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Building a Better Rat Trap: Technological Innovation, Human Capital, and the Irula

Siri Terjesen

This case follows Sethu Sethunarayanan, Director of the nonprofit Center for Development of Disadvantaged People, which is dedicated to the improvement of the Irula tribe in rural villages of southeast India. The Irulas specialize in catching rats, an activity which provides the bulk of their income and food. Following a routine visit to a local village, Sethu recognized an opportunity for a “better rat trap” to aid the Irula rat catchers. With feedback from rat catchers, Sethu developed an innovative new trap. His innovation won the prestigious Global Development Marketplace award from the World Bank which provided the funding necessary to commercialize the new technology. The venture’s implementation involved site visits to identify beneficiaries, health checks and treatment, preparatory workshops, factory establishment, factory training, production, women’s micro-credit collectives, distribution, and project evaluation. The case focuses on the relationship between human capital and technological entrepreneurship, considering the knowledge and skills required to commercialize technology for the rural poor and the positive impact on this greatly disadvantaged population.

Sethu Sethunarayanan, Director of the nonprofit, nongovernment organization (NGO) Center for Development of Disadvantaged People (CDDP), beamed as World Bank President James Wolfensohn presented him with the prestigious Global Development Marketplace grant to develop innovative technologies to alleviate poverty. At the podium, Sethu provided a brief overview of his winning project,

There are 3 million poor Irula indigeneous tribal people of untouchable status in India who make their income by catching rats in agricultural fields. They use a clay pot filled with burning straw to smoke these rats out of their burrows. Their mouths and hands touch the pot, and they are severely affected by heart, skin, eye, and respiratory problems. They are only successful 40% of the time and are in poverty and unable to send their children to schools. We developed a new hand-operated steel rat trap which eliminates the health hazards completely and enables the Irula to double their income. With this award, we can implement our project and make a complete socioeconomic change in the lives of millions.

As Sethu returned to his seat in the World Bank auditorium, he thought about how this journey began, on a morning walk through impoverished Irula villages in Tamil Nadu, India.

Please send correspondence to: Siri Terjesen, tel.: (+61) 7-3138-1105; e-mail: siriterjesen@yahoo.com

Introduction

On a sticky morning in January 2003, Sethu walked briskly, anxious to check on the progress of a new drinking water pump well installed in a remote Thiruvallar district village. Sethu wanted to make sure that the new pump was installed properly, so that the Irula people who live in the village would no longer have to bring water from several miles away.

Seeing Sethu, a tall, stout man wearing a long white mundu robe shuffling down the dusty road, the Irula villagers greeted him eagerly and escorted him to the well. Sethu was pleased to see that the pump worked perfectly, but exhausted from his 2-mile hike. He asked a lady villager for some water to drink. While she went inside her mud hut to retrieve a cup, Sethu glanced at a clay pot in front of the hut door and noticed a similar pot in front of most of the huts. Thinking he might be able to drink out of this pot, he picked it up, but noticed that, in addition to the top opening, there was a small hole at the base of the pot. He put the pot down and picked up a neighbor's pot which also had an extra hole. Sethu recalled the subsequent conversation,

I asked, 'How will you carry water in the holed pot?' She replied with a sarcastic smile, 'This is not for carrying water, but for killing rats . . . My husband carries this pot when he goes rat catching. He looks for a rat burrow and places the pot at its entrance. He stuffs wet straw into the hole and lights it, creating smoke. On this little hole at the bottom, he places his mouth and blows air through, pushing the smoke out the other side of the pot and into the rat's burrow. The smoke traps the rat. Then my husband digs into the earth and gets the trapped rat. He brings it home and I cook it for dinner. But sometimes he also comes home with burned lips and hands from handling the pot when the straw is burning. . . . He doesn't always catch a rat.'

See Figure 1 for an illustration of the clay pot rat-catching technique.

