

From Innovators Perspective: Process of Grassroots Innovation in Andhra Pradesh and Telangana

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Abstract

In the past two decades, there has been a growing interest in grassroots innovation in India and beyond, both as an area of formal research and practice. Although many different explanations of grassroots innovations exist in literature, they can be understood as novel products and processes that solve an unmet need or pressing challenge for an individual or community in a particular local context. Grassroots innovators come from rural communities and have limited or no formal education, but are capable of developing innovative solutions within the constraints engendered by the context they are embedded in. Although there is recognition of grassroots innovation by the central government in India, the vibrant discussions and learnings from the researcher and practitioner community has not translated to its inclusion in state level innovation policies, as evidenced in the southern states of Andhra Pradesh and Telangana.

Through the narratives of four grassroots innovators, the thesis explores how grassroots innovation processes materialize in these two states. Analysis of the processes reveal that a confluence of resources (financial, material, physical, knowledge and technical), individual agency, and external-organization created networks is essential to transforming an idea into a product. Drawing on insights from the analysis, the thesis then proposes ways in which grassroots innovation can be recognized and supported within the existing innovation policy frameworks in Andhra Pradesh and Telangana. This includes linking formal education and grassroots innovation, leveraging college and university infrastructure as experimentation space, giving grassroots innovators access to incubator resources, and channeling corporate social responsibility funds to financially support them.

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Chapter 1 - Introduction

In many rural parts of India, there are people in villages developing grassroots innovations that solve personal and community challenges. Honeybee Network, a non-profit organization supporting grassroots innovation in India has documented nearly 200,000 such grassroots innovations and traditional knowledge in the past two decades¹. Grassroots innovations have come to be known by a variety of terms including Jugaad Innovation (Radjou, Prabhu & Ahuja 2014)², Frugal Innovation (Bound & Thornton 2012)³, Bottom of the Pyramid Innovation (Kaplinsky 2011)⁴, and Inclusive Innovation (George, McGahan & Prabhu 2012)⁵. They can be understood as products and processes that have been developed in response to challenges and opportunities in a local context, and in ways that signal a departure from the norm in that context (IDIN 2015)⁶. These grassroots innovations often have the potential to be turned into entrepreneurial ventures, and generate a livelihood for the innovator as well as others in the community. For example, Paresh Panchal developed a set of two mechanical devices designed for poor tribal communities that previously made incense sticks using labor and time intensive methods⁷. The first machine helps create strips of bamboo, while the second splits the strips into narrow sticks for the incense to be wrapped around. This particular grassroots innovation has raised the productivity and income of the incense makers. At the same time, it has allowed Panchal to establish a successful business that employs others in his community.

Grassroots innovations are most often developed in the face of limited material, financial, knowledge and infrastructural availability (Keersmaecker, Parmar, Kandachar, Baelus 2012)⁸. These innovations can also be applicable to other communities beyond the local context in which

¹ "About NIF." National Innovation Foundation. Accessed April 27, 2016. <http://nif.org.in/aboutnif>.

² Radjou, Navi, Jaideep C. Prabhu, and Simone Ahuja. *Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough Growth*. San Francisco, CA: Jossey-Bass, 2012.

³ Bound, Kirsten, and I. W. B. Thornton. *Our Frugal Future: Lessons from India's Innovation System*. Nesta, 2012.

⁴ Kaplinsky, Raphael. *Bottom of the Pyramid - Innovation and Pro - Poor Growth*. Washington DC: World Bank, 2011. <http://documents.worldbank.org/curated/en/2011/09/16453577/bottom-pyramid-innovation-pro-poor-growth>

⁵ George, G., A M McGahan, and J. Prabhu. "Innovation for Inclusive Growth: Towards a Theoretical Framework and a Research Agenda." *Journal of Management Studies* 49 (June 2012): 661-83.

⁶ "What Is Local Innovation?" International Development Innovation Network. Accessed April 27, 2016. <http://www.idin.org/research>.

⁷ Interview with Paresh Panchal (2015)

⁸ De Keersmaecker, A. E. K., V. S. Parmar, P. V. Kandachar, and C. Baelus. "Towards scaling up grassroots innovations in India: A preliminary framework." In *UNESCO Chair International Conference-Technologies for Sustainable Development: A Way to Reduce Poverty? Lausanne, Switzerland, 29-31 May 2012*. 2012.

they were developed. Gopalbhai Surtia's grassroots innovation is a sapling pot made of manure. This innovation benefits nurseries by replacing traditionally used plastic bags with an eco-friendlier alternative that nurtures the saplings better with its nutrients. It also prevents any damage to the saplings, a common problem when using plastic bags. This innovation idea is not just useful to nurseries in Surtia's local context, but in nurseries across the country⁹.

This thesis focuses on the states of Andhra Pradesh and Telangana, where there are many such cases of grassroots innovations. For example, Godasu Narasimha developed a motor driven machine that removes hyacinth from small water bodies. By removing a hindrance to their fishing activity, this grassroots innovation has benefited the fisherman community in his village¹⁰. Another example of grassroots innovation is Malleshham's semi-automatic pedal for standing handlooms. This innovation has reduced the drudgery involved in weaving, and improved productivity of the weavers in his community¹¹.

These two states are of particular interest because Andhra Pradesh was bifurcated into Telangana in 2014. The call for a separate state of Telangana arose from the economic imbalance between a stronger economy in coastal Andhra Pradesh and the economically disadvantaged regions of present day Telangana¹². Since the bifurcation, the Andhra Pradesh Government has been struggling with a large budget deficit¹³. Both governments are keen on growing their respective economies, and have passed policies to nurture and expand innovation in the state. However, the focus of these policies is more on inculcating innovation in college education, supporting high-tech startups through incubation and infrastructure support, financial support for startups, and attracting R&D departments of major multinational corporations^{14,15}.

⁹ "Eco Friendly Cow Dung Pot for Nursery." Gujarat Innovation Augmentation Network. Accessed April 27, 2016. http://west.gian.org/innovationdetails.php?innovation_id=198&category=3&page=1.

¹⁰ "Godasu Narasimha." Palle Srujana. Accessed April 26, 2016. <http://www.pallesrujana.org/narasimha-2014.html>.

¹¹ "Ch Malleshham." Palle Srujana. Accessed April 26, 2016. <http://www.pallesrujana.org/narasimha-2014.html>.

¹² "What New Telangana State Means for India." BBC News. July 30, 2013. <http://www.bbc.com/news/world-asia-india-23499533>.

¹³ Sharma, Kumar. "Telangana vs Andhra: A Comparison of Their Fiscal Situation and More." Business Today. February 27, 2016. <http://www.businesstoday.in/opinion/perspective/telangana-vs-andhra-a-comparison-of-their-fiscal-situation-and-more/story/229633.html>.

¹⁴ *Innovation Policy 2016*. Hyderabad: Government of Telangana, 2016. <http://www.it.telangana.gov.in/wp-content/uploads/2016/04/Telangana-Innovation-Policy-2016.pdf>.

¹⁵ *Innovation and Startup Policy 2014 - 2020*. Government of Andhra Pradesh, 2014. <http://www.ap.gov.in/Other Docs/AP Innovation and Startup Policy 2014-2020.pdf>.



Figure 1: Location of Andhra Pradesh and Telangana (Source: dMaps)

The notion of grassroots innovation as a contributory component of the innovation ecosystem doesn't feature explicitly in either policy. Currently, grassroots innovators in both states are supported by a voluntary organization named Palle Srujana, which operates on the principles of the Honeybee Network (a national non-profit organization supporting grassroots innovation). Although Palle Srujana strives to support grassroots innovators in a multitude of ways, being a voluntary organization limits their resource capabilities. Through detailed accounts of four grassroots innovators, this thesis seeks to develop an understanding of how grassroots innovation processes materialize in Andhra Pradesh and Telangana. And using this analysis, I propose ways in which grassroots innovation can be supported through current state innovation policies. I contend that grassroots innovation should be an acknowledged and supported component of the

innovation policy, especially because these innovations are borne out of, and meet pressing needs of rural communities.

This is important in the context of Andhra Pradesh and Telangana where approximately 76 and 69% of the population lives in rural areas respectively¹⁶. Recognizing grassroots innovation will make the innovation policies more inclusive, and give voice to the efforts of grassroots innovators. In the case of Andhra Pradesh for example, the Chief Minister in a recent address to district collectors in the state remarked, “Inclusive growth is very important and per capita income should also increase. Economic inequalities have to be reduced. Long-term sustainability is vital”¹⁷. Including grassroots innovations in state innovation policy can turn this kind of intention into action.

Methodology

The field research for this thesis was conducted in the western and southern part of India, for a total of eight weeks during the summer of 2015, and winter of 2015/16. The aim of the field research was to i) understand the existing institutional support for grassroots innovation in India, and ii) delve into the experiences of grassroots innovators; specifically, how they traversed the journey of idea to product implementation. The first trip to India was to Ahmedabad, Gujarat where I spent time meeting and interviewing employees of Honeybee Network. The network as it stands now, can be imagined as a nexus of organizations such as National Innovation Foundation (NIF), Gujarat Innovation Augmentation Network (GIAN), and SRISTI (Society for Research and Initiatives for Sustainable Technologies and Institutions) operating together to identify, support, document, and disseminate local innovation/knowledge in rural areas of India. Instituted in 2000, National Innovation Foundation (NIF) was formed by the government to support grassroots innovation on a national scale. Gujarat Innovation Augmentation Network (GIAN) is a regional grassroots-innovation support organization focused on the western portion of India. And Society

¹⁶ "More Urban Population in Telangana than AP." Deccan Chronicle. July 24, 2015. <http://www.deccanchronicle.com/150704/nation-current-affairs/article/telangana-has-more-cells-fridges-ap-secc-report>.

¹⁷ PTI. "Andhra Pradesh Clocked 10.5% Growth despite Constraints: Chandrababu Naidu." *The Economic Times*, February 22, 2016. <http://economictimes.indiatimes.com/news/economy/indicators/andhra-pradesh-clocked-10-5-growth-despite-constraints-chandrababu-naidu/articleshow/51089406.cms>.

for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) is a non-profit sister organization that was started to support the organizational and logistical activities of Honeybee Network.

When I went back to India in December 2015, I interviewed four grassroots innovators in various villages in Telangana and Andhra Pradesh. I also met with representatives of Palle Srujana during this time, a voluntary organization part of the Honeybee Network working exclusively in Andhra Pradesh and Telangana. A more detailed explanation of these organizations and the various ways in which they support grassroots innovators has been outlined in Appendix A.

Interviews

The interviews with employees and representatives of the support organizations (NIF, GIAN, SRISTI, and Palle Srujana) were structured and lasted one hour each. The number of these interviews totaled five. There were four interviews with grassroots innovators, which were semi-structured in order to allow them to describe their stories as they saw fit. The structured portion of the interview involved reflective questions such as - “Looking back at your innovation process, what was the most challenging aspect?” While the first set of interviews helped understand the current support landscape (government policy and NGO assistance) for grassroots innovations in India, the interviews with grassroots innovators helped gain insights into how they transform their ideas into working products.

The interviewees were identified with the assistance of Palle Srujana. They provided a comprehensive list of innovators they worked with over the years, and I personally made the final selections. The full list was first truncated to include grassroots innovators with easy geographical access. Using purposive sampling (maximum variation sampling technique), I selected four innovators factoring in innovation variety and personal backgrounds (age, education etc.). To elaborate, innovation variety here refers to distinct innovations - addressing different needs, and functionally separate. The data from these interviews has been used in various portions of this thesis.

Limitations

Due to logistical complexities of travel in the rural areas, the total number of innovators that I could interview were four. A bigger sample would have helped strengthen the arguments made in this thesis. To counteract the generalizability limitation of using a small sample size, I discussed my findings with the Vice-President of Palle Srujana, Mr. Srikar Jammalamadaka. This helped verify if these particular grassroots innovators displayed patterns that were common to the larger grassroots innovator pool they have worked with over the years. These grassroots innovators have also been featured in the Indian media multiple times, and may have been tired from telling the entire story exhaustively. The gaps in their stories have been filled with the help of newspaper reports and other published material.

Thesis Structure

Chapter 1 summarizes existing literature on the concept of innovation, the academic study of innovation studies, and the growing importance of grassroots innovation both to researchers and practitioners. Chapter 2 delves into the grassroots innovation processes of the four grassroots innovators that were interviewed in Andhra Pradesh and Telangana. This lays the foundation for extracting key elements of their innovation processes. In Chapter 3, the grassroots innovation processes are analyzed and similar elements of these processes (personal characteristics, individual agency, networks, resources, and financial impediment) are described in detail. Chapter 4 explores how this analysis can inform state innovation policy in Andhra Pradesh and Telangana, in order to support grassroots innovation.

Theoretical Underpinnings

As a field of study, the origin of innovation can be traced to Joseph Schumpeter, an Austrian-American economist¹⁸. In his seminal piece ‘The Theory of Economic Development’ published in 1934, he explored the relationship between innovation and economic development. He says in his

¹⁸ Fagerberg, J. "A Brief History of Innovation Research." Inno Resource. Accessed April 27, 2016. from <http://www.innoresource.org/3-schumpeter>.

book, “economic life is essentially passive ... so that the theory of a stationary process constitutes really the whole of theoretical economics ... I felt very strongly that this was wrong, and that there was a source of energy within the economic system which would of itself disrupt any equilibrium that might be attained”¹⁹. He attributed this energy source to innovation, what he described as new combinations of existing resources.

After a period of lull, the next leap in innovation studies can be attributed to the Science Policy Research Unit (SPRU) at the University of Sussex in 1965²⁰. As a multidisciplinary group comprising of engineers, sociologists, economists, and psychologists, the researchers conducted extensive research on the role of innovation in economic development²⁰. This research spawned many publications, projects, conferences that eventually grew the innovation research community. Since then, the volume of literature has grown tremendously²⁰. Scholars are approaching the topic of innovation from the perspectives of their respective fields, reflecting the multi-disciplinary nature of innovation studies²⁰.

Even today, innovation garners a lot of attention from different sections of the society. Companies care about innovation to gain and maintain competitive advantage, countries view innovation as a means of advancing the economy, and individuals innovate to solve challenges and/or create economic and social value. But is innovation always good? Luc Soete (2013) argues against the Schumpeterian notion that innovation leads to a ‘creative destruction’, one that renews society’s dynamics and leads to higher economic development²¹. He argues that innovation benefits a select few, and as a result does not lead to long-term gains in welfare or productivity growth. He cites the example of securitization. When introduced, they were by definition a true innovation in the financial sector. The US Federal Reserve Chairman, Alan Greenspan in 2005 said, “These increasingly complex financial instruments have contributed to the development of a far more

¹⁹ Schumpeter, Joseph A., and Redvers Opie. *The Theory of Economic Development; an Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Cambridge, MA: Harvard University Press, 1934.

²⁰ Fagerberg, Jan, David C. Mowery, and Richard R. Nelson. *The Oxford Handbook of Innovation*. Oxford: Oxford University Press, 2005.

²¹ Fagerberg, Jan, Ben R. Martin, and Esben Sloth Andersen. *Innovation Studies: Evolution and Future Challenges*. Oxford: Oxford University Press, 2013.

flexible, efficient, and hence resilient financial system that the one that existed just a quarter century ago”²².

