THE ESSENCE OF LIVED EXPERIENCES OF GRASSROOTS INNOVATORS
A PHENOMENOLOGICAL STUDY

by

RAJUL GAJENDRA JOSHI

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Certificate of Original Authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of Student:

Date:

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Contents

List of Journal Articles, Conference Papers, Reports and Presentations Arising from the Thesis

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- Joshi R.G., 2012 presented '*Diffusion of Traditional Knowledge (TK) and Grass root innovation (GRI): Market-driven and Benefit sharing aspects*" in the session "Ethical knowledge management & Intellectual Property' at the Indigenous Knowledge and Biodiversity forum India and Australia, UTS Law, Australia, August 2-4, 2012

- Joshi R. G. 2014, presented extended abstract "*Indian grassroots innovations are spinning yarn of rural development*" in the 5th Asia-Pacific Innovation Conference at University of Technology Sydney, 2014, November 27-29, 2014

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List of Abbreviations

ABS: Acrylonitrile-Butadiene-Styrene

BoP: Bottom of the Pyramid

DFO: District Forest Officer

GDP: Gross Domestic Product

GEB: Gujarat Electricity Board

GEDA: Gujarat Energy Development Agency

GI: Grassroots Innovation

GIAN: Grassroots Innovation and Augmentation Network

GIMs: Grassroots Innovation Movements

HBN: Honey Bee Network

ICT: Information and Communication Technology

IE: Informal Economy

IIM-A: Indian Institute of Management-Ahmedabad

IIT-B: Indian Institute of Technology-Bombay

ILO: International Labour Organisation

INR: Indian Rupees

IPA: Interpretive Phenomenological Analysis

IPR: Intellectual Property Right

JAU: Junagadh Agricultural University

NGO: Non-Governmental Organisation

NIC: National Innovation Council

NID: National Institute of Design

NIF: National Innovation Foundation

NIS: National Innovation System

NPD: New-Product Development

PTO: Power Take-Off

R&D: Research and Development

S&T: Science and Technology

SNM: Strategic Niche Management

SRISTI: Society for Research and Initiatives for Sustainable Technologies and Institutions

TBGRI: Tropical Botanic Garden and Research Institute

TK: Traditional Knowledge

TRIPS: Trade-Related Aspects of Intellectual Property Rights

UK: United Kingdom

USA: United States of America

VFPMC: Village Forest Protection and Management Committee

Abstract

Farmers, peasants and people from the marginalised and informal sectors have long exhibited grassroots creativity that has the potential to enhance rural economies. Little is known about the experiences of these people. Further, a humanistic, bottom-up, inside-out approach to understanding the essence of these grassroots innovation (GI) phenomenon is absent in the literature.

The primary purpose of this thesis is to explore the essence of Grassroots Innovation (GI) and gain an appreciation of the subjective reality of grassroots innovators. The overarching research question is: What is the essence of the lived experiences of GI for Indian grassroots innovators? To answer this question, the researcher had to discern innovation decisions and actions of grassroots innovators along their innovation journey vis-à-vis ideation, opportunity recognition and commercial scaling.

Through phenomenological exploration and detailed thematic analysis of the innovation experiences of the thirteen Indian grassroots innovators, the research determined the nature and spirit of the relational commercial exchanges entailing and fostering GI. These participants identified as grassroots innovators by the National Innovation Foundation (NIF), an autonomous body of Department of Science and Technology, Government of India, were interviewed for this study. These innovators are all different, and the lived experience of each is unique.

Examination of cognitive and social-relation dynamics and the dominant form of exchange and socio-economic organisation embedded in innovation action provide an understanding of the nature and spirit of the GI phenomenon. This study confirmed that no single unilateral theory can fully explain the lived experiences of grassroots innovators. Rather, it is quintessential to have an integrated holistic perspective for understanding GI. The subjective reality of the GI phenomenon was inquired through the non-reductionist, inductive logic and a phenomenological approach. Such an approach provided a rich, contextually situated and an inside-out understanding of

underlying individual as well as interpersonal dynamics shaping GI in the commercial space. It is evident from the findings that GI is a mind-set driven practical solution science, with a complex mix of livelihood matters and intra and interpersonal innovation behaviours. Unlike mainstream innovation, GI involves non-linear informal processes of ideation and opportunity recognition. These findings reveal the situated reality of Indian grassroots innovators' lives. Therefore, Indian government institutions such as the NIF and non-governmental organisations could use the findings of this research to devise bottom-up policies that embrace grassroots innovators in an inclusive, participatory and empowering manner.