Figure 1

Traditional Rat Trap: Pot Fumigation



Sethu handed the pot back to the woman, but he did not stop thinking about the inefficiency of this pot and the resulting health problems. As he walked back the dirt path, he contemplated this latest challenge to help the Irula. Sethu had 25 years of experience in developing innovative solutions to improve the quality of life for poor and disadvantaged rural people. From a young age, Sethu admired Mahatma Gandhi's efforts to alleviate poverty, liberate women, create economic self-sufficiency, and end untouchability and caste discrimination in India. Sethu studied at India's only Gandhian university, focusing on Gandhi's methods for developing and unleashing human potential, resolving conflict, and introducing new ideas. Upon completion of his studies, Sethu joined an NGO where he specialized in developing collective self-help, needs-based ventures. In 1998, the then 38-year-old Sethu established his own NGO, the CDDP.

Negotiating the byzantine maze of philanthropic management regulations in India is not easy (Sidel, 2001); however, CDDP is one of only a handful of Indian NGOs to be recognized by both the United Nations and the World Bank. CDDP's mission is "To develop those who are disadvantaged educationally, economically, socially, and culturally through self-help and self-governing collective development activities." Or as Sethu says, "In short, to help them to help themselves." The activities are undertaken along Gandhian lines of organizing constructive development actions through mobilization of human and local resources and often involve technological innovation and entrepreneurship. CDDP's target areas are 80 villages in the Thiruvallur and Kancheepuram districts of the Tamil Nadu state and five villages in the Andhra Pradesh state of India. The programs are aimed at helping women and children belonging to socially and economically weak sectors, unorganized agriculture labor, small and marginal farmers, youth, destitutes, orphans, physically challenged, and other socially and economically disadvantaged people. In 1998, CDDP received the best rural development organization award from the Indian government. CDDP has 23 employees and 56 volunteers, including Sethu's 26-year-old son, Karthick Sethunarayanan, who is an expert in the effective use of information technology for the rural poor. He holds a Bachelor's degree in Business Administration from Madras University and a Master's degree in Information and Communication from Bharathidasan University. Karthick also runs his own IT company which has an alliance with Microsoft and clients in India and abroad. When driving to the villages, Karthick uses a wireless card in his laptop to access the Internet, providing a striking contrast to the road outside, populated by beggars, wandering cows, and women selling giant baskets of produce. A dynamic and engaging spirit, Karthick is keenly aware of the role of technology in transforming the world and the great potential for the world's poor. He is also a talented classical Tamil singer and the villagers often ask him to sing for them.

National, Local, and Community Context

India

A global survey revealed that India is the world's second most entrepreneurially active country with 17.9% of the adult population involved in some type of entrepreneurship (Reynolds, Bygrave, Autio, & Hay, 2002), although this activity is largely confined to members of certain castes and ethnic groups (Dana, 2006). Tamil Nadu is one of the most industrialized states in India (mostly due to the success of its capital, Chennai, India's fourth largest city and the world's 34th largest metropolitan area); however, the rural areas which the Irula populate are extremely impoverished (TNG, 2002).

Irula

An estimated 3 million Irula people live in India, including 150,000 in Tamil Nadu and 250,000 in the bordering Andhra Pradesh state. The term “Irula,” used for centuries, is thought to refer to either the dark complexions of the people, or to their spotting in forests as silhouettes. The Irula people are considered indigenous and DNA tests reveal their close ancestry to African populations (Watkins et al., 2005). Until recently, the Irula lived in forests and eked out an income by bartering or selling honey, wax, and firewood to local villages in exchange for village products. They obtained food by hunting for vegetation and wild animals in the forests. The 1976 Forest Protection Bill made the Irula lifestyle illegal, forcing moves into villages of mud huts with straw roofs and dirt floors. Most Irula people do not have the official right to occupy their lands, and the villages do not have electricity or roads. Sethu described the situation,

Irula are tribals and considered to be untouchables and unequal in society. For example, they are not allowed to use the wells of upper castes. They live in interior locations from which it is hard to reach towns and cities, and they do not interact with the community outside.