No one realized the potential systemic risk this innovation (combined with deregulation of the banking system) posed to the global financial system. Fast forward to 2007, the securitization of bad mortgages and its subsequent sale to banks abroad triggered a collapse of the global financial system. This reflects the ‘destructive creation’ that Soete (2013) describes, one that suffers from ‘short-termism’ and ‘free rider nature’. The complexity of innovation goes beyond just in the way it is defined, but also has a time dimension to it. An innovation that is benefitting a local community now could negatively impact them in the long run. An example of this could be a farming innovation that boosts production in the short run, but harms the environment in the future. An innovation that helps extract ground water can help farmers irrigate their farms better, thereby ensuring a successful crop. But in the long run, multiple farmers draining the water table faster than it is replenished can have negative consequences for the community; especially if wells are the primary source of drinking water.

The term innovation has been conceptualized and defined in many different ways. Some have described it in terms of newness. Zaltman and Lin (1971) consider as an innovation any idea, practice, or material artifact perceived to be new by the relevant unit of adoption²³. Innovation could also relate to adoption or use, “[innovation] proceeds from the conception of a new idea to a solution of the problem and then to the actual utilization a new item of economic or social value” (Myers and Marquis 1969)²⁴. Kanter (1983) defines innovation not just in terms of newness, but also as a process, “the process of bringing any new problem-solving idea into use”²⁵.

Innovation has also been defined in terms of typologies; they can be categorized based on the nature of innovation. For example, innovation as described by economists is divided into two

²² "FRB: Speech, Greenspan-Economic Flexibility." Federal Reserve. October 12, 2005.
<http://www.federalreserve.gov/Boarddocs/speeches/2005/20051012/default.htm>.

²³ Zaltman, G. and Brooker, G. Reconsidering the adoption process. Working paper, Northwestern University, 1971

²⁴ Marquis, D. G., and S. Myers. *Successful Industrial Innovations - a Study of Factors Underlying Innovation in Selected Firms*. 1969.

²⁵ Kanter, Rosabeth Moss. *The Change Masters: Innovations for Productivity in the American Corporation*. New York: Simon and Schuster, 1983.

categories: product and process (Greenhalgh, C., & Rogers, M. 2010)²⁶. Product innovation involves the creation of a new product in the market, or improvements in an existing one. An example of this is the iPhone, a breakthrough compared to other phones in existence at the time. On the other hand, process innovation is a novel manner of delivering goods and services. Restructuring the manufacturing process in a new way to boost operational efficiency is an example of this category. The OECD on the other hand exceeds the two categories described above to include marketing and organizational innovation²⁷. While the former is “the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing”, the latter is “the implementation of a new organizational method in the firm’s business practices, workplace organization or external relations.” Schumpeter (1934) and Doblin (2011)²⁸ also developed their own categorization of innovations.

Innovation has also been broken down based on a combination of newness and impact. Freeman and Perez (1988) classified innovation into four types²⁹:

1. Incremental: These are ongoing changes in any industrial or service activity, and can bring about improvements in efficiency or productivity.
2. Radical: These are borne out of research and development in firms and universities, and are discontinuous events that can have economic impact.
3. Changes in technology system: These are innovations that combine elements of incremental and radical innovation, along with managerial and organizational innovation; and affect many different sectors of the economy.
4. Changes in techno-economic paradigm: These have such far-reaching consequences that it influences behavior in the entire economy while directly or indirectly impacting every part of it.

²⁶ Greenhalgh, Christine, and Mark Rogers. *Innovation, Intellectual Property and Economic Growth*. Princeton: Princeton University Press, 2010.

²⁷ *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. Paris: Organisation for Economic Co-operation and Development, 2005.

²⁸ Keeley, Larry. *Ten Types of Innovation: The Discipline of Building Breakthroughs*. Hoboken, NJ: Wiley, 2013.

²⁹ Freeman, C., and C. Perez. "Structural Crises of Adjustment, Business Cycles and Investment Behaviour." In *Technical Change and Economic Theory*, edited by G. Dosi, 38-66. London: Pinter.

Amongst these many ways in which innovation has been defined, conceptualized and categorized, the key points about innovation can be summarized as:

1. Newness: How new is the innovation?
2. Perception: Who is it new for - village, region, country or world?
3. Process: What are the series of events that lead to a successful innovation?
4. Area of economy: What type of challenge or opportunity is the innovation addressing?
5. Impact of innovation: To what extent is the innovation impacting the economy?

If one looks at innovation over the past few decades, it has prioritized the needs of developing countries and the formal sector (defined in this thesis as organizations that are licensed, registered and pay taxes to the government: multi-national corporations, restaurants, shopping stores, manufacturers, hotels, publicly traded companies, etc.)³⁰, high-tech innovation (Kaplinsky 2011). Ergo, grassroots innovation derives its importance from the exclusion of poor in the innovation path. There are three factors that shaped this exclusion (Ruttan, 2001)³¹. First, innovators have sought to meet the needs of population segments with disposable incomes. The high-income households in developed countries were therefore emphasized over the low-income populace of developing countries. Two, the innovations in developed countries relied on “reliable, widely-diffused and centralized infrastructure”. And three, the firms set forth a reinforcing cycle of innovating in areas of past success. Furthermore, the global system of intellectual property rights has limited possibilities for new innovating entrants (Kaplinsky 2011).

Be it positive or negative, India has also placed special attention on innovation in recent years. In 2010, the President of India declared open the decade of innovation. The National Innovation Council was setup as “the first step in creating a crosscutting system which will provide mutually reinforcing policies, recommendations and methodologies to implement and boost innovation performance in the country”³². Consequently the Government of India published the Science,

³⁰ Mani, N., and N. Krishnan. "Changing Structure of Employment in Indian Textile Industry During the Globalized Era." *International Journal of Management and Social Science Research Review* 1, no. 2 (August 2014): 215-17.

³¹ Ruttan, Vernon W., and Yujiro Hayami. *Toward a Theory of Induced Institutional Innovation*. Minneapolis, MN, 1984.

³² "National Innovation Council." National Innovation Foundation. 2013. <http://innovationcouncilarchive.nic.in/>.

Technology and Innovation Policy in 2013 that emphasized measures to improve the innovation ecosystem in India, in order to deliver faster, sustainable and inclusive growth³³. More recently in 2015, Prime Minister Narendra Modi unveiled the Startup India Action Plan that includes an innovation focused program for students, and the Atal Innovation Mission for entrepreneurship and innovation. While the former intends to showcase the best of student innovations, the latter focuses on establishing experimenting spaces for high-growth startups and hosting innovation challenges to find low-cost solutions³⁴. While these various initiatives and policies focus on firm based innovation in the formal sector, the Government of India also supports rural grassroots innovation through the efforts of National Innovation Foundation in partnership with Honeybee Network.

As individuals, there doesn't seem to be a universal consensus on how grassroots innovators are described in grassroots innovation literature (Keersmaecker, Parmar, Kandachar & Baelus 2012)². Grassroots innovators have been defined as individuals that solve local problems in innovative ways, and they generally work outside of formal organizations such as businesses (Bhaduri & Kumar 2012)³⁵. They have also been defined as a network of innovative activists that are assisted by external entities with mutual interests (Church 2005)³⁶. In the context of India, grassroots innovation can refer to the "demonstrated day-to-day ability of ordinary Indians to solve problems under conditions of constraint and scarcity, and to seize opportunities in the most challenging circumstances" (Radjou, Prabhu, and Ahuja 2014). Grassroots innovations have also been defined as innovations that "redefine business models, reconfigure value chains and redesign products to use resources in different ways and create more inclusive markets by serving users with affordability constraints, often in a scalable & sustainable manner" (Bhatti, 2012)³⁷. Although many definitions of grassroots innovation and grassroots innovators exist in literature, common themes emerge. The communities in rural villages of developing countries don't have the same access to

³³ *Science Technology and Innovation Policy*. New Delhi: Government of India, 2013.

³⁴ "Startup India Action Plan: PM Modi's 12 Big Announcements." *NDTV*, January 17, 2016. <http://gadgets.ndtv.com/internet/features/12-significant-announcements-from-the-startup-india-action-plan-790781>.

³⁵ Bhaduri, S., and H. Kumar. *The-startup-india-action-plan-790781*. Bhaduri, S., & Kumar, H. (2012). *Tracing The Motivation to Innovate: A Study of 'Grassroot' Innovators in India*. Jena: Max Planck Institute of Economics Evolutionary Economics Group., Germany.

³⁶ Church, C. "Sustainability: The Importance of Grassroots Initiatives." *Paper Presented at Grassroots Innovations for Sustainable Development Conference* (UCL London), June 10, 2005.

³⁷ Bhatti, Yasser Ahmad. "What Is Frugal, What Is Innovation? Towards a Theory of Frugal Innovation." *SSRN Electronic Journal SSRN Journal*, 2012. Accessed April 27, 2016. <http://ssrn.com/abstract=2005910>.

resources (technological, human capital, knowledge, or economic) like in the formal sector. Certain people in these communities are however still capable of innovating within their constraints in order to satisfy a pressing need for themselves or for the local community, contribute to social well-being, and boost economic opportunities irrespective of whether the innovation is new to the world. These innovations also have the potential to be scaled to meet the unmet needs of other rural low-income communities in the country or beyond. For example, one of the most prominent examples of grassroots innovation in India is the Mitticool fridge. Developed by Mansukh Prajapati, the fridge is made of clay and can keep perishables such as milk and vegetables fresh for up to four days³⁸. This low-cost solution is a boon for rural communities with limited income and access to electricity. Prajapati has established a successful business selling these fridges, and is also employing others in his community. Such a solution can also find use in rural communities of other developing nations.

Dr. Anil Gupta, the driving force behind Honeybee Network opines that economically disadvantaged people must not be viewed as sinks of public aid and assistance, but rather as people capable of being solution providers³⁹. He cites this example in an interview, “Two innovators on a small farm, Mohammad Mehtar Hussain and his brother Mushtaq, designed a windmill for a cost of under 120 dollars. What's it made out of? Bamboo. The idea was to run a hand pump to pump water to irrigate a small paddy field. No big lab or big company could imagine that you could fabricate a solution at that cost for common people”⁴⁰.

Grassroots innovator solutions respond to the values and interests of communities in a local context (Seyfang & Smith 2007)⁴¹, and financial, material and institutional resources, in order to flip constraints into an advantage (Bound & Thornton 2012). And the development of such innovations in resource constrained environments often leads to low-cost products and services (Bound & Thornton 2012). This explains why Honeybee Network and NIF have been working to

³⁸ Sharma, Milan. "Mansukhbhai Prajapati's Mitti Cool Clay Creations Brings Clay Back in Fashion." *The Economic Times*, December 3, 2012. http://articles.economictimes.indiatimes.com/2012-12-03/news/35568762_1_wankaner-fridge-filter.

³⁹ Gupta, Anil K. "Innovations for the Poor by the Poor." *Int. J. Technological Learning, Innovation and Development*, 1/2, 5 (2012): 28-39.

⁴⁰ "Grassroots Innovation: An Interview with Anil Gupta." *SGI Quarterly*, January 3, 2012. <http://www.sgiquarterly.org/feature2012Jan-3.html>.

⁴¹ Seyfang, Gill, and Adrian Smith. "Grassroots Innovations for Sustainable Development: Towards a New Research and Policy Agenda." *Environment Politics* 16, no. 4 (July 17, 2007): 584-603.

scale innovations that can be applied outside of the context in which they were developed; so that they have wide social and economic impact, while generating income for the innovators and the workers under their employment.

Two other arguments can be made in favor of grassroots innovations. First, Booz Allen Hamilton conducted a study of 1000 global research and development spending corporate firms. In the words of Booz Allen Vice President Barry Jaruzelski, “There is no easy way to achieve sustained innovation success - you can't spend your way to prosperity.... successful innovation demands careful coordination and orchestration both internally and externally. How you spend is far more important than how much you spend”⁴². And second, it can be argued that even the west emerged from grassroots innovation (Radjou, Prabhu, and Ahuja 2014). It was innovators such as Ben Franklin, Wright brothers and Cyrus McCormick that helped inspire economic growth in countries such as the US. This ingenious, improvised form of innovation eventually gave way to the institutionalization of innovation through exclusive R&D departments. Radjou, Prabhu, and Ahuja (2014) characterize this structured innovation approach as one with “big budgets, standardized business processes, and controlled access to knowledge”. A big pharmaceutical firm with a large budget R&D department, and run by scientists would be a good example of this. The authors further argue that the structured innovation approach cannot keep pace with the uncertainties of present day scenarios; it is inflexible, resource intensive, parochial and elitist.

In a country like India, grassroots innovations can play an important role in providing technologies and ideas that can help the poor work more efficiently, and raise their incomes. These innovations can also help improve their quality of life. For example, pepper in the rural areas of Kerala was traditionally threshed manually, a time and labor intensive process. An innovator by the name of P. K. Ravi developed a mechanical thresher than can operate manually or using electricity⁴³. The thresher has reduced time and effort required, and boosted the amount of pepper

⁴² "Money Doesn't Buy Results - New Innovation Study Finds No Relationship between R&D Spending and Sales Growth, Earnings, or Shareholder Returns." *Business Wire*, October 11, 2005. <http://www.businesswire.com/news/home/20051011005323/en/Money-Doesnt-Buy-Results---Innovation-Study>.

⁴³ "Pepper Thresher." National Innovation Foundation. Accessed April 27, 2016. http://nif.org.in/innovation/pepper_thresher/601.

that can be produced⁴⁴. Examples of such innovations are abound in India, and in states like Andhra Pradesh and Telangana. They have immense potential to create economic and social value in the community.

As a result, research on grassroots innovation in India has burgeoned over the years. And this isn't limited to the Indian context, many other researchers and practitioners across the globe have been studying and supporting grassroots innovation in the recent past. 300 participants from across the globe partook in the Third International Conference on Creativity and Innovations at (for/from/with) Grassroots held at Ahmedabad in early 2015⁴⁵. These participants represented many countries including India, China, US, UK, Russia, South Africa, Canada, Germany, France, Brazil, Portugal, South Africa, Singapore, Malaysia, Indonesia, Zimbabwe, Togo, Nepal, Ethiopia, Kenya, Pakistan, Bangladesh, Mali, Nigeria, Italy, Sri Lanka, South Korea. Nearly 230 abstracts on grassroots innovation research were submitted, tackling its many different facets: cultural, technological, institutional and educational. The research insights in the conference were augmented by the experiences of practitioners from organizations such as the Honey Bee Network and National Innovation Foundation.

The learnings from these vibrant discussions about grassroots innovation have however not translated to its incorporation in state level innovation policies like in the case of Andhra Pradesh and Telangana, where the focus is on high-tech innovation driven by industry and student entrepreneurs^{14,15}. By developing an understanding of grassroots innovation processes in these two states, supportive mechanisms for grassroots innovators can be identified within the existing innovation policy frameworks.

⁴⁴ Prabhu, M J. "More Spice at Lower Cost with New Mechanical Pepper Device." *The Hindu*, June 26, 2008. <http://www.thehindu.com/todays-paper/tp-features/tp-sci-tech-and-agri/more-spice-at-lower-cost-with-new-mechanical-pepper-device/article1446808.ece>.

⁴⁵ Report: ICCIG 3 Third International Conference on Creativity and Innovations at (for/from/with) Grassroots. Ahmedabad: IIM, 2015. <http://www.iccig.org/wp-content/uploads/2015/01/iccig-3-report.pdf>.

Chapter 2 - Process of Grassroots Innovation

This chapter details the processes by which the interviewed grassroots innovators transformed their ideas into working products. A detailed account of their innovation processes provides a foundation for the analysis in Chapter 3, and ensures that all important aspects of the grassroots innovation process have been captured. Analysis here refers to understanding where the grassroots innovation processes diverge and what the underlying similarities are. This helps identify elements that were crucial in driving the innovation process, and areas where external support was particularly beneficial.