Chapter 1: **Introduction**

1.1 Motivation

'If my innovations are good, why did I not progress enough?' (Mr Saidullah).

The above statement reflects the triumph and sadness of an Indian grassroots innovator who developed an amphibious cycle, but was unable to scale his innovation and generate income. He earned a living selling honey by bicycling to villages, but it was barely enough to manage his household, and he could not afford to invest in the resources needed to develop his innovation. In 2005, he received a lifetime achievement award for his innovation. This recognition was just a temporary comfort, as the agony of his lost dream was strong and his question still lingers (Gupta 2005). Therefore, Mr Saudullah's statement is precursor in understanding the notion of creativity and innovations at the grassroots, the grassroots innovators' lived experiences and approach for ideation, opportunity recognition and commercial scaling of the creative, useful, beneficial and/or novel idea.

I encountered similar stories in Vietnam in 2012. My curiosity was piqued and I was motivated to investigate these innovators' worlds, their experiences of innovation and their views towards grassroots innovation (GI). After encountering GI stories published in the popular media, I recognised the need to explore the GI phenomenon and the lived experiences of grassroots innovators in a systematic manner. Mr Saidullah's statement led me to dig deeper into the literature on empiricism and idealism, to understand the absolute, mind-reason reality; the nature and the spirit underpinning the GI phenomenon. It also prompted me to seek understandings of proletarian and bourgeois society and the history of feudalism, capitalism and socialism. I examined the discussions surrounding pro-poor innovations, the informal economy (IE), just and inclusive development, poverty alleviation and sustainability. Further, examining the notions of capital, development, well-being, good life and justice directed me to

Amartya Sen's (1999; 2003) work on development as freedom, the capability approach and the notion of commitment. His capability approach serves as a framework for appraising individual welfare, and also as a theoretical base for analysing poverty, inequality and inclusive policy. Poverty is not just having a low income: it relates to the deprivation of essential freedoms and capabilities needed to live the kinds of lives people value (Sen 1999).

The literature on technological change, economics and sociology of innovation, economic and social structure, social relations, development, ethics, justice and innovation behaviour was reviewed. The need to reorient innovation and development studies and integrate them with the broad perspectives of social and economic sciences and innovation behaviour was observed. Through the literature review, it was discovered that discussion of the GI phenomenon is largely found in development studies, education, sustainability, sociology, design and management. Some issues and challenges related to existing innovation policies, justice and social structure were identified. The majority of the literature emphasises neoclassical contexts: the availability of capital, access to markets, labour supply, raw materials and technology. However, undermined are the innate aspects of GI and human behaviour underpinning the GI phenomenon, especially at the ideation, opportunity exploration and commercial scaling stages. Further, there is a normative bias in these studies, assuming grassroots innovators to be wholly rational economic actors who innovate to maximise utility and profit. Currently, GI in developing countries is subject to the conflicting worlds of the market and social economies, and there is the need for research on GI (Seyfang & Smith 2007).

The measure of utility and income aspects has been limited to endowments and aid. However, it should also involve freedom of choice and capability enhancement (Sen 1999; 2003). A holistic, bottom-up view integrating intrapersonal and interpersonal dynamics and social, emotional, moral and economic aspects of the GI phenomenon was observed to be missing in the literature. Concurrently, the views of grassroots innovators towards their innovation experience are missing in the business

management, innovation and development discourse. Such views reveal the values, beliefs and experiences of individuals, which are important for fostering innovation (Rogers 2003). These revelations from grassroots innovators can be used for pro-poor innovation management research, and to set inclusive development policy agendas.

The literature on economics, sociology of innovation and development studies was also consulted, as I was more interested in the emotional, psychological, economic and social aspects of GI than its design, technical or scientific aspects. The seminal literature, current policy news and debates on inclusivity, sustainability and development confirmed the need to explore the essence of the GI phenomenon, as experienced by GI.

The research on grassroots innovations in developing countries is still in its nascent stage, and there is a need to explore the GI phenomenon through a human science approach. Identifying a gap, I decided to study the experiences of grassroots innovators, and the meaning they ascribe to their being in the world of GI. This desire—coupled with the curiosity to explore the spirit of the phenomenon and the meaningful context of being there, '*Dasein*'—led me to a phenomenological philosophical approach. Taking into account the gaps, issues and opportunities, I decided to explore the GI phenomenon as experienced by grassroots innovators who have been recognised for their innovation, and who have offered or are offering a product or process with a commercial value.