The Irula have a life expectancy of approximately 45 years. Only 95% of Irula children under 15 attend school and as a community they are 99% illiterate. Today, Irulas in Thiruvallur and other districts make their income by performing physical labor for land owners. For example, men, widows, and destitute women catch rats in agricultural fields. The farmers pay per rat and the rat catcher’s average income varies from \$15 to \$30 per month. The rat may be the Irula’s only source of meat and grains, usually consumed as one meal per day. In the past, some Irula people have starved.

Building a Better Rat Trap

Back in the office, Sethu decided that there might be an opportunity to develop a better rat trap. With the help of a local mechanical engineer, he set about looking for a solution. Together they fashioned a steel cylinder and hand-crank to generate air for pushing smoke into the burrow and a door on the cylinder for straw and a wooden handle to eliminate direct contact with the hot areas of the trap. Sethu provided sample traps to fifteen Irula rat catchers whom he met with regularly to get feedback. After six iterations over an 8-month period, Sethu was satisfied that the trap met the villagers’ rat catching and safety needs. See Figure 2 for an illustration of the new trap.

The rat catchers brought Sethu to the fields. He remembers watching the men,

I asked the catcher, ‘How do you find the rat?’ He said, ‘The rat keeps his house like my wife does—very tidy, including the area outside the door. So I know when I come across a burrow hole with a clean entrance, there is a rat inside.’

Sethu observed as the rat catchers filled the steel trap with straw. The men located a hole on the bank between two fields, and two other holes about five feet away, which they covered with dirt to prevent the rat’s escape and to cause its suffocation. The lead rat catcher dug a larger entrance to the first hole, and put the trap’s pipe inside. The other two men guarded the covered holes and watched as the lead rat catcher opened the trap’s door, lit the straw, and cranked the handle. The trap chortled as smoke filtered down the hole, emerging from another hole in the earth, which was then quickly covered. It became clear that if there was a rat inside the hole, it had been deprived of oxygen. The lead rat catcher

Figure 2

A Better Rat Trap



then removed the trap and began to dig on the side of the hole, following the winding burrow. He reached down the hole and pulled out a dazed rat, stunned by smoke. The rat was then humanely killed with a blow to its head. Sethu and the rat catchers were excited—the trap was a success!

Sethu realized that he had identified a suitable technology for this opportunity and decided to seek funding for its commercialization. From past experience, Sethu knew that he would need to convince outside organizations of the merits of such an investment. He outlined the problems with the traditional pot method and the advantages of the steel trap and the project objectives. See Figures 3 and 4.

Sethu applied for a grant from the annual World Bank Global Development Marketplace. Since 1988, the World Bank has distributed over \$40 million to 1,100 projects in more than 60 countries. Sethu presented the rat trap project at the marketplace in December 2003 and received a grant for \$98,500, enabling him to implement the project.

Implementation

The rat trap project was undertaken from January to December 2004 and incorporated the following key components: site visits to identify beneficiaries, health checks and

Figure 3

Disadvantages of Traditional Fumigation Method and Advantages of New Trap Technology

Disadvantages of Traditional Fumigation Method

Occupational health : When mouth blowing, the rat catcher inhales heavy amounts of smoke, leading to severe respiratory, heart, eye, and other health problems. Forty percent have one or more health complications, particularly burns to lips, hands, and fingers. Poor efficiency and limited income: The method is only effective in 40 of 100 attempts due to the limited air pressure and lack of constant or even distribution of smoke. Thus, the rat is more liable to escape. Irulas are paid per rat and income ranges from \$15 to \$30/month, less than the \$35/month required to meet their families minimum requirements for food, shelter, medicine, and education.

Mud pot break: In the course of their work, the Irula carry the pot over long distances. The pot breaks about once every 2 months and a new pot costs 50¢.

Drudgery of work: The rat catcher's lack of success makes work a drudgery, leading to disinterest in the work, which in turn leaves him impoverished.

Rat menace in agriculture fields: Fewer kills lead to greater rat menace. Rats destroy about 25% of grains in agricultural fields. This is economically devastating in a country where 85% of the population is involved in agriculture. One estimate indicates that if the rat menace were alleviated, India would be able to feed its entire population thrice a day.