The innovation processes of the four grassroots innovators are described below. Mr. Tondapi Guravaiah is a farmer by profession, and Mr. Patan Saida is a TV mechanic. Both are from the state of Andhra Pradesh. Mr. Mullapudi Satyanarayana is a farmer like Guravaiah, and Mr. Bommagani Mallesh is an electronics repairman. They are from the neighboring state of Telangana.

Tondapi Guravaiah: Multi-Functional Seed Dispenser

Born in the small village of Rupenguntla in Andhra Pradesh, Guravaiah is a 65-year-old farmer who studied till the fifth grade. He has been a farmer since the age of 25, growing maize and millet on his 15-acre plot of land. His innovation is a tractor mounted device that performs multiple functions such as making furrows, dropping seeds, adding fertilizer, closing the furrow and spraying weedicide between the furrows. All of these functions are carried out simultaneously, and a major benefit is the optimized dispersion of seeds, fertilizer and herbicide.⁴⁶

Guravaiah developed this innovation for the purposes of zero-tillage farming, a technique that involves sowing seeds in the residues of previous plants using a coulter (vertical blade that helps make furrows for the seeds). This method is considered to be better than conventional tilling from

⁴⁶ Note: The innovation process has been pieced together using the interview and published material listed below. Interview with Guravaiah (2016) | "Tondapi Guravaiah." Palle Srujana. Accessed April 27, 2016. <http://www.pallesrujana.org/t-guravaiah-2014.html>. | Sastry, K., and O. Tara. "The Journey of Farmer as an Innovator." In *Rural Innovations @ Grassroots Mining the Minds of Masses*, 9-27. Hyderabad: National Academy of Agricultural Research Management, 2014. | "No-Till Farming Pros and Cons." Mother Earth News. May 1984. <http://www.motherearthnews.com/homesteading-and-livestock/no-till-farming-zmaz84zloeck.aspx>.

a soil conservation perspective. The latter method turns soil at a depth of 8 to 12 inches, and contributes to the loss of topsoil.



Figure 2: Guravaiah with his multi-functional seed dispenser (Source: Author)

The need for this innovation came from rising labor costs and frequent unavailability of labor. Labor shortages in the state are being caused by “migration from agriculture to other sources of livelihood, and the introduction of several labor-oriented schemes by the government have had a cascading effect on the availability of manpower on the farm”⁴⁷. Guravaiah observed the difficulties faced by farmers in his community due to labor shortages, especially during the critical harvesting and sowing season. Guravaiah was also personally affected by this issue, since he hired labor to perform different functions such as land tilling, sowing seeds, spraying herbicide etc. It was this acute need that inspired him to think of alternative solutions to the labor problems faced by him and his fellow farmers.

“Two things are very important to humans - need and hunger, and this can either veer him towards being a crook or a great mind.” - Guravaiah (2016)

⁴⁷ "Labour Shortage: Farm Mechanisation Gets a Boost." *The Hindu*, June 7, 2013. <http://www.thehindu.com/todays-paper/tp-national/tp-andhrapradesh/labour-shortage-farm-mechanisation-gets-a-boost/article4790125.ece>.

Guravaiah's innovation is immensely beneficial to the farming community because input costs for labor are reduced, which translates to more disposable income for the farmers. By performing five separate functions at once, the work that required many laborers previously can now be done by only two people handling the tractor mounted with Guravaiah's innovation. It also ensures that wastage in the use of seeds, fertilizer and weedicide is reduced. The innovation also addresses other issues such as inaccuracies in seed-sowing depth and non-uniform spacing of seeds. Guravaiah estimates that this machine would cost Rs. 130,000 (\$1950) and believes that a subsidized price of Rs. 70,000 (\$1050) would be attractive to farmers like himself.

Guravaiah's journey of innovation began at a gathering for farmers at Lam Farms, an agricultural research organization based in the outskirts of Guntur, Andhra Pradesh. During the meeting, Guravaiah brought up the issue of labor to scientists present there and inquired if there was a technological solution that can help till land and sow seeds simultaneously. The scientists said that they were working on a machine that can do these tasks, but that it would take more time to near completion. A few months later, Guravaiah contacted the scientists again to find out if there was any progress, and was informed that they were still working on it. During those months however, Guravaiah began thinking about his own solution to the problem. He had a concept in mind that was informed by his extensive knowledge of farm equipment and farming practices. Throughout the innovation process, he refined this concept by learning from mistakes and iterative reflection about what works and what doesn't. He traveled to Lam Farms again, and met with Mr. Yerramanda Reddy, one of the research scientists there. When he described his idea to Mr. Reddy, he was encouraged to build a working prototype of the machine. Mr. Reddy offered a small grant to help Guravaiah get started with the experimentation process.

Since Guravaiah lacked the technical expertise to work with metal parts, he began seeking the help of different welders in the nearby town. According to Guravaiah, the welders initially underestimated the complexity of the task and they all gave up when they realized the volume of work involved. He lost nearly three months in the process. He later found that one of his acquaintance's son had opened his own welding shop in another town called Vatturu. He sought his help, and with the help of purchased iron parts from another nearby town called

Chilakalurpeta, both of them collaborated to build a working prototype of his idea. He took this prototype to Lam farms, where he showed it to Mr. Reddy and his colleague Mr. Subbarami Reddy. The machine however did not function as intended. Around the same time, Mr. Yerramanda Reddy transferred to another office. And his replacement scientist lacked the same experience with farm equipment. Mr. Subbarami Reddy suggested Guravaiah meet with the Principal of an agricultural research college in Bapatla (town two hours away from the village).

The Principal of the college agreed to help Guravaiah, and provided a grant of Rs. 40,000 (\$615). He also asked the college staff to assist Guravaiah in any way they can. One of the staff members along with a mechanic at the college workshop worked on the machine with Guravaiah. They then tested the prototype in the farms near the college. At this point, the machine was functionally very simple and could create two furrows for sowing the seeds. The testing process brought out a few more technical challenges that required further experimentation. But the college was unable to provide any more funds to Guravaiah. He then returned to his village, and a year later he got the chance to meet representatives from Palle Srujana. The organization heard about Guravaiah from another grassroots innovator they had worked with, who heard about him from one of the farmers in the area near the college. The Palle Srujana team traveled to Bapatla to meet with Guravaiah, and see the machine for themselves. The team then brought the innovation to the attention of NABARD (National Bank for Agriculture and Rural Development), who sanctioned a grant of Rs. 90,000 (\$1350). This was through the Rural Innovation Fund, a fund “designed to support innovative, risk friendly, unconventional experiments in Farm, Non-Farm and micro-Finance sectors that would have the potential to promote livelihood opportunities and employment in rural areas”⁴⁸. According to the Vice President of Palle Srujana, these funds are earmarked specifically to support rural innovation, and are therefore not inherently risky for the bank. With these funds, Guravaiah then began redesigning his machine. The Palle Srujana team also connected Guravaiah with a mechanic in Aler (a town four hours away from Guravaiah), who helped him build a working prototype. This prototype included more coulters in the seed drill than in the previous

⁴⁸ "Rural Innovation Fund FAQs." NABARD. Accessed April 26, 2016. https://www.nabard.org/english/rif_faqs.aspx.

one. Palle Srujana then helped Guravaiah bring this prototype back to his village, so he could test it in his farm.

The prototype still didn't work as it was intended to. The Palle Srujana team then contacted three mechanics in the nearby town of Narsaraopeta, and asked if they could assist Guravaiah. These mechanics helped Guravaiah add two additional coulters and include a dispensing system for the fertilizer and herbicide. All the while they were making these modifications, they tested it in the fields nearby and asked other farmers for suggestions and concerns. This iterative experimentation process finally resulted in a machine that could be attached to a tractor, and performed the five functions described previously.

Guravaiah's innovation process began in 2009, and lasted three years. In 2011, he was introduced to Palle Srujana and in 2012, he was able to present a final working prototype. He could not work on the innovation for about six months, when his wife had to undergo surgery for blindness. Guravaiah displayed immense dedication and perseverance through out the innovation process. Guravaiah's family was well settled at this point, and he had no reason to pour so much effort into the innovation. But he still retained a passion for farming, and recognized the need for such a machine to reduce his labor costs, and make his farm output economically viable. During the time he was traveling and experimenting with his innovation, he even leased his farm so he could spend more time working towards a final design.

Guravaiah has won numerous awards, and has been recognized at the state and national level for his efforts. Interestingly, although his innovation has such immense positive attributes for the farming community, he has not attempted to market and sell this product, in spite of many requests from Palle Srujana. He believes that the future lies in harvesters, and wants to replicate the functions of his tractor mounted innovation in a harvester. He is not completely averse to the idea of selling his grassroots innovation, but wants to entrust it to someone who can work on the farmer's behalf rather than for financial gain.

Guravaiah wants to continue innovating, and has his eyes set on modifying a harvester such that it cuts crop and sows seeds at the same time. He is hoping to obtain funds (Rs. 200,000 ~ \$3000) that can help him begin experimentation on this idea.

“In the past four or five years, a harvester is cutting the crops. I have an idea, why not use the harvester to also sow seeds for pulses while it cuts the crops. There is a good market for pulses now, and it would be very beneficial to farmers. But I need money for developing this, at least Rs. 200,000. If the government or anyone else gave me this money, I can make the harvester sow seeds and spray herbicide while cutting the crops.” – Guravaiah 2016

Mullapudi Satyanarayana: Mini Tiller and Solar Cotton Picker

Satyanarayana hails from Janampeta village in eastern Telangana, and is a farmer by profession. He owns a 10-acre plot of land where he grows various crops such as cotton, tobacco, chilies etc. He is 55 years old, and has been working on innovations for the past seven years. During this time, he developed a mini-tiller and is on the verge of completing a solar powered cotton picker⁴⁹.

The mini-tiller is an easily operable, diesel driven tiller that is also cost-effective. It has benefits for farmers who cannot afford expensive tilling machines and have small land holdings. In addition to tilling, the machine comes with attachments that can perform other activities such as weeding, leveling, crop cutting etc. The solar cotton picker on the other hand is a solar powered suction device that helps remove cotton from the plants.

⁴⁹ Note: The innovation process has been pieced together using the interview and published material listed below. Interview with Satyanarayana (2015) | "Mullapudi Satyanarayana." Palle Srujana. Accessed April 27, 2016. <http://www.pallesrujana.org/mullapudisatyanarayana-2014.html> | Sastry, K., and O. Tara. "Cotton Quick Picker" In *Rural Innovations @ Grassroots Mining the Minds of Masses*, 117-125. Hyderabad: National Academy of Agricultural Research Management, 2014. | Palle Srujana. "Mullapudi Satyanarayana." Facebook. November 27, 2015. https://www.facebook.com/permalink.php?story_fbid=1068866603146923&id=547249201975335.



Figure 3: Mini Tiller and Satyanarayana with the diesel version of the cotton picker (Source: Palle Srujana)

The idea for the mini-tiller originated from his dissatisfaction with current tillers in the market, and his motivation to design a tiller better suited to farmers like himself. Alternative methods such as cattle driven tilling and tractors are expensive for farmers with small farms. When Satyanarayana was asked how farmers in his community currently till, he answered:

“Using cattle. If they are able to hire a tractor, they do that. But mostly cattle, which is a long process. And you have to spend Atleast Rs. 200 per day to feed it, which is almost Rs. 70,000 per year. An average farmer has a five-acre plot of land, and Rs. 70,000 per year is a big portion of his income. Comparatively, my machine is far cheaper.” – Satyanarayana 2015

For the solar picker, Satyanarayana’s motivation was from personal experience and his observation of changes occurring in farming. He personally struggled with the high labor costs and found his cotton crop becoming less financially viable.

“While removing cotton, not picking it within 20 days results in cotton falling to the ground and getting spoilt. Or a cyclone comes along and wets the cotton. The labor cost in removing cotton from the plants is also high. For each kg of cotton

removed, it costs Rs. 10. That translates to nearly Rs. 1000 for each quintal. That means that for a selling price of Rs. 3400 - 3500, Rs. 1000 goes to labor costs. I thought to myself - why can't we make a machine that helps reduce these labor costs? I have been working on this for the past six years.” – Satyanarayana 2015

The solar cotton picker is useful to farmers for multiple reasons. First, the mechanization of the removal process reduces need for labor, thereby reducing input costs. Second, a solar powered cotton picker is both eco-friendly, and can be used as an inverter battery in the night. Third, it eliminates wastage that occurs during manual removal of cotton. And finally, it mitigates contamination (plant bark etc.) in the collected cotton, an issue common during manual extraction.

Satyanarayana only studied till the eight grade, but this did not deter him from trying to seek a solution to the problem he faced as a cotton farmer. In 2008, he read about an innovation that National Innovation Foundation (NIF) supported in a newspaper. He contacted them in the hopes of finding assistance. NIF introduced him to the team at Palle Srujana, who then helped him get started on the innovation. Palle Srujana acted as an emotional anchor, monitoring his progress and giving him advice when possible. Palle Srujana also connected Satyanarayana to their contacts who could offer technical assistance. He found that material resources and skilled metal workers were scarce in his village, and therefore decided to split his time between Hyderabad (capital of Telangana) and his village. He rented a space in Hyderabad, and hired some skilled workers to help him build parts for the cotton picker. During this time, he often interacted with the team at Palle Srujana, given their proximity. He also began experimenting with various designs for his concept.

Satyanarayana did not have a technical background, but he had a strong affinity towards machines since his childhood. He often observed mechanics fixing machines, or would experiment with electrical or mechanical objects. Even though he was not capable of using complex tools like CAD, his interest and experience with machines enabled him to direct his workers. He communicated clearly what he expected from the technicians, and they built the necessary parts. He also approached small manufacturers for parts that he could purchase directly. For the next four years,

he worked on nearly 8-12 versions of the cotton picker. In 2012, he was finally able to produce a working prototype of the cotton picker.

This prototype ran on diesel, and was able to collect nearly 100 kg of cotton per day per person. It consumed one liter of diesel to run three hours. Satyanarayana however was not satisfied. Rising diesel costs, and heaviness of the cotton picker inspired him to redesign the picker to run on solar power. For this conversion process, he was awarded some funds from NIF. He has been experimenting with multiple versions of the solar cotton picker over the past few years, and believes he is very close to a finished product. During the experimentation process, he also took his different versions to various innovation exhibitions, where he invited other farmers to make suggestions. This fed into his experimentation process.

The networking support offered by Palle Srujana in Satyanarayana's innovation process was crucial. The team connected him to people who could help with the innovation, or were willing to invest in the product. By getting his story published in the local media, they also ensured that his grassroots innovation was recognized. Such is their belief in him that certain members of the team at Palle Srujana also invested their personal money to help Satyanarayana complete the solar cotton picker. By doing so, they shifted the financial risk from him to themselves.

In the mini-tiller's case, it took Satyanarayana nearly two years to complete the innovation. He worked on it simultaneously with the cotton picker, and completed a final version of the tiller in October 2015. He worked on it in the same workshop in Hyderabad. Although he wants to bring this product to market, he lacks the requisite funding. He estimates a need of at least Rs. 5,000,000 (\$75,000) to begin production of the tiller. He was also able to patent this innovation with the help of a patent agency named Prometheus in Hyderabad. He read in the news about the founder's interest in helping farmers. When he approached the firm, they helped him file a patent for the innovation. It is important to note that for any patentable grassroots innovation supported by Palle Srujana, the patent is held by the grassroots innovator.