Interpretations of the GI phenomenon—in terms of the meanings grassroots innovators bring to their natural settings—can reveal its essence. Therefore, utilising the phenomenological approach, I explore the lived experiences of grassroots innovators and comprehend the spirit of the phenomenon. Such *in situ* revelation of the essence of the GI phenomenon aids the sui-generis conceptualisation of GI. This relates to the unique aspects of the GI phenomenon of its own character and embedded in its own situations. Such conceptualisation can serve as a useful guide for innovators, policymakers, activists and researchers.

The main research question was developed from these initial explorations: What is the essence of the lived experiences of GI for grassroots innovators in the Indian state of Gujarat? The focus of the study is on the innovation conceived and developed by the grassroots people of India, who combine modern technology with TK and traditional practices to solve problems. Grassroots people include the marginalised, those with low income and those involved in the informal sector. Exploring the nature and spirit of GI embedded in the doing and being aspects of the lived experiences of individual grassroots innovators is the core motivation for this study. Therefore, the community-led GI is outside the scope of this thesis. This research focused on the lived experiences of individual grassroots innovators of only one state of India as its aim was not to generalise. However, this study can be useful for further research on other regions of India as well as internationally.

There are three compelling reasons for studying Indian GI. First, GI is abundant in India, and in the past 20 years, institutional mechanisms have been put in place to foster such innovations, contributing to the unleashing of India's innovation potential (Dutz 2007). Further, among emerging economies, India is a strong case for innovation-driven inclusive development (Dutta 2012; Dutz 2007). Second, there is strong need for empowerment-focused sustainable development, leading to prosperity with inclusion and development with equity and environmental conservation (Kalam & Singh 2011). Additionally, Gupta (2013) posits that the innovation eco-system for individual innovators in India is still weak, adversely affecting innovations that could have a commercial future. Likewise, acknowledging India's potential in the innovation landscape, Dutz (2007) emphasises the need to commercialise and scale-up pro-poor initiatives, foster the abilities of informal enterprises, grassroots creativity and local knowledge. Third, I had access to the community of grassroots innovators through the National Innovation Foundation (NIF), which made exploration of GI not only convenient but also realistic, in terms of the research project's timeline. Additionally, my experience and training in the entrepreneurship field in developing countries equipped me with an understanding of the phenomenon from the perspective of practice.

Grassroots innovators from Gujarat were interviewed for three reasons: first, the movement to foster GI began in Gujarat; second, I am from the region, enabling me to connect effectively with the respondents' experiences and their environment; third, the pioneering institutions in this field have headquarters in Gujarat.

1.2 Situating the Thesis

Human civilisation has witnessed big eras of change after Stone Age. The invention of fire, wheel, steam engine and money has ushered in changes in social and economic lifestyle of the human being. The notion of innovation gained momentum in the industrial age. During this time the innovation agenda was mainly relating to new product development. Product novelty and market leadership were organisations' main goals. In formal organisations, scientists and engineers were the pioneers of innovation. Later, control and efficiency started driving the innovation agenda. From NPD, organisations focused on new business development, creating opportunities for sustainable development and growth. Today, the innovation agenda are more decentralised and innovation is co-created, collaborative, user and consumer generated.

Over the last three decades, bottom-up GI from developed and emerging nations has gradually become a source of inclusive growth and regional development (Cécora 1999; Church 2005). Farmers/peasants and people from the marginalised and informal sectors have long showcased their grassroots creativity, knowledge, practices and innovations, which have revived rural economies. To help rural economies in developing countries, formal and informal inventions and adaptations work together (Hall 2005; Torri 2010), leading to the combining of innovation and developmental concerns and focusing on fairness and equity (Cozzens & Sutz 2012; Erika & Watu 2010).

With the increase in 'green economies', grassroots creativity is a sought-after knowledge asset (Davies 2012; Gupta 2013). Though the terms creativity and innovation are used interchangeably, there are subtle differences. The former involves the production of novel and useful ideas, and the latter requires the production, adoption, implementation and diffusion of the useful ideas (Amabile 1983; Rogers 2003; Bhaduri & Kumar 2011). Generally, innovation invigorates socio-economic transformation, leading to development. The trajectories of development are construed through the study of innovation and technological change (Nelson 1993; Lundvall et al. 2002).