Advantages of New Trap Technology

Complete elimination of occupational health hazards: The hand-operated, wooden-handled trap eliminates burns to the lips and hands. No problems with smoke inhalation.

Doubled work efficiency: Rat catchers achieve 95% success. The rat is instantly stunned and unable to escape. The trap is easier to operate, enabling participation by older men and widowed/destitute women who do not have the stamina for mouth blowing.

Doubled income: The success rate improvement more than doubles rat catchers' income to \$60, enabling the Irula to send their children to school and attend to health-care needs.

No breakage: The steel trap is impossible to break.

Release from work drudgery: The rat catcher is able to undertake his work with ease, comfort, and efficacy. The Irulas take pride in working with a machine, rather than a dirty pot. They are willing to work and earn more.

Social and educational change: The additional income enables the Irula to send their children regularly to school. Members of higher castes in neighboring communities may develop respect due to the decent professional type of device.

Reduction of rat menace: The rat menace is reduced although it is impossible to eliminate entirely as each female rat produces up to 1,000 offspring in her lifetime.

Affordable cost: The new trap costs just \$25 and is affordable for the rat catcher.

Figure 4

Project Objectives

1. To remove the occupational health hazards of tribals undertaking rodent control activity through pot fumigation method by introducing new trap technology.
2. To improve the income levels of the poor tribal rat catchers through the use of the new trap technology.
3. To undertake a comprehensive occupational health check-up and follow-up treatment for the severely affected beneficiaries.
4. To organize a collective income generation self-employment micro-enterprise venture for the poor tribal women and youth in the making of the new device and also to produce other types of agriculture tools and instruments.
5. To conduct nonformal life education activity for the beneficiaries in order to increase their education and awareness levels.
6. To promote self-help groups and micro-credit activities among the beneficiaries.
7. To disseminate the information and technology of the project to other interested individuals and organizations.
8. To help farmers reduce the rat menace in their agriculture fields, through tribal rat catchers using upgraded technology.

Source: CDDP

treatment, preparatory workshops, factory establishment, factory training, production, establishment of women's microcredit collectives, distribution, and project evaluation.

Site Visits to Identify Beneficiaries

Sethu and CDDP volunteers began by visiting 170 Irula villages in order to identify the most needy individuals. The visits were conducted simultaneously in order to reach the target deadline, but the visits were not without their problems. As Sethu explained,

We needed to take extra time to explain the project to the villagers. The Irula are especially sensitive to political matters, and at first they thought the CDDP volunteers were politicians. . . . We encountered this problem in every new village.

The selection criteria were health and socioeconomic need, with priority given to those suffering health problems from the old pot fumigation method and whose entire income is based on rat catching. Destitute, deserted, and widowed women were also a priority and comprised 15% of the beneficiaries. The selectors included members of the local government and community and farmer groups. A total of 1,500 beneficiaries were identified. One volunteer reported,

The enthusiasm and interest among the beneficiaries is more than we had expected. They feel this device is going to be a turning point in their impoverished life conditions. The response was really exemplary so we added 278 more beneficiaries in our reserves in case the others dropped out.

Health Check and Treatment

A basic health check was completed for 1,500 beneficiaries. In some cases, special tests for tuberculosis and diabetes, as well as electrocardiogram, X-ray, and optometry exams were conducted. Treatment was begun for all affected villagers.

Preparation Workshops

Individual and collective meetings were held in the villages. From his experience working on the water pump and other projects, Sethu knew that he would need to work closely with the Irula to elicit interest in the new technology. Sethu explained,

In the past, the Irulas have been given things by other NGOs and the government, but these things have basically been useless. So they do not like to get things for free. The only things they consider useful are those that they work for. Irula want to be involved and to express their needs . . . We ask about their health. We try to find out if the pot fumigation method was causing problems and to get them to see the link between the old method and their health troubles. We ask them if they would like to solve these problems. We talk about how important it is to be healthy and how the new technology can help them. Sometimes it takes weeks to reach a level of understanding and commitment.