Bommagani Mallesh: Solar Sprayer

Mallesh is a grassroots innovator who has been working on multiple innovations for the past 15 years, since he was 15 years old. He was born in a small village called Arjimpet in Telangana. He only studied till the 10th grade, but displays a strong fascination and expertise in electronics. His knowledge of electronics was developed during his work at a repair store in another village in Telangana. Over the years, he has worked on 12 different innovations. One of his earliest ones in 2004 was a remote control for lights and ceiling fans in a room. More recently, he developed a solar powered sprayer for farmers⁵⁰.

The remote control was made keeping his bedridden grandmother in mind. He wanted to develop a device that helps old people like his grandmother control electronic appliances (ceiling fans, lights etc.) with the touch of a button.

“The light and fan remote controller for example, I developed keeping the many old bed-ridden people in mind. Also those people who cannot get up to switch lights and fans on and off. For these people, it is convenient if they can just control them from the bed. My own mother finds it difficult to get out of bed, and I made this innovation keeping her in mind as well.” - Mallesh 2015

The solar sprayer was inspired by his observation that motor driven sprayers used by farmers are heavy, and incur considerable operational and maintenance costs. He was motivated by a strong desire to help the farming community.

“For farmers, spraying costs nearly Rs. 1000 (\$15) for petrol use in the mechanical pumps. If there is anything in the world we don't have to purchase, it is sun's energy.

⁵⁰ Note: The innovation process has been pieced together using the interview and published material listed below. Interview with Mallesh (2015) | | "Bommagani Mallesh" Palle Srujana. Accessed April 27, 2016. <http://www.pallesrujana.org/mallesh-2014.html> | Sastry, K., and O. Tara. "A Serial Innovator from a Grassroots Landscape." In *Rural Innovations @ Grassroots Mining the Minds of Masses*, 111-117. Hyderabad: National Academy of Agricultural Research Management, 2014. | "Youth Develops Solar Sprayer for Farmers." *The Hindu*, January 16, 2012. <http://www.thehindu.com/todays-paper/tp-national/tp-andhrapradesh/youth-develops-solar-sprayer-for-farmers/article2806839.ece>. | "Solar Sprayer a Boon to Farmers." *Hans India*, November 11, 2013. <http://www.thehansindia.com/posts/index/2013-11-11/Solar-sprayer-a-boon-to-farmers--76615>.

Using this solar energy, farmers can spray their farms easily until sunset. The innovation also has the added benefit of being lighter. Moreover, the cost of my sprayer is just Rs. 5,000 (\$75) compared to the other sprayer that costs Rs. 7,000 (\$100). So this innovation saves the farmers a lot of money that would otherwise be used on buying petrol and other maintenance charges.” – Malleesh 2015

“Across the world, farmers are really important. Without farmers, the situation is going to be really dire. I want to create something that will help them. I want to help them in such a way that their costs reduce and their profits increase. This will motivate more farmers to continue farming. If everyone takes up a job, who is going to farm?” – Malleesh 2015

In addition to cost benefits of the solar sprayer described by Malleesh, the solar sprayer is also lighter and eco-friendlier than the conventional sprayer in the market. Moreover, small gadgets such as mobile phones can be charged with the solar panel when not in use, or from the battery storage during nighttime.

In 2005, Malleesh underwent a course on solar technology in the town of Pochampally in Telangana. The course was offered by Swami Ramananda Thirtha Rural Institute, a vocational training institution. The knowledge of solar technology coupled with his knowledge of electronics proved useful as he began incorporating elements of solar in his innovations. When he got an opportunity to fix a broken motor-driven sprayer at the repair store, he saw an opportunity to make it more affordable and green. However, he did not have the necessary funding to begin experimenting. In 2009, he was introduced to Palle Srujana through another grassroots innovator he met in his district. With the help of Palle Srujana, Malleesh secured a loan of Rs. 800,000 from NABARD.



Figure 4: Mallesh displaying the functionality of his solar sprayer (Source: The Hindu)

Mallesh then moved close to Hyderabad, and rented a workshop. He also hired some workers to assist him in the experimentation process. Since he was in such close proximity to the city, he did not face problems in acquiring the necessary material such as solar panels etc. It took two years to finalize the design, and he developed nearly six different versions of the sprayer during this time. Once a final working sprayer was developed, he started assembling them in his workshop. Till date, he has sold around 2000 sprayers, and not just in Andhra Pradesh and Telangana. He reinvests the money from sales back into his business.

Akin to Satyanarayana's case, Palle Srujana catalyzed the innovation process by connecting Mallesh to funding opportunities, giving him suggestions about his innovation, bringing him recognition through the local media, and linking him to people interested in his innovation. In order to transform the solar sprayer into a viable business, another organization played an important role. Creative Minds is a partner organization of Palle Srujana, one that focuses on the commercialization of innovations by providing mentorship (monitoring production, sales, revenues etc.) and marketing support (connecting to markets). This organization is run on a working capital of Rs. 200,000 (\$3000) that was contributed by the President of Palle Srujana Brigadier Ganesham and Mr. Durga Prasad, a businessman interested in assisting grassroots

innovators⁵¹. The innovators receive 50% of the profits and the rest is used to run the organization. The solar sprayer is one such innovation that was brought to the market with the help of Creative Minds.

Mallesh has overcome many family difficulties to design creative solutions to problems he observed around him. And he isn't interested in innovation for the sake of it, he believes it must be useful to people.

“I have an interest in developing new things, but at the same time I want that innovation to be helpful to many people. Developing something new without it benefitting anyone is useless.” - Mallesh 2015

Patan Saida: Groundwater Extraction with Horizontal Wind Turbine

Saida is a 40-year-old TV mechanic, and a resident of Chilakalurpeta, a town in Andhra Pradesh. Although he did not elaborate why, Saida dropped out of school after the ninth grade, and has been working and managing at repair stores since then. His innovation is a horizontal wind turbine that extracts groundwater for farm applications such as irrigation. It stands at only 15 ft., and is capable of extracting groundwater from depths of 30 to 70 m⁵².

Although it eventually shaped into a farm product, the innovation initially was intended to generate electricity. This was driven by the personal struggle faced by Saida when he lost business due to power cuts in his town.

“As a TV mechanic, I earned only Rs. 400 or 500. As a result, I struggled a lot. And the electricity cuts were a persistent problem. I didn't have the money to buy a back-up generator. And there were no inverters during the time.” – Saida 2016

⁵¹ "Structure." Creative Minds. Accessed April 27, 2016. <http://ngo.in3ator.com/pallesrujana/creative-minds-2/>.

⁵² Interview with Saida (2016)



Figure 5: Saida's horizontal wind turbine (Source: Rajeswara Rao)

A farm applicable wind turbine is a pressing need for farmers in the state. Electricity supply is far from reliable and farmers face huge problems during time sensitive operations such as irrigation. It is also useful to farmers who do not have access to electricity, and also those who incur high operational and maintenance costs from their diesel driven pumps. In addition to addressing this need, the wind turbine driven water extraction is less carbon intensive. On the downside, the wind turbine requires good wind resources for operation, and potentially a tank to store the water.

After he dropped out of school, Saida joined a large electronic store as a TV and radio mechanic. As his children began growing up, he decided to open a store for more income. He found that his business was severely affected due to power cuts.

“One day, as usual there was a power loss and there were a lot of customers. It was very inconvenient. The power was not restored until evening. In the evening we were told that the transformer had burnt, and there would be no power for two days. During this time, I thought to myself, why do I have to face problems if a transformer somewhere stops working. How does my house function during those two days?” – Saida 2016

So Saida first started experimenting with a dynamo in 2010, trying to generate electricity through continuous rotation. He spent nearly Rs. 20,000 (\$300) on material purchase, and tried different ideas for nearly six months. When he was unsuccessful, he started rethinking ways in which electricity could be generated. After pondering various options, he decided to experiment with a wind turbine.

“You don’t see a small wind mill. I wanted to make a small scale wind turbine that can be used domestically. I wanted to put this above my shop, and be able to continue working during power cuts that last around seven hours at a time.” – Saida
2016

For the next five years, he drew up various designs, built prototypes and tested them. This iterative process helped him understand how changes in design affect its operation. Since 2010, he was also in contact with Palle Srujana, and they were aware of his attempts. When the President of Palle Srujana Brig. Ganesham recognized the potential of this innovation in a farm setting, he helped Saida reorient the application of his innovation from electricity generation to farm irrigation. In 2013, when he started making progress, Palle Srujana helped him secure funds from NABARD (a grant of Rs. 70,000~\$1000) for the prototyping process. Previously, Saida spent his personal money to purchase material for the prototypes. During Saida’s experimentation process, he built nearly seven versions of the turbine that failed. Eventually, he was able to build a successful working prototype that could extract water from the ground, and installed it in an area near his town. After this successful implementation, NABARD provided another grant of Rs. 110,000 (\$1650) to Saida for installing the turbine in a salt farm in Nellore, Andhra Pradesh.

During the innovation process, Saida used his aunt’s roof as a workspace, and bought all the required material from the market nearby. And he utilized welders from the market to build parts according to his specifications. Like Satyanarayana and Guravaiah, Saida did not have the technical and scientific know-how of wind energy, but instead used a process of reflective iteration and trial and error to build the different prototypes.

He hopes to scale this into a business, and has nearly 200 orders pending currently. He is working with Palle Srujana to devise a way in which he can deliver these orders, given the financial constraints. Saida estimates that producing the wind turbine costs nearly Rs. 70,000 (\$1000) and believes that a selling price of Rs. 40,000 (\$600) would be attractive to farmers provided it is subsidized by the government. His pricing ideas are in line with other subsidized alternatives in the market such as solar pumps. When the Government of Andhra Pradesh decided to provide solar pumps to farmers in 2015, they set a subsidized price of Rs. 55,000 (\$800) for a Rs. 500,000 (\$7500) solar pump, and Rs. 40,000 (\$600) for a 330,000 (\$5000) one⁵³.

The diagrams below visually summarize the innovation processes of the four grassroots innovators. These diagrams have been inspired by the model of entrepreneurship developed by William Bygrave (1994)⁵⁴. The process begins with the innovation idea, which is influenced by the grassroots innovator’s personal characteristics and individual agency, and challenges present in their environment. The experimentation phase utilizes different resources such as finance, material and skilled labor, and is enabled by different organizations or by the grassroots innovator’s self-initiative. In the Market Opportunity phase, the innovation is scaled and brought to the market when possible. The market opportunity phase is detailed only in the case of Mallesh, since his is the only product that is currently being sold in the market.

Tondapi Guravaiah

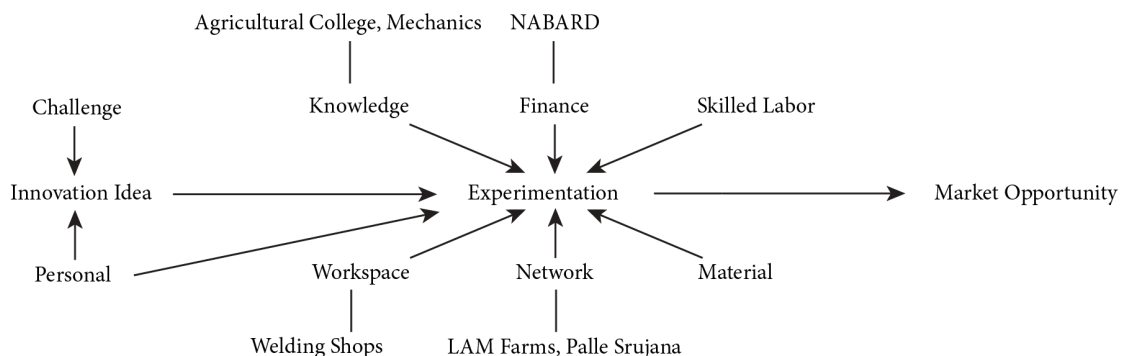


Figure 6: Visual overview of Guravaiah’s grassroots innovation process (Source: Author)

⁵³ "7,000 Solar Pump Sets to Be Installed for Andhra Pradesh Farmers." *The Hindu*, April 2, 2016. <http://www.deccanchronicle.com/150109/nation-current-affairs/article/7000-solar-pump-sets-be-installed-andhra-pradesh-farmers>.
⁵⁴ Bygrave, William D. *The Portable MBA in Entrepreneurship*. New York: Wiley, 1994.

Guravaiah’s innovation had its origin in a combination of personal struggle and the challenges faced by fellow farmers in his community. His experimentation phase of the innovation process utilized multiple resources that were enabled by external organizations, or through self-initiative. The knowledge support in Guravaiah’s case was provided by the agricultural research college, and the mechanics introduced to him by Palle Srujana. Palle Srujana also brought NABARD funding to Guravaiah. Their networking support was preceded by the scientists at Lam Farms. Guravaiah did not have a workspace of his own, and therefore relied on welder workshops in the nearby town. These welders were also the skilled labor that built parts for the seed dispenser. And metal for the grassroots innovation was purchased at the town market near Guravaiah’s village.

Mullapudi Satyanarayana

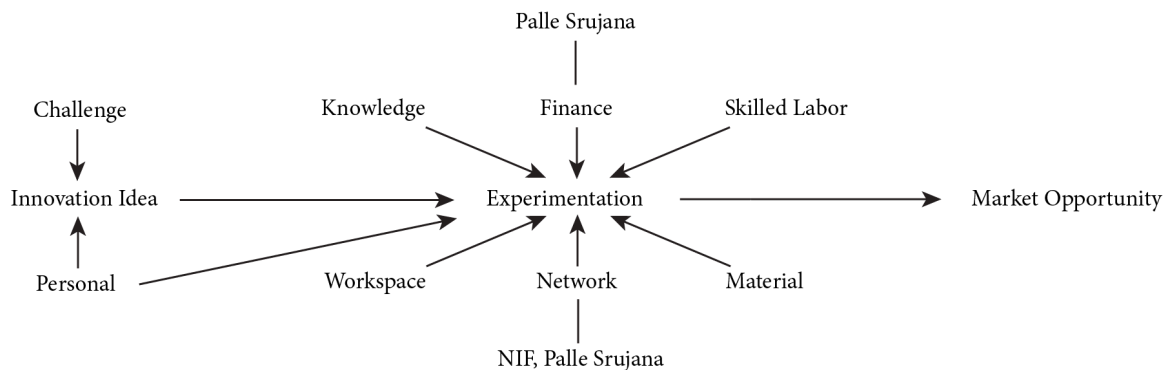


Figure 7: Visual overview of Satyanarayana’s grassroots innovation process (Source: Author)

Although Satyanarayana’s experimentation phase made use of a similar set of resources, his process differs in what resources he obtained by himself and what resources were provided to him through external support. Satyanarayana obtained financial support through Palle Srujana, and the organization also provided marketing and visibility support. NIF initiated the process by connecting him to Palle Srujana. He is currently seeking funding to help him bring the innovation to the marketplace.