Joseph Schumpeter was one of the first proponents of innovation and entrepreneurship in capitalist societies. Schumpeterian capitalist innovation economic framework stresses novelties, creative destruction, qualitative change and open and uncertain developments in socio-economic systems. Under this framework, individuals and nations are assumed to be rational economic actors, driven by market forces. It has proven to be a useful basis for the study of conventional innovation and entrepreneurship. Nevertheless, the framework overlooks the endogenous aspects of innovation processes, economic justice and the concept of the good life, relating to the freedom of individuals to propose, test and exploit new ideas and new ways of doing and being (Phelps 2013). Endogenous is attributed to something coming from within and not from an external entity. Endogenous aspects of innovation relates to individual's attitude, knowledge, experience, learning and capabilities (Lundvall et al. 2002, Ludvall et al. 2011, Hanusch & Pyka 2007). These aspects of innovation are the building-blocks of socio-economic well-being and the development of the people and nation (Lundvall et al. 2002, Ludvall et al. 2011). It is the human capital (Coleman 1988) influencing the generation, development and diffusion of an innovation (Agarwal 1983).

Currently, there is a need to overcome the generalised way of dealing with the sources, conditions and effects of technological change. Neo-Schumpeterian economics has a ubiquitous bearing on the praxis of innovation, emphasising all

aspects of a socio-economic system and the innovations resulting largely from technological and economic uncertainties and interdependence (Hanusch & Pyka 2007). It also stresses the endogenous aspects of innovation for qualitative change. The socio-economic frame of innovation conceptualisation in neo-Schumpeterian economics emphasises the role of open, uncertain, interdependent and unconventional facets of innovation. This has allowed the convergence of social science aspects of innovation and technological change.

According to Schumpeter (1934; 2012), development is long-running economic change that is led by new combinations of knowledge, resources and technological competition. Development studies allow further understanding of the changes induced by science and technology (S&T). However, for the development of human capital, innovation studies should primarily focus on the innovation capability, rather than on S&T capacity (Hall 2005). According to Kalam and Singh (2011), nations can aim for sustainable, inclusive and prosperous regional development through the economic and social empowerment of innovators and communities.

Inclusive development can be achieved by fostering technological innovations and knowledge production in both the formal and informal sectors. Innovation in the informal setting—especially GI—has received little attention from scholars of management, innovation or development studies (Cozzens & Sutz 2012). GI, according to Bhaduri and Kumar (2011), functions in informal settings where problem situations, regulatory frameworks and incentive structures are ill defined. An informal setting, according to Cozzens and Sutz (2012), is a place in which marginalised households and communities stay and earn their livelihood. They encompass the informal economic activities of marginalised people, who are positioned within both the informal and formal sectors, earning a living from both (Cozzens & Sutz 2012).

Cozzens and Sutz (2012) emphasise the need for inclusive growth, and public and private interventions to improve connections between innovation, livelihoods and problem solving. Livelihood, according to Chambers and Conway (1992), comprises of

the activities for the means of living, the capabilities, material and social resources (assets). Therefore, it is very important to understand the social, moral and market economies underpinning the innovation phenomenon at the grassroots level (Gupta et al. 2003; Seyfang & Smith 2007). Table 1.1 illustrates the focus and objectives of social, moral and market economies, which can help explain the source of socio-economic change prompted by innovation and technological change in the informal setting. Understanding of these three economies can further provide insights on the wellbeing and role of innovation in the inclusive growth. Well-being, according to Sen (1999; 2003), is usually defined in terms of utility, income or capability.

Table 1.1: Context of the Three Economies

Social economy	Activities to meet the social needs of those on the margins of the public and private sectors, between market and non-market economies (Molloy, McFeely & Connolly 1999).	Social well-being Social capital Objective : welfare and social relations
Moral economy	The moral norms and sentiments that structure and effect economic practices (formal and informal) and the way in which these are reinforced (Sayer 2007).	Moral well-being Ethical capital Objective: greater good and ethics
Market economy	Self-interested optimising behaviour and profit appropriation in the sphere of market relations.	Economic well-being Human and intellectual capital Objective : self-interest and profit

Source: Self Compiled

Building on neo-Schumpeterian innovation economics and Sen's notion of development as freedom and capability enhancement, I discuss the findings in relation to innovation-driven, socio-economic qualitative change. The basic principle of neoclassical economics—that an actor is fully rational—and the equilibrium model of social optimum—in which appropriate institutional settings ensure a free market—are rejected in neo-Schumpeterian innovation (Weber 2007, p. 107). The neo-Schumpeterian view of innovation is that a collective phenomenon results from interaction between heterogeneous agents (Hartmann 2012). Innovation is the result of neither science nor technological push factors; and nor can it be derived from market needs only. Rather, it emerges in response to a range of social, technological, economic, political and other environmental factors (Weber 2007, p. 127). Therefore, I draw upon social exchange theory, psychological contract theory and diffusion theory,

as they allow the comprehension of embedded socio-economic exchange dynamics; inter-relationship and expectations; and other contextual factors of individual innovation actions and decisions. The outcome of this research is a phenomenological description of grassroots innovators' lived experiences, and their views and beliefs for the fostering of GI in a commercial space.

