**Teaching note for the *Walk Tall – the story of REX Bionics* teaching case.**

**Synopsis of the case**
The case is about the key decisions faced by the founders of REX Bionics in the commercialisation of the initial idea to provide a “walking skeleton” for those that are wheelchair bound. The history of REX Bionics lies in the founders’ first-hand experiences with people diagnosed with multiple sclerosis (MS). Over the course of some fifteen years the company evolved from a “workshop idea” in a garage to a public listing on the London AIM Stock exchange. In a context challenged by multiple institutional hurdles, rapidly moving technology and high start-up costs, the company has successfully begun to commercial the walking robotic exoskeleton inspirited by the “Power Load” in the movie Aliens. The founder faced some tough choices about what commercialisation pathways to pursue in the light of diverse perspectives from an advisory board, various investors and personal missions.

The changing role of the founders in a technology-based business and the interplay between the founders’ vision and the reality of growing technology-based businesses is the focus. The case is set in New Zealand, a small industrialised economy that is geographically distant from financial, customer and regulatory markets typically associated with high technology medical devices. Over the course of the case, REX Bionics secured start-up funding in the weak local venture capital market and development-based investment for scale-up through to a London AIM stock exchange listing. Underpinning the REX Bionics case is the founders’ intimate customer engagement with users that have provided them credibility and valuable design input.

**Theoretical framing**

As stated above, the focus for the case was the founder’s entrepreneurial journey from start up to established technology business. In particular, we were interested in exploring entrepreneurial action in practise. This discussion is framed at the nexus of the entrepreneur and the opportunity (Shane, 2003). We are interested in the entrepreneurial mindset (Timmons & Spinelli, 2011) and the opportunity discovery and/or creation process (Alvarez & Barney, 2007; Alvarez, Barney & Anderson, 2013). The notion of risk and uncertainly forms part of this discussion (Courtney, Kirkland & Viguerie, 1997); Kaplan & Mikes, 2011).

In addition, we a explore the types of innovation that arise in both the start-up and growth phases of the business. To frame this conversation, we draw on Keely’s (2013) discussion of the Ten Types of Innovation. This framework presents both a context for innovation as well as highlighting the building blocks of a business. It also enabled the case to focus on the users/customers.

**Method**

This is a Harvard style case drawing on a range of data sources. Secondary data was sourced from published material that included: REX Bionics website, newspaper articles, academic publications and publicly available videos. One of the founders, Richard Little gave guest lectures to a final-year undergraduate course three times over four years, which provided us with insights into his thinking at different time points. Two very targeted interviews were carried out with Richard Little (Founder-CEO) and the authors visited the manufacturing premises in Auckland to understand the manufacturing process and to experience first-hand the user experience of wearing REX.

 Ethics approval was sought and approved through the University of Auckland Case Study Centre, University of Auckland. The presentation of the case is factual and there is no fabricated information.

**Target group/Positioning**
The case is aimed at postgraduate and executive students and is written for audiences interested in the challenges of technological entrepreneurship. Our experience has been to use the case with research and executive students in bioscience and commercialisation programmes and PhD students from STEM subjects taking research commercialisation electives. It would be equally useful for general entrepreneurship audiences at both an undergraduate and graduate level.

**Learning objectives and key issues**
The overall objective of this case is that students can discuss the commercialisation options for the founders and the implications of these decisions

To achieve the learning objective, key issues that require discussion include:

* Founder mission – what alignment, if any, was there between the entrepreneurial mindset and the investor mindset?
* Founder capability at the start-up phase and in subsequent stages of growth
* Who are the users and who are the customers? Often students do not distinguish between those that purchase a product (hospital, insurers) and those that use the product (MS, coronary heart patients, spinal injuries). It is important to make these distinctions as information asymmetries are experienced by all but the ones associated with the (potential) buyer are what is most important is assessing potential markets for the product. It is equally important for students to clarify what value is potentially created for the user and the value created for the buyer.
* What are the types of innovation emerging from this case? While the product innovation is apparent, there is also potential innovation occurring in the service provided to users and challenges around other innovations as discussed in Part 2 of *Ten Types of Innovation* by Larry Keeley.
* Where do the firm's (and to some extent the entrepreneurial founders) preferences fit? Often students, particularly executive students with strategy or entrepreneurship backgrounds, privilege the firm’s or the founder’s preferences in regards to commercialisation pathways that support those goals. Regarding working out what commercialisation pathways are viable, it is important that students focus on understanding the issues related to information asymmetry, tacitness, specialised investment and IP protection that determine the market for the product first. Unless a market for the product can be established, then the goals of the firm/entrepreneur are meaningless.

**Teaching strategy**
We use the case in three ways reflecting different elements.

The entrepreneurial mindset and growth journey

We start by asking students to go inside the head of Richard Little, one of the co-founders. From the founder’s perspective, we ask what challenges he has faced and how has he addressed these. From here, students usually establish that there are some common challenges that matter – which relates to funding, the slow pace of this type of technological development due to the “do no harm” principle, and the various institutional hurdles, e.g. how the insurance market works when selling new medical devices. Also, we ask students to consider whether the opportunity that is discussed in the case, best illustrates an effectuation logic, a causation logic, or a combination, and the implications this has for the commercialisation pathway.