Bommagani Mallesh

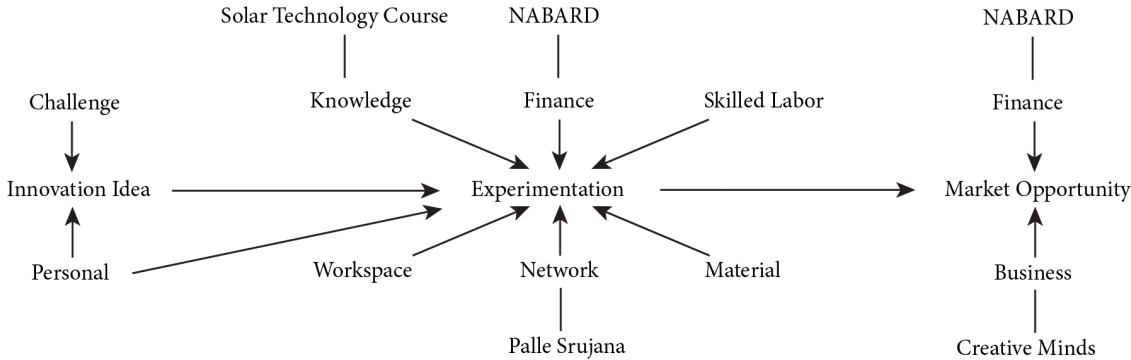


Figure 8: Visual overview of Mallesh’s grassroots innovation process (Source: Author)

In comparison to Guravaiah and Satyanarayana, Mallesh’s experimentation phase also differs in resources obtained through self-initiative and those that were supplied by Palle Srujana. Mallesh gained the knowledge required for the innovation idea through his experience as an electronics repairman, and the solar technology course. Palle Srujana provided prototype funding through NABARD, and they also helped bring recognition to Mallesh. Its partner organization, Creative Minds provided entrepreneurial support to take the solar sprayer to the market, manufacturing support for which was given by NABARD.

Patan Saida

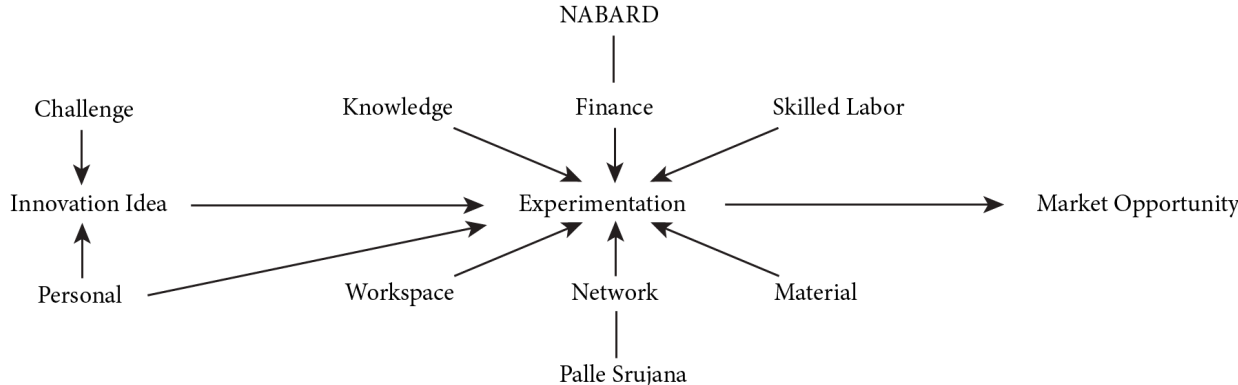


Figure 9: Visual overview of Saida’s grassroots innovation process (Source: Author)

Saida did not rely on external support for knowledge, physical experimentation space, skilled labor, and material i.e. he accessed these resources himself. Like in the case of Mallesh and Guravaiah, Saida received financial support through NABARD, and marketing and recognition support from Palle Srujana.

There are several key insights that can be gathered from the detailed descriptions of these grassroots innovation processes. The narratives of the four grassroots innovation processes in themselves paint a picture of variability in how these grassroots innovators went from innovation idea to a working product. Each of them was introduced to Palle Srujana in a different way, and they all received help in different ways. And not all of them have been able to bring their product to the market. But a closer look reveals underlying similarities.

The grassroots innovators displayed qualities such as resilience, patience and perseverance that were critical to the innovation process, especially since their innovations took multiple years to complete. As seen in the diagrams, they all made use of a similar set of resources for their innovation: financial, knowledge, skilled labor, workspace, network and material although they had access to it in different ways. The grassroots innovators either had access to some of these resources by virtue of their location, or were able to obtain it with the help of Palle Srujana or other external actors. These similarities and other key insights are discussed in greater detail in the following chapter.

Chapter 3 - Analysis of the Grassroots Innovation Processes

The grassroots innovations developed by Guravaiah, Satyanarayana, Saida and Mallesh were borne out of personal necessity, and an awareness of challenges faced by fellow members in their community. In the case of Saida, the latter was brought about by the team at Palle Srujana. Revisiting the conceptualization of innovation in literature, two questions are particularly important a) How new is the innovation? and b) Who is it new for: village, region, country or world? These grassroots innovations are not new to the world or even the same country in some cases, but are new in the context in which the innovators are embedded in. Even though they might not fit within the traditional notion of innovation, they are innovations in that particular village or region.

Did the grassroots innovators then just try and solve their local problem, or do they exhibit the characteristics that literature describes as constituting an innovative mindset? And is education level the big distinction between how these grassroots innovators and innovators from the formal sector are perceived in terms of capabilities? Analyzing the processes of grassroots innovation described in Chapter 2, narratives of the four grassroots innovators evince characteristics that literature recognizes as constituting an innovative mindset. These grassroots innovators exhibited many qualities that one would expect to observe in formally educated innovators in the formal sector. As seen below, there are five other key insights that can be gathered from this analysis:

- a) In addition to reflecting many traits of an innovative mindset, individual agency of the grassroots innovators proved to be a very critical component of the grassroots innovation process, especially in overcoming stymieing difficulties.
- b) There is a human side to the innovation process - both in terms of how Palle Srujana interacts with grassroots innovators, and how the family and friends of grassroots innovators respond to their efforts.
- c) The network support provided by Palle Srujana is important because it connects grassroots innovators with the resources (financial, knowledge, skilled labor, workspace, network and material) required for their innovation process.

- d) The spatiality of these resources is also particularly important i.e. how far apart or close they are to the innovators, and relative to each other.
- e) Finally, finance is a big bottleneck in the innovation process, especially during the innovation scaling phase.

1. Personal Characteristics

The different published work on the characteristics of innovators varies slightly, but share commonalities. Authors Jeffrey Dyer, Hal Gregersen, and Clayton Christensen in their book, “The Innovator’s DNA” delve into the behaviors of leaders managing the worlds best corporate innovators such as Apple, Amazon, Google etc.⁵⁵ This analysis was the result of an eight-year long study that identified how business innovators in these firms are different from ordinary managers. In another interesting piece of literature, George Couros describes a comprehensive list of 8 traits that an innovative mindset exhibits, although he comes at this from an educator’s perspective⁵⁶. He describes the innovative mindset as a set of traits that must be inculcated in students so they can become future innovators in their endeavors.

For the sake of comparison, the characteristics described in George Couros’s work is compared against data obtained from the interviews with grassroots innovators. This particular published work includes the five characteristics (questioning, observing, networking, experimenting, and associational thinking) of innovators that the Dyer, Gregersen, and Christensen study describe, and includes three additional ones (risk-taking, resilience, creating). The eight characteristics of innovators that are listed by Couros include:

⁵⁵ Dyer, Jeff, Hal B. Gregersen, and Clayton M. Christensen. *The Innovator’s DNA: Mastering the Five Skills of Disruptive Innovators*. Boston, MA: Harvard Business Press, 2011. | Upbin, B. "The Five Habits of Highly Innovative Leaders." *Forbes*, July 20, 2011. <http://www.forbes.com/sites/bruceupbin/2011/07/20/the-five-habits-of-highly-innovative-leaders/#18c5e35f3eff>.

⁵⁶ Couros, George. *The Innovator’s Mindset: Empower Learning, Unleash Talent, and Lead a Culture of Creativity*. San Diego, CA: Dave Burgess Consulting, 2015. | Couros, George. "8 Characteristics of the Innovator’s Mindset." George Couros. March 14, 2015. <http://georgecouros.ca/blog/archives/5135>.

a) Empathy and Observation

Empathy is a characteristic of innovators that helps to put themselves in the shoes of who they are developing the innovation for. The Christensen study has a slightly different take on this characteristic, and calls it observing. This refers to the ability of being observant of surrounding activities, and detecting ways in which they can be done better. In the case of grassroots innovators, their awareness stems from personal struggles, and an understanding of the difficulties faced by the fellow members of their community. The grassroots innovators displayed an abundance of this particular trait, as seen by their quotes below.

Satyanarayana developed a mini-tiller for farmers, and is currently working to finalize a solar powered cotton picker to reduce labor costs associated with manual cotton extraction. His innovation was borne out of personal experiences, and his observation of changes taking place in the farming sector.

“A lot is changing, and many people are moving away from farming to other fields. Farmers are not allowing their children to farm. Even laborers in the farm are not allowing their children to work in farms. As a result, manpower is becoming a challenge for farming.” – Satyanarayana 2015

Mallesh developed numerous innovations over the years, and they have always been inspired by an urge to satisfy the needs of others. One of his first innovations was designed to help his bed-ridden grandmother and the geriatric population in India. And his most recent innovation, the solar sprayer was developed to mitigate rising labor costs.

“Across the world, farmers are really important. Without farmers, the situation is going to be really dire. I want to create something that will help them.” – Mallesh 2015

“I have interest in developing new things, but at the same time I want that innovation to be helpful to many people. Developing something new without it benefitting anyone is useless.” – Mallesh 2015

Guravaiah's innovation is a tractor mounted device that can perform five different farm functions, and it was developed for the purpose of reducing operational costs for farmers. Being a farmer himself, he understood the problems faced by his fellow farmers very well.

“I want to help the farmers decrease their operational costs.” – Guravaiah 2015

b) Problem Finding or Questioning

This characteristic is the ability of innovators to question the status quo and consider other possibilities that can solve a particular challenge or opportunity. In each of the interviews with grassroots innovators, it was obvious that they had all asked themselves the same question – “why can't we do things differently?”

Satyanarayana wondered why he couldn't do things differently, so that farmers like him don't have to suffer the consequences of high labor costs in cotton extraction.

“As a farmer, I know what farmers go through and thought to myself, why can't we do things differently?” – Satyanarayana 2015

Mallesh also questioned the changes occurring in farming, and began thinking of solutions that can make farming more financially attractive.

“I want to help them in such a way that their costs reduce and their profits increase. This will motivate more farmers to continue farming. If everyone takes up a job, who is going to farm?” – Mallesh 2015

Guravaiah's innovation also originated with the question of why there isn't a less labor intensive method of doing multiple farm functions. *Saida's* innovation journey began by asking why he had to suffer each time there was a power loss, and why he couldn't generate the electricity himself.

“One day, as usual there was a power loss and there were a lot of customers. It was very inconvenient. The power was not restored until evening. In the evening we were told that the transformer had burnt, and there would be no power for 2 days. During this time, I thought to myself, why do I have to face a

problem if a transformer somewhere stops working. How does my house function during those 2 days? Why can't I do something without having to rely on the people delivering the electricity?" – Saida 2016

c) Networking

This characteristic of innovators allows them to learn from, and harness the perspectives and ideas of people from similar or other backgrounds. This characteristic is reflected in the experiences of the grassroots innovators wherein they learnt and adapted their innovations based on the inputs of other people involved in the innovation process. *Satyanarayana's* grassroots innovation was driven by his intimate knowledge of farming, combined with what he learnt from machine mechanics over the years.

"I studied till 8th class. But I always had an awareness and interest about how motorcycles, tractors and different machines work. I used to observe when mechanics made repairs to a machine and learnt how they function." – Satyanarayana 2015

Guravaiah was aided by ideas of students and faculty at the agricultural research college. He was also assisted by local mechanics, who helped him modify his design and resolve technical difficulties.

"So Mr. Subbarami Reddy suggested I go to Bapatla where he said he knows people at the Agricultural Research College, that the principal and the kids there can help. So I went to Bapatla. There I met Satyanarayana Rao, the principal. As soon as I told him, he called his staff...we worked on it, and tested it in the farms near Bapatla." – Guravaiah 2016

Mallesh was able to apply solar technology in farm equipment owing to a three month course he took on electronics and solar technology. His grassroots innovation was enhanced by his knowledge of how a different perspective can be brought to farm equipment.

“I don’t have a lot of formal education, I only studied till 10th class. I took a three month course on electronics and solar panels in Nalgonda. After my training, I started experimenting to develop this machine.” – Malleesh 2015

Although *Saida*’s initial idea was to generate electricity using his innovation, this eventually evolved into an opportunity to help others.

“I had started with the aim of using the wind turbine to generate electricity but Ganesham sir suggested that I focus on the water extraction application. He explained how farmers are the spine of our country, and that they will benefit from this innovation.” – Saida 2016

d) Experimenting and reflecting

The experimental and reflective trait of innovators enable them to iterate on different ideas and designs, learn from their mistakes and solve them. All of the grassroots innovators built many prototypes over an extended period of time (often years), learnt what worked about them and what didn’t. And this iterative process helped inform their final design.

Satyanarayana – “Oh yes, I made almost 12 versions of the cotton picking machine. The 12th version was about 70% successful. I am continuing to experiment and improve upon it.” – Satyanarayana 2015

“You learn from the mistakes, and you improve upon them.” – Guravaiah 2016

“It took nearly two years to experiment, understand what works and what doesn’t, and then develop a successful prototype.” – Malleesh 2015

“For each of the designs I drew, I created prototypes... I made a design, checked if it is working, and iterated on that.” – Saida 2016

e) Associational thinking

This characteristic of innovators helps them connect ideas from other fields to their own ideas. This is kindled by a combination of the characteristics mentioned previously - questioning, observing, networking, and experimenting. Except in the case of Mallesh and Saida, the interviews did not provide definitive evidence of this particular characteristic, although it could possibly be a function of information access and limited exposure to other applicable knowledge and ideas. Mallesh was able to incorporate solar technology in his sprayer with the knowledge he gained from the short course. In the case of Saida, the associational connection between wind turbine and groundwater extraction was made with the assistance of Palle Srujana.

f) Creating

This is an attribute of innovators that equips them to go beyond their ideas to creation and implementation. This requires a hard working ethic in innovators. The grassroots innovators that were interviewed did not just stop at idea formulation, but instead invested considerable time and effort to convert that vision into a working product.

“I decided to design my own wind turbine. And this took me nearly a year to do, and I worked hard day and night. I used to stay up late, and wake up by 4 or 5 am.” – Saida 2016

“I struggled during the experimentation phase because it takes a lot of effort to draw designs, get people to develop the parts. If it fails, you have to start all over again. Sometimes even after developing the innovation, it fails. And then you have to change the design.” – Mallesh 2015

“I went to Narsaraopeta 10 - 15 times in those six months. I used to mount the device on my tractor and take it there.” – Guravaiah 2015

“I stayed in the village for 15 days and 15 days in the city.” – Satyanarayana 2015

g) Resilience

The innovation process is rarely straightforward, and requires resilience in the grassroots innovators. This helps them overcome obstacles and failure to continue pushing forward with the innovation. In the face of limited resources, this particular characteristic featured prominently in the interviews.

“Whatever I did, I never felt put down by failures.”; “I have been working on this for the past 5-6 years. It has not become completely successful yet, I am still trying to perfect it.” - Satyanarayana 2015

“People used to think, what is this mad person doing. They don’t realize it’s not easy.”; “It took 3 years to finish it, between 2009 and 2012.” – Guravaiah 2016

“I have made 6 such machines, each one cost Rs. 50,000. I took out loans for it, and my parents and acquaintances were berating me...they kept saying - why are you doing such things, do you even know that it’s going to work?” - Saida 2016

h) Risk-taking

Couros defines this attribute of innovators as the ability to think beyond the beaten path, and explore something new. In the context of grassroots innovators, a different kind of risk-taking was observed. Some of the grassroots innovators risked their financial well-being in the pursuit of their ideas. They mentioned the support of their families and self-belief as being invaluable.