1.2.1 India and Grassroots Innovation

India is a lower to middle income country with more than 1.2 billion inhabitants, and a gross domestic product (GDP) per capita of US$4,077 (Cornell University, INSEAD & WIPO 2014). The 2011 Census of India demonstrated that 68.84 per cent of the population live in villages, of which there are 638,000 (Office of the Registrar General and Census Commissioner 2011). Forty-two million Indians live below the absolute poverty line (Chataway, Hanlin & Kaplinsky 2014). Challenges related to food access, health, housing, farming equipment and education persist. Therefore, to thrive socially and economically, India will have to foster pro-poor innovations from grassroots communities (Dutta 2012; Dutz 2007; Gupta 2010).

India was once a predominantly agrarian society, although today agriculture contributes only 14 percent of India's GDP. It is the main source of income for 58 per cent of the rural population (National Sample Survey 2011). The contribution of the informal sector—including agriculture—to India's GDP between 2000 and 2010 was 54.2 per cent (Charmes 2012).

The agrarian way of life has spurred GI, especially those relating to agro-technology. Grassroots innovations are informal, need-based, user-led, self-generated, bottom-up, scarcity-led innovations (Srinivas & Sutz 2008; Pathak 2008; Onwuegbuzie 2010; Cozzens & Sutz 2012) that meet local needs and solve rural problems using traditional knowledge (TK), skills and materials (Gupta 1998; Jain & Verloop 2012). The notion of GI and its importance for India was first emphasised by Mahatma Gandhi. By demonstrating the importance of local technologies such as the spinning wheel for

rural self-reliance, he initiated the People's Science movement in India (Abrol 2005). This movement has also influenced the conceptualisation of Scumacher's (1973) appropriate technology notion for development. In the early 1990s, Anil Gupta emphasised grassroots creativity and the significance of knowledge-rich, economically poor people. The initial discourse on GI and policy initiatives to scout, reward, document, mobilise and protect grassroots creativity was led by Gupta. His Honey Bee Network (HBN) is recognised as having mobilised and protected Indian GI and TK (Cozzens & Sutz 2012).

To focus on inclusive development, the Government of India has made innovation a core agenda for economic development, and declared 2010–2020 the Decade of Innovation. Additionally, the Indian National Innovation Council (NIC) was established in 2010 to discuss, analyse and help implement strategies for inclusive innovation in India, and prepare a Roadmap for Innovation 2010–2020. NIC, along with private organisations, is building networks, facilitating exchanges and helping build capacity and scale-up GI for inclusive development.

Sensing the potential of GI, India has taken extensive institutional mechanisms to scout, protect, reward and encourage grassroots creativity, knowledge and practices. For instance, the NIF was established in Gujarat in 2001 as an autonomous body of the Department of Science and Technology by the Government of India. The NIF scout, generate and sustain innovations in the grassroots sector. The NIF has a growing repository of more than 160,000 GIs and TK practices. Various other institutions—such as the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), the HBN, the Grassroots Innovation and Augmentation Network (GIAN), the Sustainable Agriculture and Environmental Voluntary Action and the Rural Innovation Network—also play an important role in mobilising GI and pooling TK practices, licensing and sharing benefits with all Indian stakeholders.

Most GI in India uses either TK or adapted modern technology that is affordable to lower-income groups (Gupta 1996; Jain & Verloop 2012; Pathak 2008). TK can be

defined as the beliefs, practices and knowledge of a traditional community (Ganguli 2000). GI results from the interest in finding alternative ways of doing things, and the actions of economically deprived and marginalised individuals to meet a need overlooked by mainstream or formal sectors (Monaghan 2009). Some examples of such innovations are the amphibious bicycle, the bicycle sprayer for watering small farms, the modified pulley to draw water, the motorcycle-driven plough, clay refrigerators, mobile flourmills, windmill-operated tube-wells, non-stick clay pans and cotton stripper (Gupta et al. 2003; NIF 2004–2011).

