GLOBAL HEALTH

Innovation Insight Series

Courtesy of ReMotion Designs

Joel Sadler (center) and his teammate, Eric Thorsell, talk with a patient who was fitted with a JaipurKnee

THE JAIPURKNEE PROJECT II: Scaling Up the Business

STANFORD, CALIFORNIA AND JAIPUR, RAJASTHAN, INDIA

ESTABLISHED 2008

REMOTION DESIGNS AND D-REV

THE PROBLEM/SOLUTION SPACE

Around the world, more than 20 million people have had limbs amputated due to natural disasters, trauma caused by accidents or war, and diseases such as diabetes. Of these amputees, 80 percent live in a developing country and are unable to afford modern prosthetics, which can cost from $10,000 to $100,000 depending on their level of sophistication.[1] Low-cost prosthetic leg systems have been developed, but they typically are based on suboptimal or out-of-date technology.

ABOUT THE JAIPURKNEE PROJECT

Seeking to better address the needs of India's 1.65 million above-knee amputees,[2] Bhagwan Mahaveer Viklang Sahayata Samiti, Jaipur (BMVSS) reached out to Stanford

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for assistance with designing a new low-cost knee joint that could be manufactured locally for use in its clinics. BMVSS, which was commonly referred to as the JaipurFoot Organization, was an India nonprofit that provided a variety of mobility solutions to the "physically challenged, particularly the financially weak among them."[3] Joel Sadler and a team of three other students accepted the challenge.

The JaipurKnee team researched the problem, including the limitations of the existing knee joints the clinics were using. Over time, it created an innovative knee joint that met the unique needs of developing world amputees. Key characteristics of the design included:[4]

> **High performance** Gait stability and a natural swinging motion. 165-degree range of motion that enabled kneeling and squatting.
>
> **Durability** Made from oil-filled nylon polymer and self-lubricated with use. 3-5 year lifespan in bench top testing.
>
> **Simplicity** Only five plastic pieces and four standard fasteners.
>
> **Comfort** Just 1.5 pounds.
>
> **Affordability** One-tenth the cost of comparable polycentric knee joints.

ONE CHALLENGE: SCALING UP THE BUSINESS

By late 2011, the JaipurFoot Organization had fitted 3,000 patients with the JaipurKnee joint in its clinics across India. 79 percent of these patients continued to wear their JaipurKnees (compared to 65 percent of those fitted with a different joint). Moreover, 95 percent reported no failures with the artificial knee joints.[5]

Given its charitable mission, the JaipurFoot Organization had provided the JaipurKnees and the procedures at no cost to the patients. It locally manufactured the joints in its machine shops to keep its dependence on outside partners to a minimum and to directly control the inventory it needed.

Sadler and his teammates viewed their early experience with the JaipurFoot Organization as incredibly valuable. The partnership had given them the opportunity to rapidly develop, test, and iterate the product, as well as providing a mechanism for quickly building a track record of successful patient use. "Working with a local partner really helps you get the ball rolling and reach a stable design," he noted.[6] However, they also recognized certain limitations of the JaipurFoot model. "Jaipur does a great job serving local needs across its twenty-something centers," Sadler said. "But they're not able to scale beyond that, because they're thinking in a certain way. They believe that everyone should get a free limb, which is great, but it's totally unsustainable from a business perspective."

As the team continued to work on enhancements to the knee joint, their aspirations expanded as well. "With the next version of the knee, we're thinking a lot broader," Sadler explained. The team wanted to make its low-cost knee joint available to amputees beyond the Jaipur clinics in India. They modified the interface between the knee and the rest of the prosthesis to be "universal," so that it could work with any artificial leg (not just those manufactured by JaipurFoot). "This way," said Sadler, "when we go into another country, like China, we can take the product and show them how it can be a useful addition to what they're already doing."

With such design changes underway, the team began investigating a business strategy that would support its expansion plans. Unfortunately, Sadler and his teammates discovered significant market barriers. "According to some estimates, there are nearly 30 million amputees worldwide. This sounds like a lot of people on paper," he said, "but the majority of these individuals are extremely poor and extremely remote and hard to reach using current distribution channels." There were no well-established channels for reaching the millions of amputees who could benefit from the product, primarily because they were served by thousands of small, scattered clinics. This meant that the target market would be costly to reach, which could make the knee joint less appealing to for-profit investors (compared with other potential investment opportunities) as the team tried to attract expansion funding. "I think these are some of the core dilemmas of working in the developing world, especially on problems for niche populations in poor countries," Sadler commented.