Patan Saida – “I am poor, and my earnings are low. My earnings were all used to educate my children. But this has never stopped my passion to innovate. I racked up a lot of loans, but I did not want to leave it midway.” – Saida 2016

“I even closed my store during this time.” – Saida 2016

When asked if he ever thought he was taking a risk, *Saida* said, “No, because I wouldn’t be successful otherwise. Even though people said many things, I told myself that trees take time to grow, to bear fruit, to ripen. This takes time, and moreover I know I am successful but they would never understand that. They don’t think that much, and that’s why they will stay behind. I never paid attention to their words, because I know they are not capable of innovating like me. You need to be daring to accomplish this. If you are scared, you can’t do it. I worked very hard, day and night. It took me five years, but if I didn’t have financial difficulties, I could have done it sooner.” – Saida 2016

Mallesh when asked if his family was ever worried about his financial stability, said, “I always had the determination that I wanted to do it, and just persevered with that.” – Mallesh 2016

Satyanarayana when asked if he ever thought he was taking a risk by utilizing half his time on experimentation, time that he could otherwise spend farming – “I had a lot of belief in myself, that I will be able to make this successful. I always knew I will eventually make it. I have been doing this for nearly seven years now.” – Satyanarayana 2015

Guravaiah however did not display this particular characteristic, and felt comfortable innovating when his family was well settled.

It can be seen, in the own words of the grassroots innovators, that they exhibit many of the same characteristics that would be expected of an innovative mind in the formal sector. Based on conversations with the team at Palle Srujana, and from their experience of working with many innovators over the years, these grassroots innovators displaying such qualities is not unique to them. This does not imply that they are all born with these qualities. Some may be born with it, but these characteristics can also develop through personal experiences, upbringing, and the cultural

and social environment. Highlighting personal characteristics of the grassroots innovators is a means of showcasing that they don't have to be perceived as a separate class of innovators. They share many similar characteristics to innovators from the formal sector, and are capable of creating economic and social value. This forms the basis for why grassroots innovators must be acknowledged in state level innovation policy.

2. Individual Agency

An element that emerged from the analysis of grassroots innovation processes is the importance of individual agency in driving the innovation process forward. In Guravaiah's case, he could have easily given up when a) the agricultural college could not provide more funds and b) when he was traveling to many different places for prototyping support. He even faced a period of personal hardship when his wife suffered from temporary blindness. Although these various factors elongated the innovation timeline, they never dissuaded him from completing the innovation.

Satyanarayana displayed exceptional patience and self-belief during his seven-year process of innovation. He even leased his lands nearly four years ago to ensure that his innovation is a success. Additionally, he invested some of his own hard earned money during the experimentation phase of the cotton picker and mini-tiller. He believes he lost a lot of money during the seven years he has been working on innovations, but this never dwindled his desire to continue pushing forward.

Mallesh could not study beyond basic schooling, owing to trying circumstances at home. When his family faced a financial crisis, he moved to the city of Mumbai where he saved money for his sisters' marriage. Even during this difficult time, he set aside some money that he could then use for idea experimentation.

Saida's innovation took nearly five years to complete, and even in the face of limited technical knowledge and derision from immediate family, his passion to complete the innovation never wavered. In his interview, Saida also mentioned his lack of internet knowledge. But what he could

have learnt online, he experimented and learnt through a process of trial and error. He also borrowed money, and closed his shop just so he could concentrate on his innovation.

From all of these innovation stories, in addition to displaying a lot of the qualities described previously, these grassroots innovators exhibited a strong desire and tremendous self-belief to do what it takes to implement a successful working version of their ideas. This makes their stories highly compelling, and also exceedingly inspirational. There is an instructive component to this that could be beneficial when linking grassroots innovation and formal education.

3. Human Element

There is a human element in the innovation process that is not visibly captured in the stories of these grassroots innovators. To elaborate, on one side are the innovators families, and the people around them. And on the other side is Palle Srujana. In the former, either support or ridicule can have positive or negative consequences on the innovation process. Guravaiah's family was well settled around the time he started experimenting with his idea, and therefore faced no resistance from them. But the people in his village questioned what they termed as 'mad' attempts. Satyanarayana said in his interview, "I had the full support of my family. My wife has always been very supportive. Even if a rival product comes to the product, I have the determination to push forward and create something even better." Similarly, Mallesh also attributed his risk-taking ability to his family, "My family was quite supportive". Saida also faced a lot of criticism from his extended family and friends, but he always had the support of his own family, "I took out loans for it, and my parents and acquaintances were berating me. My own family was supportive, but everyone else wasn't happy. They kept saying - why are you doing such things, do you even know if it is going to work?" In these cases of grassroots innovation, the innovators were enabled by family support while they braved disapproval from others in the family or in the village. Although these innovators have been successful, others who find themselves in similar situations might not show a similar strength and conviction.

Although Palle Srujana's role as a support organization is captured in the innovation process, the nature of their interactions with the innovators is an important aspect that can get lost amongst the other details. Having personally observed the interactions between the grassroots innovators and Palle Srujana, it was striking to observe a) how accessible the organization makes itself and b) how there is mutual respect between grassroots innovators and the Palle Srujana team. The mutual respect is built over time, and this is a result of how well these grassroots innovators are treated by the team. This helps build a foundation of trust in the relationship, which translates to a close working association between the grassroots innovators and Palle Srujana. The grassroots innovators know they can visit the office or call the Palle Srujana team whenever they need advice or other assistance.

During a conversation with Mr. Srikar Jammalamadaka, the vice-president of Palle Srujana, he attributed the functioning style of Palle Srujana to their voluntary status. The absence of external funding has allowed the team to dictate the terms with which they support grassroots innovators. Since its inception, Palle Srujana has been run using the personal money of key individuals such as the President and the Vice-President. This doesn't imply that they don't follow the principles outlined by the Honeybee Network, the principles are still at the core of how they operate. Being a voluntary organization, their team is composed of people who genuinely care about the organization mission. The President and the Vice-President of the organization are retired professionals who do not need to continue working, but they still do. They are passionate individuals who want to support grassroots innovators in any way they can. The team at Palle Srujana is also very small, only five members in total. The small team structure, although it limits the support that they can provide, translates to a more attentive approach in their dealings with grassroots innovators. The functioning style of Palle Srujana creates an intangible value in their interactions with grassroots innovators, one that is not easily captured.

4. Networks

The importance of networking in a grassroots innovation process cannot be underemphasized. In spite of the grassroots innovators driving the innovation process forward, it is often a confluence

of the individual drive, networks, and resources (financial, material, knowledge, and technical) that results in the successful development of an innovation.

Within their capabilities, Palle Srujana provides networking support by linking innovators with other actors that can provide the resources necessary to the innovation process. Although the initial linkage in the case of Guravaiah was provided by the scientists at Lam Farms, Palle Srujana later helped in two key aspects: they secured prototyping funding for Guravaiah from NABARD, and they introduced him to mechanics that provided the technical know-how he lacked. Both of these elements were equally important in the innovation process. Similarly, for Saida and Mallesh, Palle Srujana assisted in providing funding through NABARD. It is important to note that Mr. Srikar Jammalamadaka, the Vice-President of Palle Srujana previously worked at NABARD and this enabled a good working relationship between the two organizations. Another way in which Palle Srujana connects innovators to people that can help in the innovation process is through marketing. By bringing media attention to grassroots innovators, Palle Srujana creates an opportunity to attract prospective investors and interested buyers. This kind of support by Palle Srujana is particularly valued by the grassroots innovators. Mallesh, when asked about the value of this marketing support, replied, “It would have been very difficult. They know people, and have connections. It is difficult to do everything on my own”. He also remarked how media attention piqued the interest of farm equipment distributors, “...sometimes they will see it on TV or in the newspaper, and approach me directly.”

Satyanarayana describes the networking effects of Palle Srujana well, “The foremost is marketing support. If anyone is interested in taking the product forward to production, they are helping to find such interested parties. They have also brought recognition to my innovation. Another thing is that they help me connect to people who might be interested in working with me, or invest in the product. Palle Srujana doesn’t have a lot of funding, so it’s hard for them as well”.

Saida also had an experience similar to Satyanarayana, “Palle Srujana got an article published, and it was circulated state wide. It also came on TV, on every channel except TV9. I got calls from many people, including many from the industry. He also said, “Publicity is very important. But not just

spreading the word, but having good things to say is also important”. Palle Srujana therefore acts as a conduit between grassroots innovators and other actors that can provide the resources and influence the outcome and impact of the grassroots innovation.

5. Resources

As mentioned in Chapter 2, resources (financial, material, physical, technical: welders, blacksmiths etc., and knowledge) also play an important role in the innovation process. It is a combination of these resources that are utilized by the grassroots innovators to build a working prototype of their innovation ideas. The spatiality of these resources is particularly interesting. For Mallesh, his proximity to the city of Hyderabad was an advantage. He had access to material at the local market, rented workspace, and hired technical help. But the knowledge was gained during his work at the electronic store, and the solar technology course he completed in another town.

Satyanarayana realized early on in the innovation process that his village does not have adequate resources. He therefore traveled to Hyderabad each month to access material, rented workspace, and help from hired technicians. When asked whether he can produce the machines in his own village, he said, “Not really, there are problems for material and people who can build the parts and machines. Moreover, you need workers which is hard. If you decide to build it at home yourself, you need a lot of machinery that is expensive”.

Guravaiah was in a similar situation to Satyanarayana. Because his village did not have the resources he required to take his innovation forward, he traveled to multiple towns for material, a place to experiment, skilled welders, and knowledgeable technicians that can help modify his design. And Saida’s situation mirrors that of Mallesh, because his proximity to the town gave him access to material and skilled welders. And because he used the rooftop of his aunt’s home as a workspace, he wasn’t forced to seek it elsewhere.

The location of the grassroots innovator influenced the types of resources that they had access to. In two of the instances the lack thereof meant that the resources had to be sought elsewhere. The

underlying similarities in all of the cases is the combination of resources that enabled the innovation process.

6. Financial Impediment

Lack of money for production was a recurring theme in the innovation process of these grassroots innovators. Indeed, there are going to be innovators like Guravaiah who do not have an interest in scaling it into a business, but others like Satyanarayana and Saida are looking to sell their products in the market. Mallesh was fortunate to receive a loan from NABARD for producing the solar sprayers on a larger scale. But Satyanarayana and Saida do not have the required capital, although they are keen and have people interested in their products. Satyanarayana attributed the lack of financing as a big hurdle, “Yes, it is [if financial capital was an issue] ...Roughly Rs. 50,00,000 (\$90,000) [money needed for production]”. Saida has an interested investor from the state of Maharashtra, although it is still in the works, “We need people like this investor who can offer capital. I really need that”. This investor works at the Buldana Urban Cooperative Credit Society. He met the President of Palle Srujana at a meeting, and realized during their discussions that grassroots innovations supported by Palle Srujana can be applicable to communities in Buldana and others in the state of Maharashtra. Like in Saida’s case, a lack of money for production can lead to situations where a useful innovation is never disseminated.

Lack of financial resources can also constrain the innovation earlier in the process. Saida borrowed money but the others relied on funding from NABARD, NIF and Palle Srujana to help finance their experimentation efforts. When asked what the biggest challenge he faced in his innovation process was, Mallesh said, “Financial constraints are huge. I can manage marketing if I need to. I can even develop the innovation. But finance is a problem.” Guravaiah was asked a similar question and he replied, “I have more challenges now than before; I mean in developing the harvester. I had NABARD funding then. But there is no funding from them this time.” He is referring to his efforts in developing a new innovation that replicates the functions of his innovation, but in a harvester instead. Although this might be considering a counterfactual situation, it is hard to imagine the innovation process moving forward in the absence of outside funding. Especially when the

grassroots innovator cannot offer a collateral to borrow money from banks or other private financial institutions. Satyanarayana was asked how he was planning to generate capital for producing the mini-tiller, and he responded by saying, “There are not many opportunities. To approach a bank, you require collateral or a guarantor. But come what may, I’ll continue moving forward.”

Perception is important to how grassroots innovators like Guravaiah, Saida, Mallesh and Satyanarayana are viewed. They exhibit many qualities that the Christensen study and Couros attribute to an innovative mind, and this is common to other grassroots innovators that Palle Srujana has supported over the years. In their innovation processes, grassroots innovators are aided by an amalgamation of their personal drive, family and friend support, resources (financial, technical, knowledge and physical), and a network of supportive actors. The role of Palle Srujana is an important one, since they work closely with the grassroots innovators and treat them respectfully. As a result, their participation in the grassroots innovation process is highly valued by the grassroots innovators. The various elements and findings from the four grassroots innovation processes inform ways through which current state innovation policies in Andhra Pradesh and Telangana can integrate and support grassroots innovation.

Chapter 4 - Implications for State Innovation Policy in Telangana and Andhra Pradesh

In this chapter, the analysis of the grassroots innovation processes is evaluated in parallel to current state level innovation policies in Telangana and Andhra Pradesh. The main elements of the grassroots innovation processes suggest ideas through which grassroots innovation can be incorporated into the policies. Current innovation policies in both states don't acknowledge the ingenuity and efforts of grassroots innovators, especially when their efforts involve solving pressing challenges in their communities. Within the current policy directions, grassroots innovators can be supported in the following ways: linking students and grassroots innovators for internships; allowing grassroots innovators access to workshops at engineering colleges and universities, and incubator resources; and connecting corporate social responsibility funds to grassroots innovators.

The Telangana government released its innovation policy in 2016¹⁴, and emphasized its ambition to nurture an innovation ecosystem that can increase its competitive advantage relative to other major cities in India and elsewhere in the world. The state innovation policy is organized around these five themes:

- a) *Physical Infrastructure and Program Management Capabilities*: Over the next five years, Telangana seeks to develop 1 million square feet of workspace exclusively for startups. This is building on its current efforts at T-Hub in Hyderabad, which is going to be a central portion of their plans. The vision for T-Hub or Technology Hub is a space that is attractive to “the best startups and entrepreneur organizations from across the world.” Prospective entrepreneurs will be equipped with the skills necessary to transform their idea into a sustainable business. Apart from the infrastructure, the government is also going to make the permit process easier, reduce the time to open businesses and institute a startup cell that will assist in IP protection and accessing state and national incentives.
- b) *Funding Models and Capital*: The government recognizes financial capital as a significant constraint in the innovation ecosystem, and their mission is to create a system wherein the

entrepreneur can walk in with ideas, get it validated, and obtain the necessary assistance and financing. The government is instituting various funds such as the early-stage investing vehicle T-Fund (Telangana Innovation Fund) and T-Seed Fund for seed stage startups. For example, “The T-Seed Fund aims to ease the costs incurred at an early stage such as company registration, patent filing, quality certifications, travel etc.”