Factory Establishment

A factory was established in a 60-square foot building adjacent to CDDP's field office in the Nedumbaran village. Based on 50 workers, 8 hours a day, the factory has a monthly

capacity of 400 traps, but can easily be expanded. Sethu calculated that each trap would cost \$30 to produce, including \$25 for raw materials and \$5 for labor. Karthick negotiated wholesale prices from Tata Steel, lowering costs by \$3, a savings which was reinvested in the factory. In the event of a drop in demand for traps, the factory is equipped to make other steel items to be sold to farmers, including knives, sickles, ploughs, grill gates, chairs, and benches.

Factory Training

Sethu faced an important decision regarding the manufacturing of the traps: which Irula should run the factory? Rat catching is predominantly undertaken by men, sometimes accompanied by their sons, while wives and older women have a historical role cooking and caring for family members. Selecting men, boys, or wives for factory work would upset traditional tribal roles and create friction in the community. Sethu opted to create new opportunities for young, unmarried women who were unemployed. Fifty young women were invited to work in the factory. The women organized themselves into the “Tribal Women Technotrappor Producers Society” and registered as a small industries cooperative. They appointed officers and took responsibility for the factory’s daily operations. CDDP transferred whole ownership of the factory to the workers so that the women could control the profits. CDDP hired two technical people to provide three months of training in manufacturing, marketing, and finance. The young Irula women, who did not have any business or manufacturing training, took great delight in their new roles. They were paid \$35–\$70 a month, very high for village standards and were able to provide for their siblings and parents. Sethu shared in a progress report,

To our surprise, the tribal women who were illiterates and totally new to industrial type of work grasped the industrial techniques very quickly. . . . It is a source of great pride among all the villagers that the devices are made by their own women. The villagers can go to the factory anytime to watch them make traps.

Production

To make the trap, the young women first trace rectangular shapes on the sheet metal. A compass and chalk were then used to mark a 15-inch diameter circle. Next, a team of young women pull a heavy handle to cut the metal and drilled holes for smoke ventilation. The rectangle piece of steel is rolled through a machine to make it cylindrical. From here, two young women work together to weld the cylindrical rectangle to the circle. Finally, the door and hand crank are added. See Figure 5 for an illustration.

Women’s Microcredit Collectives

In parallel, CDDP launched a number of women’s microcredit funds, each comprised of 12–15 women. The fund enabled the women to obtain small loans for urgent household needs or to begin self-employment activities, reducing dependence on exploiting money-lenders. Each micro-credit group had a revolving fund collected from their monthly savings and also from the interest accrued from the loan. Each woman’s initial contribution was \$1–\$2. Fund availability ranged from \$200–500 depending on each group’s prerogative. The micro-credit groups were often used to purchase the new trap. Once a woman raised 50% of the payment for the trap, she received the trap and paid the remaining half in loan installments according to a timeline agreed by the group.

Figure 5

Trap Manufacturing in the Factory



Distribution

The trap was distributed in special village ceremonies. As most Irulas are illiterate, Sethu began by reading a 10-commitment pledge. This pledge included a promise that their families will use the rat trap or else return it to CDDP for distribution to other families. One by one, villagers' names were read and they came forward, signing the pledge with a thumbprint and receiving the new rat trap.

Project Evaluation

An evaluation committee, composed of local World Bank employees, government officials, and development experts met with beneficiaries, staff, and concerned communities to ascertain the impact of the project. The committee learned that many families are now able to send their children to school. Based on the evaluations, the World Bank considers CDDP's rat trap venture to be a success and used the knowledge exchange to share lessons learned with other projects and to suggest appropriate policy responses. In the final progress report to the World Bank, Sethu shared,

We estimated that the income of the tribal rat catchers would be doubled. To our surprise, income is more than tripled. There is great enthusiasm among the families. Another important unexpected positive development is that the rat catchers could use the trap for catching rabbits, foxes, and other small animals which live in burrows. This fetches very high income for them.

The total project expenses is provided in Figure 6.