THE SOLUTION: DEFINING A NEW BUSINESS STRATEGY

To help them define a new business strategy that would allow them to scale up, the JaipurKnee team (which would become known as ReMotion Designs), ultimately joined forces with D-Rev, a nonprofit technology incubator whose mission is to improve the health and incomes of people living on less than $4 per day.[7] "When they came to us," said Krista Donaldson, D-Rev's CEO, "they were getting a little bit of money, but not enough to be viable, and not enough money to go and make it out on their own. They also weren't necessarily clear in what their business model was going to be."

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At D-Rev, the ReMotion team mapped out a new business strategy for producing and commercializing the knee joint. First of all, ReMotion would become a non-profit entity with a mission to become financially self-sustaining. "In general," said Sadler, "I don't think a feel-good, charitable model provides a very long-lasting incentive for a business to create and sustain great products." As co-founder Vin Narayan added, "The decision to sell devices rather than donate them was fundamental to our philosophy on social impact. People will almost always accept a donated product even if it does not work for them, but they will not continue to purchase your product unless it provides them with value. It's very difficult to find out if you are actually solving the problem when you give things away for free."

In terms of overcoming issues related to the size of the amputee market and being able to raise expansion funding, the new business strategy would depend primarily on foundations rather than on mainstream or social VCs until it began generating its own cash flows. "The key realization was that the accessible market, while not immense, was large enough to sustain the project and let us establish a 'beachhead' while we worked to develop the remaining unaddressed market," said Narayan.

As for manufacturing, the team briefly considered licensing the technology, but with no obvious partners to approach they decided to move to a centralized, contract manufacturing model. Abandoning local production would allow them to improve quality by using more advanced manufacturing equipment and techniques. Because they would be producing higher quantities of a universal product that would work across multiple geographies, the team would also be able to reduce costs.

Courtesy of ReMotion Designs

A young patient tries out her new prosthesis

With regard to sales and distribution, Donaldson elaborated on the problem: "The market is very fragmented. We see a few large clinic systems, but at most they're fitting 1,300 knees per year. And the smaller clinics are fitting 20 or 30 knees per year. So, how do we scale up in this environment?" After studying the landscape, the team envisioned catalyzing the development of networks among the smaller clinics so that they could share resources and make joint purchasing decisions. "One of the things we've heard time and time again in developing countries is that it's really hard for people to procure parts," Donaldson said—which was one of the reasons the JaipurFoot organization preferred to control its manufacturing locally. "We would actually interface with the clinics and help them build these networks," she explained. She reasoned that if clusters of small clinics would make joint purchasing decisions, they could improve their assurance of supply, for prosthetic knees as well as other devices. At the same time, it would be more manageable for ReMotion to meet the needs of these smaller entities.

It remained to be seen whether this new business strategy would enable ReMotion to effectively commercialize its knee joint beyond the Jaipur clinics. The new business model represented a different—even more challenging—type of prototype that still had to be proven in the market. However, the team believed that it was already benefitting from the clear focus the new approach provided.

NOTES

1 "Designing Solutions to Improve Health for All," NCRR Reporter, Winter/Spring 2011, http://www.ncrr.nih.gov/publications/ncrr_reporter/winter-spring2011/innovations.asp?p=all (February 15, 2011).

2 Ibid.

3 "Organization: Who Are We?" JaipurFoot.org, http://www.jaipurfoot.org/01_org_whoarewe.asp (February 15, 2012).

4 "JaipurKnee: Design," D-Rev, http://www.d-rev.org/projects/remotion/design.html (February 16, 2012).

5 JaipurKnee: Impact," D-Rev, http://www.d-rev.org/projects/remotion/impact.html (February 16, 2012).

6 All quotations are from interviews with Joel Sadler and Krista Donaldson conducted by the authors unless otherwise cited.

7 "About Us," D-Rev, http://d-rev.org/about.html (February 21, 2012).

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