- c) *Human Capital*: This part of the innovation policy focuses on linking entrepreneurship and education. This involves a slew of measures that would encourage interested student entrepreneurs. For example, one of the ideas is the concept of student entrepreneur-in-residence wherein “outstanding students who wish to pursue entrepreneurship can take a break of one year (after first year of college) to pursue entrepreneurship full time. Another idea is giving students the option of using their startup idea as the required final year project. Students and faculty will also be given the opportunity to visit university-startup hotspots like MIT, Harvard and Stanford. And finally, students will be required to do an internship in their final year of college.
- d) *Engagement with Industry*: The government sees industry as a powerful entity that can contribute to driving innovation in the state and efforts in this regard involve “initiating collaborations with leading technology bellwethers to use their expertise and experience in driving innovation and technology adoption across all levels of society.” Another piece of industry engagement is attracting large corporate entities with dedicated R&D facilities, ones with expertise in setting up incubation or accelerator centers, and also linking companies to universities so that students can get hands-on experience.
- e) *Rural and Social Enterprises*: These enterprises are defined by the government as “a social enterprise is an organization that uses commercial business strategies for building a company, whose core mission is to add positive impact to human and environmental well-being. A rural enterprise, which sometimes can be categorized as a social enterprise, has people in rural areas as their target audience.” The government plans to create a specific fund for such enterprises, and also build satellite T-Hub facilities in smaller cities and towns. They also will setup an incubator/accelerator dedicated to startups in these areas.

The Telangana government also wants to market itself as “an ideal test-bed for students, youth and social entrepreneurs across the world to come and work on live projects in the state”. The government also mentions its motivation to be a customer for technologies developed by rural entrepreneurs. In the innovation policy, the government also announced a number of financial (value added tax and central sales tax reimbursement, assistance for patent cost etc.) and non-financial incentives for incubators and startups.

The Andhra Pradesh (AP) government also formulated the innovation and startup policy 2014-2020 in the late 2014¹⁵. Their policy is structured around these five key areas:

- a) *Shared Infrastructure*: As part of their commitment to developing innovation, entrepreneurship and start-up culture in the state, the AP government is focusing on providing the necessary infrastructure that can be utilized by technology-product and technology-service startups. Two key activities in this area are: encouraging existing business incubators to set up in the state, and instituting the Incubation Infrastructure Development Fund that will build the necessary infrastructure through public-private partnerships. In the public private partnership model, the government’s role is providing support for building the infrastructure, while the private entity’s role is managing every day operations of the incubator.
- b) *Accelerators / Incubators*: In addition to ensuring that a world-class incubator/accelerator is started in the state, The AP government aims to support smaller incubators/accelerators in many other locations. All in all, the government is targeting 1 million square feet of incubation space by 2019.
- c) *Human Capital*: The AP government believes that “inculcating the habit and embedding the idea of innovation among all the citizens in every aspect of economic activity is essential for promoting the culture of innovation in the people.” In this regard, many of their proposed ideas echo those of the Telangana government - entrepreneur in residence, required internship, exchange program to visit university startup hubs etc.
- d) *Funding*: In the policy, the government has committed Rs. 100 crores (\$20 million) that will be used to establish pilot incubators, fund human capital development programs, and

invest in startups. The investment portion of the innovation fund will be managed like a venture capital fund, and partners from the industry will be part of the investment committee.

- e) *State Support*: Similar to the Telangana policy, the Andhra Pradesh government policy also lists fiscal (reimbursement of value added tax and central sales tax) and non-fiscal incentives (a fast track approach process that reduces time and money required to set up a business).

Having outlined the innovation policies of Andhra Pradesh and Telangana briefly, it is clear that grassroots innovation does not feature explicitly in either of these policies. Some of the ways in which these policies can incorporate and support grassroots innovators are included below:

1. Recognition of Grassroots Innovators

Of foremost importance is the integration of language in the state innovation policies acknowledging grassroots innovation and the efforts of grassroots innovators. Grassroots innovators like Guravaiah, Satyanarayana, Mallesh, and Saida have developed innovations that satisfy a pressing need in rural farming communities. By recognizing grassroots innovators and the value they create, the state gives them a voice and in the process makes the policy more inclusive. The importance of this can be better understood in the words of Saida (2016):

“Rural innovations are those that have been created by an uneducated person. An innovation made by a formally educated engineer has some value. But when an uneducated person like me innovates, who recognizes it? People might ask - who certified this? If somebody asks a farmer that, he might put a blank face and get dissuaded. That’s why I had a report made by an engineer who did formal calculations, etc. If the government can step in and help, there are so many ideas that can move forward.”

The recognition of grassroots innovators in the state innovation policy is a way of legitimizing the hard work and ingenuity of grassroots innovators, and can directly have an impact on how they are perceived; as people who are capable of solving their own challenges and not reliant on external assistance.

2. Linking Education and Grassroots Innovation

Both state innovation policies emphasized the importance of human capital, and their commitment to ensuring that students are molded into innovators and entrepreneurs. Instead of just encouraging to do their projects in industries, motivating students to work with grassroots innovators can be mutually beneficial. Since grassroots innovators ideas originate from personal or community hardship, they have an understanding of problems that need to be solved. Therefore, students get a chance to collaborate on solutions that positively impact rural communities. They also become more sensitized to challenges faced by rural communities.

The grassroots innovator on the other hand gets access to technically-minded students who can assist the grassroots innovators in their innovation process. Moreover, there is an inspirational component that can be instructive for students, especially when they observe the grassroots innovators persevering in a resource constrained environment. And assisting in the innovation process can contribute to the creative thinking of the students themselves. For example, during a summer internship at the National Academy of Agricultural Research Management, two students from the Indian Institute of Technology Kharagpur had an opportunity to work with Guravaiah for their final project. The students described it as “one of greatest experience in their lives which brought out the practical side of engineering”.

3. Inclusion in Incubators

The Telangana innovation policy acknowledged lack of funding as a major bottleneck in the innovation process. This is true for the grassroots innovation process as well, as highlighted in Chapter 3. In the case of Telangana, a small portion of social and rural enterprise impact fund can

be earmarked for scaling grassroots innovators. Especially because grassroots innovation like the ones discussed in Chapter 2 fit well with how social and rural enterprises have been defined by the state. Furthermore, allowing grassroots innovators access to the proposed incubator/accelerators in multiple places can help by combining multiple resources in one location (financial, technical, entrepreneurial, physical etc.). This speaks to the spatiality of resources discussed in Chapter 3. Introducing grassroots innovators to the incubator environment could be more useful when a working prototype has been developed. By ensuring that a grassroots innovation is feasible and implementable, the incubator resources can be better managed. Even having a crude working prototype that functions can go a long way in bringing a focused approach to product refinement and development at the incubator. Since Palle Srujana has considerable experience in working with grassroots innovators, they should act as the intermediary between the grassroots innovators and the incubator environment. This is important to bridge the cultural and attitude divide.

4. Experimentation Space

The above recommendation however hints at a gap in the innovation process. Incubator resources are useful when grassroots innovators have a product that can be turned into an entrepreneurial venture. There is however no provision in either innovation policy for the experimentation phase. The grassroots innovators still require resources and space to experiment with their ideas. They need a space one level below incubators. Building maker-spaces specifically for grassroots innovators could be a potential option but there are two problems associated with this. First, it is hard to estimate how many maker spaces would be required and where they would be placed. And second, whether running these maker spaces can be economically viable. If such spaces are built, who will manage them? If an organization like Palle Srujana is tasked with this, it might require expanding their resources and capabilities. But there is no guarantee that the organization can remain equally effective. A more promising way of connecting grassroots innovators with the physical and technical resources necessary for their innovation process is by leveraging the infrastructure of colleges and universities in the state. Andhra Pradesh and Telangana have a large number of engineering colleges and universities that have workshops and labs. These can be utilized by the grassroots innovators, where they can partner with students or faculty. By

encouraging colleges to welcome grassroots innovators, colleges introduce their students to the innovation process, while teaching them about technological solutions to social problems. Palle Srujana's role in this case would be to connect the grassroots innovators to a college or university nearest to them.

5. Corporate Social Responsibility Funds

Telangana and Andhra Pradesh both state their goal of attracting big corporate firms, and engaging the existing ones in driving innovation in the state. An interesting avenue that can be explored is channeling Corporate Social Responsibility (CSR) funds towards grassroots innovations. India passed the corporate social responsibility rules under the Companies Act of 2013, which requires firms with a turnover of at least Rs. 100 crores, net worth of Rs. 500 crores or net profit of Rs. 5 crores to spend two percent of the average net profit on CSR activities. Amongst others, these activities can include “eradicating hunger, poverty and malnutrition, promoting preventive healthcare, promoting education and promoting gender equality, setting up homes for women, orphans and the senior citizens, measures for reducing inequalities faced by socially and economically backward groups, ensuring environmental sustainability and ecological balance”⁵⁷.

Supporting grassroots innovation through financial assistance can bring considerable social and economic benefits to grassroots innovators, while enabling corporate firms to fulfil their CSR requirements. Companies also gain the added benefit of boosting their brand value and perception. Palle Srujana can continue working on behalf of the grassroots innovators, and act as a conduit between CSR funds and grassroots innovators. The potential for this idea has also been mooted at the Third International Conference on Creativity and Innovations at (for/from/with) Grassroots 2015⁴³. In one of the sessions, it was recognized that, “There is a need to identify the possible roles of intermediaries, relevant institutions, technology organizations and support, including funding, from corporates societal responsibilities policies [to support grassroots innovation].”

⁵⁷ Bahl, Ekta. "An Overview of CSR Rules under Companies Act, 2013." *Business Standard*, March 10, 2014. http://www.business-standard.com/article/companies/an-overview-of-csr-rules-under-companies-act-2013-114031000385_1.html.

If one were to consider a firm with a net profit of Rs. 50,000,000, a two percent contribution to CSR activities equals Rs. 1,000,000. Even if the company were to contribute only a quarter of that to non-company activities, that equates to Rs. 250,000. For Guravaiah, that money reflects an opportunity to experiment with his idea for a multi-functional harvester. In the interview, he lamented the lack of funds, “In 2014 and 2015, I worked on the harvester. I need Rs. 200,000 to make it work”.

There are two potential ways in which such an idea can be implemented. One would be to require firms to contribute a small portion of their CSR spending to a common fund dedicated to grassroots innovators. The governments of AP and Telangana can provide some of these funds to Palle Srujana for prototyping support and the rest to incubators that can provide entrepreneurial and business development support to grassroots innovators. The benefit of such an approach would be a single source of financial assistance to grassroots innovators, but the downside is that it requires government commitment and coordination between multiple actors (Palle Srujana, incubators and government). This could complicate the grassroots innovation process and require expanding the capabilities of Palle Srujana significantly.

Another way could be for the governments to make companies in the state aware of grassroots innovation, and encourage them to commit some of their CSR resources to assisting grassroots innovators financially, or in other ways. This method is less prescriptive, and reduces government effort. However, this method does not guarantee that companies will provide financial assistance to grassroots innovators. Moreover, who will channel the funds to grassroots innovators? Having to coordinate and deal with multiple firms that have varied vested interests and motivations can prove difficult for a resource constrained organization like Palle Srujana.

Grassroots innovators like Guravaiah, Satyanarayana, Mallesh and Saida exhibited strong personal qualities that enabled them to overcome many difficulties and constraints during their attempts to build a technological solution to a pressing personal and local community challenge. In all of their cases, the solutions also have the potential to be scaled into a business that can generate social and economic value for themselves and others in the community. They can also be disseminated

beyond the context in which they were developed. By acknowledging and incorporating grassroots innovators in the innovation policy, the governments signal a commitment to inclusive development, and also encourage future efforts of grassroots innovators. For two states keen on innovation driven growth, utilizing human capital beyond just college educated youth, corporate and government institutions is advantageous, especially when it is addressing unmet needs of rural communities.

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Appendix A: Laying the Landscape - Support for Grassroots Innovation in India

Principal Actors

Honeybee Network: The network derives its strength from enthusiastic volunteers and staff, in addition to their emphasis on the ethics of knowledge⁵⁸. No innovation or knowledge is documented without the express permission of the innovator/knowledge provider, and neither is it disseminated. In the event that a certain innovation/local knowledge can generate financial returns, all proceeds go the innovator/knowledge provider. He or she also holds the intellectual property rights. Over the years, the network has built a database containing nearly 2,11,600 innovations/knowledge¹. This database is currently maintained by SRISTI.

National Innovation Foundation: NIF began in 2000, aiming to build on the work and success of the Honeybee Network. NIF is a government agency, under the aegis of the Ministry of Science and Technology. NIF has been tasked with coordinating the activities of the Honeybee Network, and performing the network activities on a national scale. Their headquarters is a bungalow in a residential neighborhood of Ahmedabad, Gujarat, India. Approximately 80 - 100 employees work in this building.

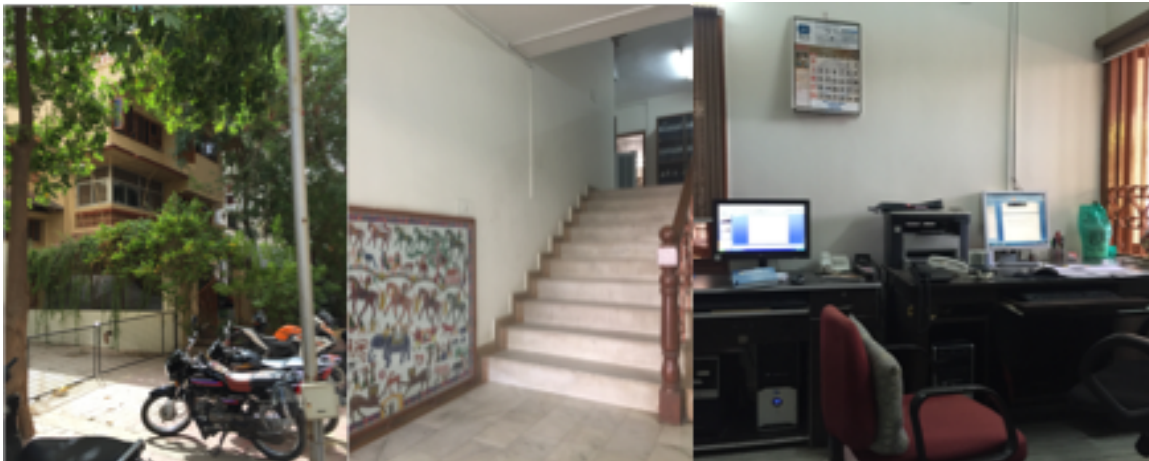


Figure 10: Offices of NIF and GIAN, Ahmedabad India (Source: Author)

⁵⁸ Note: The description in this chapter is informed by personal interviews with representatives of the mentioned organizations and publicly available information on the organization websites.

Gujarat Innovation Augmentation Network (GIAN): GIAN is a subset of the Honeybee Network, co-located with NIF in the same building in Ahmedabad, India. The distinction lies in their scope, both in terms of work and geography. They are focused on the western region of India, and on incubating and commercializing grassroots innovations. Approximately 10 employees manage GIAN from within the NIF building.

Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI): SRISTI was set up as an offshoot of the Honeybee Network, to provide organizational and logistical support. The SRISTI office is also located in Ahmedabad, India. Their objectives include “systematically documenting, disseminating and developing grassroots green innovations, providing intellectual property rights protection to grassroots innovators, working on the in situ and ex situ conservation of local biodiversity, and providing venture support to grassroots innovators”.

Palle Srujana- Founded in 2005, Palle Srujana is a voluntary organization founded on the principles of the Honeybee Network. It is located in the city of Secunderabad in Telangana. Although they do not have the same resources as NIF and SRISTI, they assist grassroots innovators in Andhra Pradesh and Telangana within their resource capabilities. The organization thrives on volunteer support and the passion of the leadership team.

