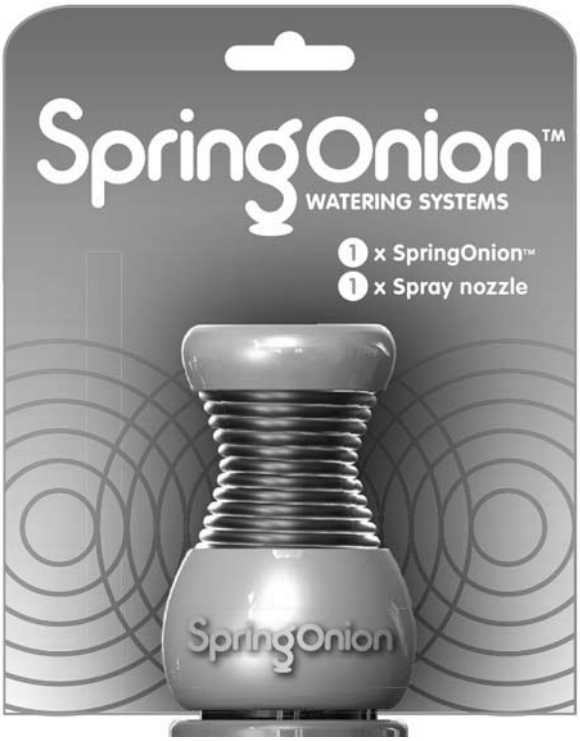


*Figure 3. SpringOnion watering systems.*

We knew that garden hose connection systems were less than ideal, so we started thinking that this could be a strong area for development. What we realised was the main problem here was not the quick connect part so much, but where the hose connects to the system.

So back we went to the helix to solve that problem and here is the result – the SpringOnion – seen here in Figure 3. At our AGM a shareholder suggested a by-line of 'not a leek'.

We had been in preliminary licensing talks with a large manufacturer to bring this to market, but progress stopped because they wanted us to complete a whole prototyping and testing cycle and we had run out of money yet again. Luckily at this time our golf technology was becoming hot as the international golfing equipment firm,Titleist announced a new line of clubs with dual angle technology similar in function to ours.

A product that existed at the time I first invested in Puku Ltd was the spring bolt. Figure 4 is the Titanium version of one. It works by mismatching the thread of the nut and the bolt and forcing the spring bolt to stretch as it goes into the nut. This

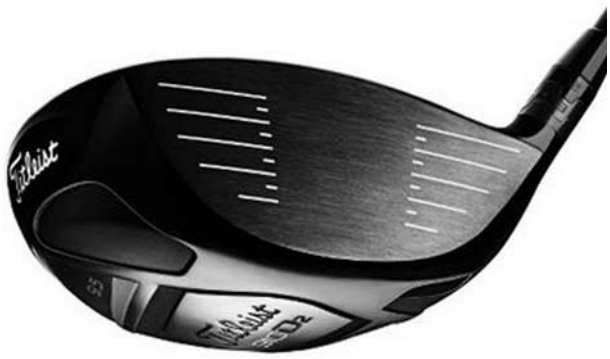


*Figure 2. The Titleist D19 driver.*

*Figure 4. The vibration-proof spring bolt.*

means it is more difficult to tighten but does not require torquing up, is vibration proof, is shock proof and has some native flex. I should add that the worldwide fastener market is about $60 billion dollars. Vibration is a major problem – it is the enemy of connections.

Towards the end of 2009 , we were visiting a company who uses a lot of screws to connect steel framing, and we hit on the idea of using a spring as a potential replacement for the rivet or metal screws. The spring rivet could well be the biggest opportunity we have. Advantages of this technology include: being vibration-proof, speed of application, cost, and not requiring a tapped hole. A potential place to enter the market might be as a replacement for micro rivets.

We also have patents under way for external helical drive bits and internal drive bits. Both of these have strong security applications and manufacturing advantages because they can drive a round bolt or nut, or a screw with a tapered hole punched into it, rather than a conventional hex or cross.

So to connect ends of the story, springs were very much top of our minds at the time of the Gulf of Mexico oil spill. I had joked to my family that Puku probably had a solution for the crisis, but thought the leak would be plugged within a week or two. That was not to be. Two weeks later people were talking seriously about 'nuking' the well, and film director and inventor, James Cameron, of *Titanic* fame, was getting dragged into brainstorming sessions. I was in Puku's Ponsonby office (the library) when it dawned on me that we could help, and it was a desperate race from that point to develop, prototype, demonstrate and publish our solution. We don't know if we were heard by BP, but we do know that the final solution was very much what we were proposing – a pipe within a pipe solution (that at least two marine engineers were very sceptical about).

## The Puku business model

The Puku business model is licensing. Strategies we use to get large multi-national licensing deals include:

- Speculative development of technology, e.g. our golf driver technology;
- Consultancy with nominal licensing arrangements, e.g. with high-tech firms;
- Consultancy and licensing, e.g. with the marine tech and design firm Southern Spars and the motorsports, Williams Race Team;
- Manufacture and market a technology on a small scale to prove the market, e.g. with the SpringOnion.

We are on the point of success with the first type of development, and are in active discussions for the others.

## Puku and the innovation system

How does Puku fit into the innovation system? Puku does not do research as such, or if it does, it is at the very applied end. For Puku, it could be considered that development is research due to the staggering number of discoveries we make as a bi-product of development.

We have good contacts into university engineering schools and we look forward to working with these institutions more in the future, especially in identifying the best applications for our technologies and helping test and accredit our connection systems.

We have had a grant from TechNZ a few years back to research connection systems, and this was certainly helpful. TechNZ events and programmes have provided us with some very worthwhile networking opportunities, for instance the TechNZ Innovation Forum in June last year, where we met such companies as INRO and Aerograph. Another programme allowed us to meet R&D managers from Fisher & Paykel, Gallagher's, and Framecad. These are very important companies for the likes of Puku, because there are so few manufacturing exporters in New Zealand.

The NZTE market capability (travel) grant has enabled us to visit golf companies these last two years as well as fastener and spring manufacturers and trade fairs. This has been exceedingly useful for us and I am sorry to see that this programme has been discontinued.

## Some general observations on R&D in New Zealand

Clearly national (private and public) spend on R&D is low. However, I saw that half the R&D in the USA is done by the manufacturing sector, and we have a very small manufacturing sector so I guess our low R&D spend is not so surprising.

So why do we have so few successful manufacturing and exporting businesses? One reason is that successive governments have allowed a massive over-investment in property, which has crowded out investment in productive businesses. The lack of a compulsory superannuation fund has further starved New Zealand businesses of investment funds.

Because the government has relatively little to spend on R&D, I feel it needs to channel it into a few well-chosen areas. We at Puku strongly believe Cleantech should be one of those areas.

There is a global industrial revolution going on, and New Zealand has a choice of whether to adapt to the new clean economy and prosper, or resign ourselves to being a low value-added commodity economy. Probably of any nation in the world, we have the best brand from which to leverage cleantech exports. We are skilled innovators who can readily meet the challenges of this industrial revolution, but it is a new industry which will need help getting established.

Puku's model is a very good model for New Zealand as it is a weightless export powered by what New Zealand is best at – coming up with world-leading ideas.

What got us into business was market pull (in textbook fashion) with our golf technology, but now we have a collection of unique patented connections and articulations, and our challenge is to seek out the best industries and applications for those. We need to see blood on the floor in wealthy industries – medical and mining industries make a good starting point.