Once the discussion of these questions is exhausted, our follow-up question is what Richard Little could have done differently. Facilitators can take the follow-up questions in at least two directions:

1. Is to compare and contrast the REX Bionics case with the current situation for medical device commercialisation to a recent start-up to identify the underlying challenges and to identify the challenges that change as industries evolve.
2. Is to compare the experience of the REX Bionics founders to the founder characteristics in the extant technological entrepreneurship literature to understand how the mindset and skillset informs the set of choices the founders can consider.

The final question that can be asked is: what will Little do next?

The founders made a choice to stay with the company when it was publicly listed and there were challenges with that. The company is about to enter another challenging phase as they seek FDA approval, upgrade REX in light on technological developments, and growing into multiple countries. Little indicates he is expecting to his travel commitments to reduce and he would spend more time on building new devices. This provides students with the question of whether Little will stay on in his current role or whether his role will change since his future description is incongruent with the REX’s current situation.

Types of innovation in a technological start-up

Since we use Keely’s (2013) Ten Types of Innovation framework, we challenge students to explore what types of innovation are present in the case and what combinations of innovation types are most important. This task can be done in small groups then reported back to the larger class. Also, it can be done individually and then shared.

Risk and uncertainty in technological entrepreneurship

Using a risk framework, we start by identifying the types of risk faced along the commercialisation journey. Frameworks in either the Courtney et al. or Kaplan and Mikes papers (listed below) work well for this and lead into helpful discussions clarifying risk versus uncertainty in a Knightian sense. Also, these frameworks, lead to follow-on questions about how the company mitigated (managed) the various risks. In particular, there is a provocative question to ask as to whether Richard Little, the Founder-CEO, then CTO, is a risk given his limited managerial experience in the early stages, and how prospective investors might view the company. For classes where risk management is central, an alternative line of discussion is about what tools are appropriate for managing the types of risks faced by technological entrepreneurs.

**Background reading**
We provide the following as pre-reading.

* For entrepreneurial mindset and growth journey, we recommend any standard text.
* On the effectuation and causation question, we recommend Alvarez, S. A., & Barney, J. B. (2007). Discovery and creation: Alternative theories of entrepreneurial action. *Strategic Entrepreneurship Journal*, 1(1‐2), 11-26; Alvarez, S. A., Barney, J. B & Anderson, P. (2013), Forming and Exploring Opportunities: The implications of Discovery and Creation processes for Entrepreneurial and Organizational Research, Organization Science 24(1), 301-317).
* For innovation, we use Keeley, L., Walters, H., Pikkel, R., & Quinn, B. (2013). *Ten types of innovation: The discipline of building breakthroughs*. John Wiley & Sons.
* For risk and uncertainty, we use Courtney, H., Kirkland, J., & Viguerie, P. (1997). Strategy Under Uncertainty. *Harvard Business Review*, 75(6), 67–79 or Kaplan, R. S., & Mikes, A. (2011). *Managing the Multiple Dimensions of Risk: Part I of a Two-Part Series* (The Balanced Scorecard Report). Harvard Business Publishing, which is available from http://www.thepalladiumgroup.com/KnowledgeObjectRepository/KaplanOnRisk.pdf

**Experience of using the case**

We have used the case twice, once with Masters students in a research commercialisation course that has a bioscience focus and once with Executive students in an entrepreneurial science and technology course. Both classes were about 25 students each.

In the former, students have multiple experiences of case-based analysis and classes are three-hours in duration. Because they are more skilled at preparing for and discussing cases, the discussion can easily run for 2-3 hours. Also, the case is the basis for an individual assessment requiring students to address three pre-set questions.

In the latter, the case is used to engage students through a case-based discussion focussing on entrepreneurial mindset and innovation. The students have neither prior experience nor skills in case discussion. Often their case reading is superficial, so we revise the learning objectives to achieve lower-order outcomes such as identifying, labelling and illustrating key concepts that are important to the topic.

In both instances, we find it is useful for students to complete the following:

* Draw a timeline of key events in the firm's history to date and decisions made by the founder. This is a long case and covers some 15 years, so it helps students to visually depict key decision points that they think matter to understanding the case.
* When we specify other pre-readings, we direct students to complete pre-work to illustrate and apply the models to the case, so they have some ideas to share.

**Multimedia**
Some of the early users who were employed for a short time at REX Bionics elaborate on how the exoskeleton works and the effects it has on their lives. Hayden Allen appears in Exhibit B of the case and this clip featuring him provide students insights about the value he gained from the exoskeleton. <https://www.youtube.com/watch?v=EGw5DYngHTo>

Similarly, Sophie Morgan shared her experiences in a UK television report. <https://www.youtube.com/watch?v=2HKrcHOigTU>

NB: the content in Hayden and Sophie experiences are similar so facilitators might consider whether both clips are necessary.

From a growth perspective, CEO Crispin Simon speaks about the growth opportunities in two markets – physiotherapy and home/work environments - in this 2015 video, which chronologically is where this case ends.

<https://exoskeletonreport.com/2015/05/rex-bionics-new-applications-and-markets/>