Supportive Mechanisms

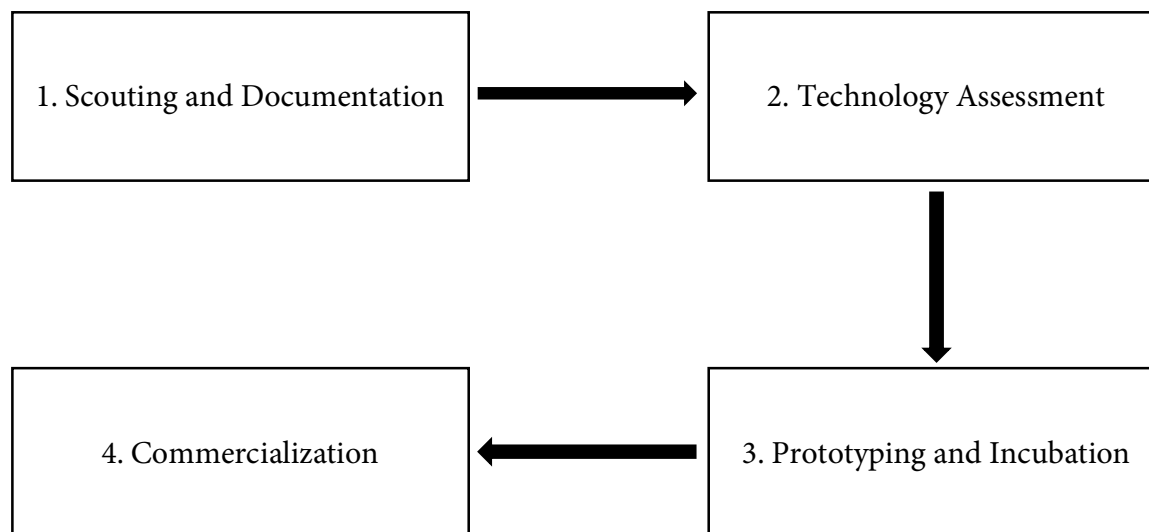


Figure 11: Visual overview of supportive mechanisms for grassroots innovation (Source: Author)

The current landscape of support for grassroots innovation in India, and how the grassroots innovator navigates this landscape is briefly captured in the above diagram.

Scouting and Documentation

The whole process begins with the scouting and documentation, which is carried out through a number of different methods⁵⁹. These include:

1. *Shodh Yatra*: The Shodh Yatra is a bi-annual event organized jointly by NIF and SRISTI. It translates to 'Journey of Innovation', and involves long treks in remote parts of India in order to identify, document, and disseminate local innovation/local knowledge⁶⁰. The organizers strive to conduct the yatra in the remotest of areas, where people face hardships from lack of basic needs such as electricity, infrastructure etc. Ultimately, the aim is to travel to all corners of India. Interestingly, the Director of NIF Dr. Vipin Kumar in his interview stated that the

⁵⁹ "Scouting, Documentation and Database Management (SDDM)." National Innovation Foundation. Accessed April 27, 2016. <http://nif.org.in/sd>.

⁶⁰ "Shodh Yatra." SRISTI. Accessed April 27, 2016. http://www.sristi.org/cms/shodh_yatra1.

Yatra is organized in hot areas during the summer, and cold areas during the winter. The rationale is that the organizers want to convey they are serious about helping people, and are not taking an easy route. Volunteers walk a total of approximately 250 km, spread over seven or eight days. They move quickly between villages, often spending just two to three hours in each.

In terms of logistics, volunteers gather from across India and abroad. All volunteers pay their own expenses. These volunteers are first trained, and informed about the Honeybee Network, the ideology, and their responsibility towards the communities they are visiting. The volunteers are mixed with local people who help with translation.

In an interview with the coordinator of SRISTI Mr. Ramesh Patel, he emphasized that in order to build trust between volunteers and the local people, the volunteers first disseminate knowledge that can help solve problems in the local community⁶¹. This disseminated knowledge is extracted from the Honeybee Network database, and distributed in the form of booklets that have been translated to the local language.

Staff and volunteers from SRISTI visit all the villages (part of Shodh Yatra) beforehand, observe and note all the difficulties faced by local communities. Potential solutions to some of these difficulties are then gathered from the database, and compiled. This element of the Shodh Yatra is particularly important to volunteers at SRISTI, who believe strongly in the dissemination of knowledge/solutions.

The volunteers are not given any clear instructions about what counts as innovation and what doesn't. According to Dr. Vipin Kumar, Director of NIF, many of the volunteers are social science students who are more interested in how people are solving local challenges, than what can be considered as an innovation⁶². Therefore, volunteers are asked to point out anything they find interesting. They are not held up to strict standards. When volunteers find something

⁶¹ Interview with Ramesh Patel (2015)

⁶² Interview with Vipin Kumar (2015)

interesting, they are not required to fill in any prescribed form. Instead, volunteers call the staff (from SRISTI), who then document all the information they can possibly note about the innovation/local knowledge. This could include the name, address, details about the innovation itself, how it works, and the genesis of the innovation.

In terms of other activities during the Yatra, they are manifold. All these activities revolve around building capacity/raising awareness, so that local communities don't rely on another Shodh Yatra for solutions, but rather seek it themselves. A competition is organized during the Yatra, one that recognizes innovation in food (recipes). This is to motivate women, and also give them recognition and respect on a public platform. They also organize meetings (with audiovisuals) to create awareness amongst the local residents, and motivate them to think about solutions that can benefit their community. Particular attention is given to kids; because Mr. Ramesh Patel says that SRISTI believes that ingraining such thoughts early on makes them think more about solutions and community welfare.

When local knowledge/innovation is documented, a prior informed consent is taken from the community member. This speaks to the ethical dimension of the network's work (giving due credit). The documentation is thorough, and involves both paper and digital forms (photographs, diagrams). If enough data has not been collected to make an informed decision about the innovation, another team visits again to collect remaining information. This remaining information can be more detailed 3-D diagrams, photographs etc. i.e. information that can shed light on the functionality of the innovation.

2. *Student Scouting (Scouting of Odd Balls)* - Students from public schools in Gujarat are also recruited as a means of gathering examples of local innovation/local knowledge⁶³. This happens during the summer, when these students go home to their respective villages. They are instructed to document (through a form) what they find interesting/out of the ordinary in their communities. When the students return from their summer vacations, all their

⁶³ "Scouting of Odd Balls." SRISTI. Accessed April 27, 2016. <http://www.sristi.org/hbnew/scout.php>.

forms are collected by SRISTI. The documentation is not taken at face value, and SRISTI staff follows up with the community member to make sure the documentation is accurate. In case of promising ideas, staff even visits the communities to further verify the claims.

3. *Volunteer Network* - Innovations/local knowledge are gathered from the volunteers of Honeybee Network, and also from other innovators that Honeybee Network has worked with.
4. *Advertisements* - Local advertisements are also published to encourage entries.
5. *Direct Mail* - Entries can also be emailed, mailed, posted on website directly by anyone in the country. It stands to reason that all claims are verified.

Each year, examples of innovation/local knowledge are gathered from a mix of all the above-described methods.

Technology Assessment

The next stage of the process involves whittling down this massive list into innovations and local knowledge that have the potential for commercialization.

1. *Prior Art Search* - This involves checking the innovation/local knowledge at hand, against the public domain (internet, patent databases, knowledge of technical partner institutions). This is the essential first step in determining if a certain innovation is worth pursuing. Other decision criteria that aid in this decision are market scope, user friendliness, economic viability, and competitive advantage. Dr. Vipin Kumar pointed out that money is limited, and they have to be strategic about which opportunities to pursue.

The prior art search is the first layer of list reduction, and is carried out by the VARD (Value Addition Research and Development) Team. Because NIF and GIAN are co-located, they share

human resources. GIAN also assists with the technology assessment, but its mandated support begins only at the incubation stage. In addition to the prior art search, internal discussions are also held between VARD, Business Development team and Intellectual Property Rights team. When there is ambiguity, Dr. Kumar pointed out that NIF relies on its vast network of technical partner institutions such as Indian Council for Agricultural Research, Indian Council for Medical Research (35 institutions), Indian Council for Scientific and Industrial Research (70 institutions), major educational institutions etc.

1. *Technical Committee's* – The Head of GIAN, Mr. Mahesh Patel explained that two separate committees then assess promising innovations/local knowledge identified by VARD⁶⁴. The Research Advisory Committee (RAC) is comprised of scientists and experts from all over India. They look through the various innovations and give their opinion on which ones can have societal impact, and are commercially viable. Another committee tasked with a similar analysis is the Informal RAC. This is comprised of successful grassroots innovators that NIF has worked with in the past. NIF has found that certain innovations that have been dismissed by the RAC occasionally find support with the informal RAC. Having perspectives from both the formal and informal sector helps in ensuring that the potential of an innovation is not overlooked. The informal RAC is changed yearly, with the members being decided by the executive committee (Chairman of NIF, Director of NIF, and Dr. Anil Gupta).

Based on the recommendations of these two committees, the final decision is made by the executive committee. It is worth pointing out that these committees also decide upon the issue of novelty. The criteria for this analysis are form, features or functions. Economic viability, and scalability are also other essential considerations.

Prototyping and Incubation

The next phase involves building a working prototype of the innovation. This is done collaboratively between the innovator and external consultants from the partner institutions and

⁶⁴ Interview with Mahesh Patel (2015)

members of the Value Addition Research and Development Team. It is important to note that NIF can move the innovation directly to the prototyping phase without presenting it before the RAC committee, if they are sure that the innovation is worth pursuing.

For building a working prototype, support from the VARD team is provided to the innovator. A Fab Lab is made available for collaboration during the value addition process. This Fab Lab was built in 2009, with help from MIT (Kumar 2015). Depending on the type of innovation, these facilities vary. In the case of herbal innovations for example, SRISTI has labs assist in value addition. The same labs also determine innovativeness in herbal formulations.

Once a working prototype has been developed, the innovation moves to the incubation stage. The incubation stage involves conducting a market analysis, mass production potential, channels of distribution etc. Depending on where the innovation is from, either NIF or GIAN collaborate, or work independently. This is where the Business Development Team takes over. Their basic goal is “to build a value chain around these innovations to facilitate their transition into self-supporting sustainable enterprises. The ultimate objective is to make these innovative products available to the masses through the market mechanism or otherwise”⁶⁵. The Business development team mentors innovators, and helps them commercialize the product.

Commercialization

To enable this, the Business Development team devises an investment plan and presents it to the Fund Management Committee (FMC). The committee decides which innovations will receive financial support to do pilot production. The team then develops a sustainable business based on the innovation. This financial support is channeled through the Business Development and Micro Venture Innovation Fund (BD & MVIF). The approval procedure, according to NIF is unique, hassle free, and fast. The NIF and GIAN teams provide mentoring support throughout, and other handholding support to the innovator. They also guide the innovator in utilization of the funds.

⁶⁵ "Business Development and Micro Venture Innovation Fund (BD&MVIF) | National Innovation Foundation-India." National Innovation Foundation-India. Accessed April 28, 2016. <http://nif.org.in/bd>.

The FMC team also provides the Business Development Team suggestions about project management, commercialization strategy and corrective measures.

According to NIF, “The uniqueness of MVIF of NIF is the first and only of its kind micro venture risk fund in the world, which extends financial support to grassroots innovators under a single signature on a simple agreement of understanding without any collateral or a guarantor. Unlike micro finance or conventional venture funds, MVIF invests in risk areas with high failure probability, investing in those technologies and products for which either market does not exist or may be very limited. Apart from financial returns, one of the key criteria for selection of a technology for MVIF support is social return or social value created for the benefit of society at large.”

Apart from commercializing and managing the business themselves, innovators have another option - technology licensing⁶⁶. After the innovator develops the technology, an entrepreneur can take over and commercialize that technology based on a license agreement. These entrepreneurs can pay money either as a royalty based on sales, or as a lump-sum amount at the time of agreement. The exact amount is determined by exclusivity of the rights and the geographical area. The final agreement is drawn between the innovator, NIF and entrepreneur. Other variations include:

1. The innovator develops a prototype, and the entrepreneur works on making it a viable product.
2. The innovator licenses just the idea to an entrepreneur, maybe even for a different application.

The figure below consolidates all the above-described information into a flow chart that shows the various steps of the innovation process, and which organizations help in each of these steps (Source: Gujarat Innovation Augmentation Network).

⁶⁶ "Technology Transfer." National Innovation Foundation. Accessed April 28, 2016. <http://nif.org.in/bd>.

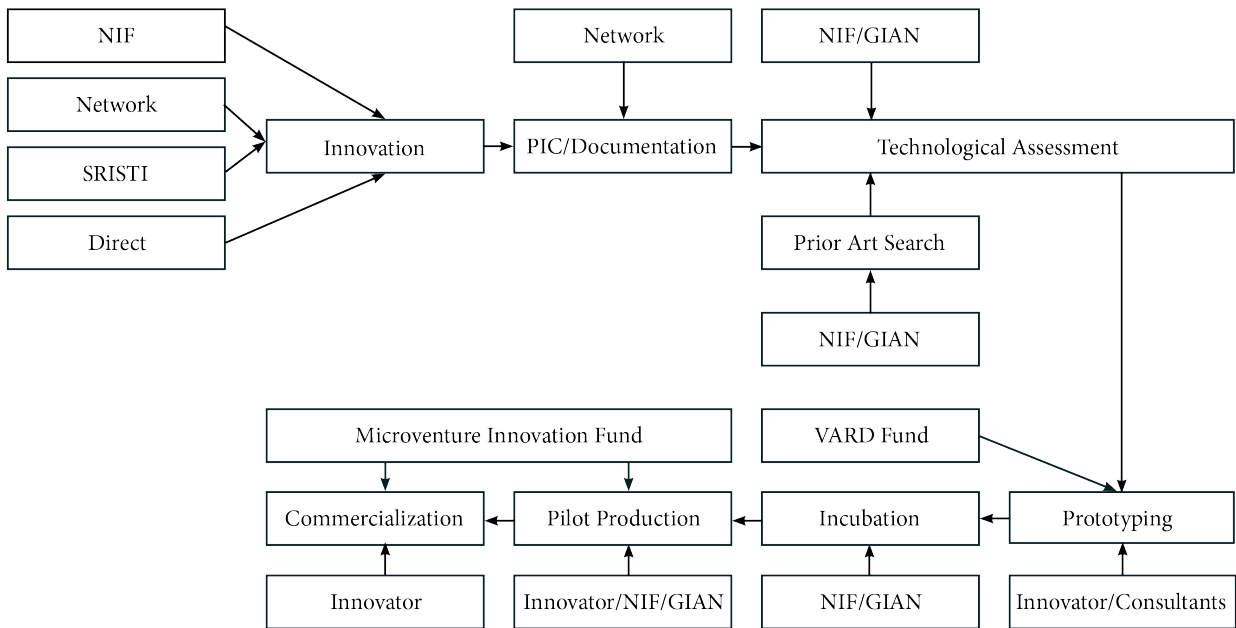


Figure 12: Visual overview of institutional support for grassroots innovation in India (Source: Gujarat Innovation Augmentation Network)

The ethical dimension underscores this whole process of innovation and value creation. In spite of all the financial and human resources poured into the development of a successful product and business, all proceeds go the innovator. NIF also applies for patents on behalf of the innovators and provides them with intellectual property protection. NIF essentially functions as a philanthropic organization funded by the government. Based on personal observations, the ethics aspect of the Honeybee ideology is taken very seriously by the employees of NIF. The employees seem committed to the cause of nurturing grassroots innovations that have positive consequences for the innovator and create wider societal impact.