Conclusion

Driving back from an Irula village visit with the case author, Sethu and Karthick discussed the future challenges for the rat trap project and their development work.

Figure 6

Project Expenses for January–December 2004 (in US\$)

Materials and equipment: machinery and raw materials to make 1,500 traps	\$67,197
Training: making traps and other steel items to be sold to farmers	\$9,435
Health and self-help groups: identification and treatment of health problems, formation of micro-credit groups, societies, and workshops	\$7,529
Personnel	\$7,053
General administration	\$2,930
Travel	\$2,300
Information dissemination	\$2,056
Total expenses	\$98,500

Quoting Gandhi, Sethu said, “I do not wish to study history, I wish to make it.” Sethu and Karthick identified the following major challenges: factory expansion, NGO alliances, micro-credit developments, providing support for special projects, continuing to develop technology-based solutions, fundraising, and spreading Gandhi’s message.

With more than 100 million small farmers in the Tamil Nadu and Andhra Pradesh states seeking the Irula rat catchers’ help, the trap is in great demand. CDDP has taken orders for over 2,000 devices. Sethu considered the factory expansion options,

We could expand the factory to more than 50 employees, but then it would need to be registered under the Big Industries Act and we would incur enormous taxes and other bureaucratic problems. Instead, we could create a number of small factories across the villages. Each could cater to the needs of people in those locations. We would also reduce transportation costs and the local people would be employed. . . . If the demand for traps ever falls, these small factories can produce steel products for farmers instead. . . . We also need to figure out a way to lower our overall costs to make the traps so we can have more profit.

CDDP has received requests for assistance and alliances from over a dozen NGOs, based locally and as far afield as Sri Lanka. Sethu contemplated the best way forward,

This technology is the best available to control rats and the project will boost agricultural community living anywhere. But we want to make sure that we identify and train good partners. It is not easy to organize.

A third challenge is to determine the best loan structure that will enable the Irula to buy new traps and repay their loans. Relatedly, Sethu is eager to explore other possibilities with the micro-credit.

Fourth, CDDP would like to continue to devote resources toward special projects such as the release of children who are bonded laborers in other villages. CDDP has already helped some children attain their freedom. These children now attend special programs and holiday camps, including competitions in literature, dance, drama, and sports. Some special projects are not planned in advance. For example, when the December 2004

tsunami devastated oceanfront villages in Tamil Nadu, Sethu immediately organized CDDP assistance in the form of food, shelter, grief counseling, and self-help collectives.

Sethu and his team continue to use technology to create innovative solutions for the poor, including a smokeless oven and a natural water purification system that uses materials, such as indigenous plants, which are easily found in impoverished areas.

Karthick noted the need to attract fundraising to expand the projects, "What we have achieved is very little and the demand on us is so heavy that we have to continuously seek patronage from various quarters." CDDP has received other international funding, including the 2004 \$50,000 San Jose Tech Museum Innovation Award and a \$10,000 grant from the Rachel Golden Foundation.

This case concludes with comments from the villagers whom the author interviewed, using a Tamil translator, during her site visit 18 months after the completion of the World Bank initiative:

As a man living with severe respiratory problems due to mouth-blowing for rat catching, I found the new device to be a God-sent property. I wish this device to be given to more people of our community.

My husband brings more rats home, which I skin and cook. It tastes very good. The grains that the rat kept in its hole also taste very good. Because the rat has chewed on them a little, they have a special taste which is better than ordinary grains. Would you like to come to my house for dinner with me and my family?

My son and daughter now go to school in the evening. When they come home, sometimes we learn something from them.

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Siri Terjesen is an assistant professor at Texas Christian University and a visiting senior lecturer in the Brisbane Graduate School of Business at Queensland University of Technology in Australia.

The author is grateful for the hospitality of Sethu, Karthick, and the Irula villagers during her visit. The case benefited from many conversations with Sethu, Karthick, and other CDDP team members, as well as the Irula villagers, Dr. Rachel Golden, representatives of the World Bank, and leaders of local and international NGOs operating in the region.