A geographic distribution of grassroots innovators in India and the distribution of categories within GI are depicted in Figures 1.1 and 1.2, respectively. Selecting 61 from the 64 awardees of the 2013 NIF awards, two maps were generated using ArcGIS ver10. Figure 1.1 demonstrates that a large number of grassroots innovators come from Gujarat, as well as Tamil Nadu, Manipur and Bihar. Innovations in these states are fostered through innovation networks, government subsidies and contractual agreements (such as benefit sharing), and the intellectual property rights (IPR) of a few GIs have been protected.

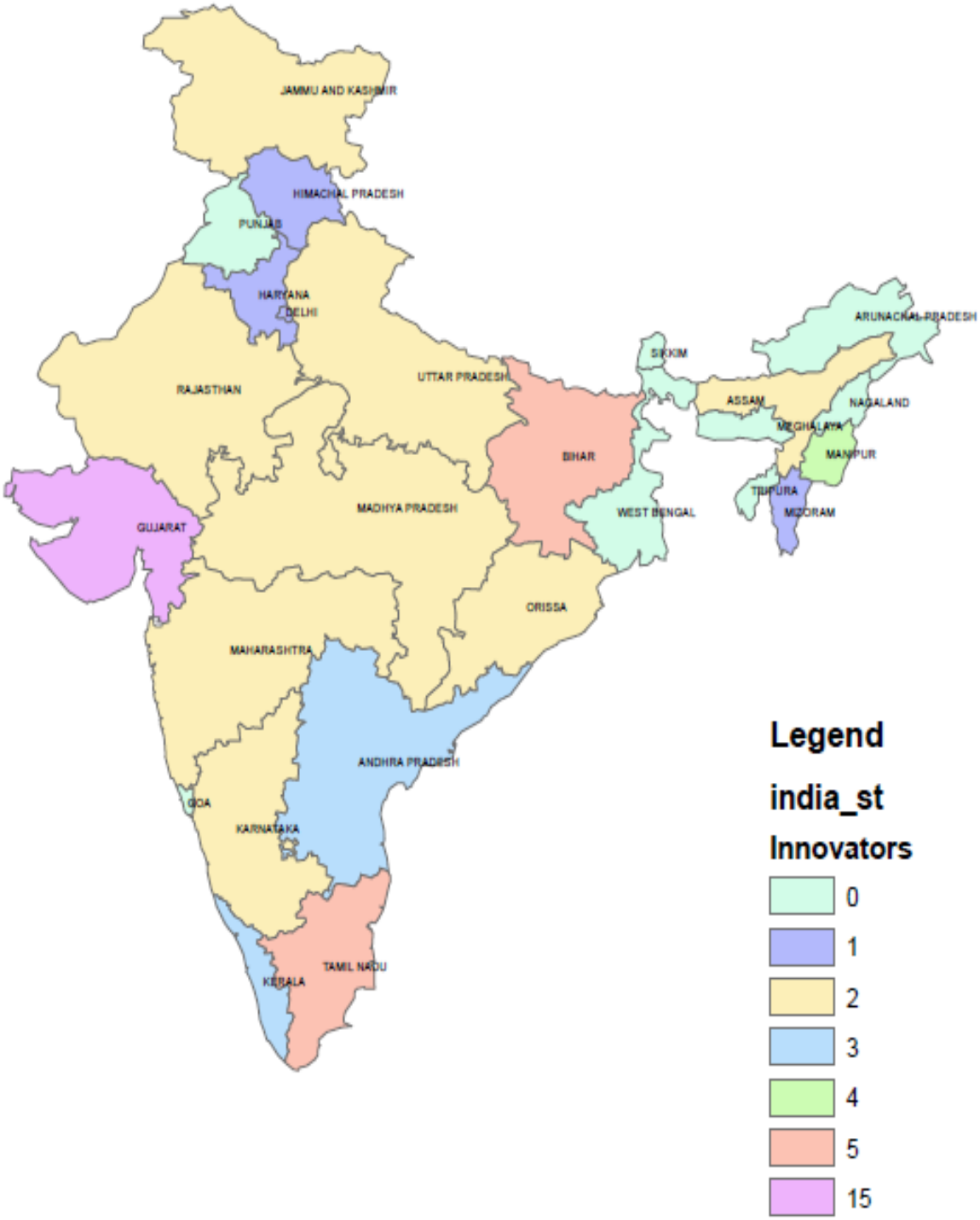

Figure 1.1: State-Wise Distribution of Grassroots Innovators in India

(Not to scale)

(Inspired by the work of Bhaduri & Kumar 2011)

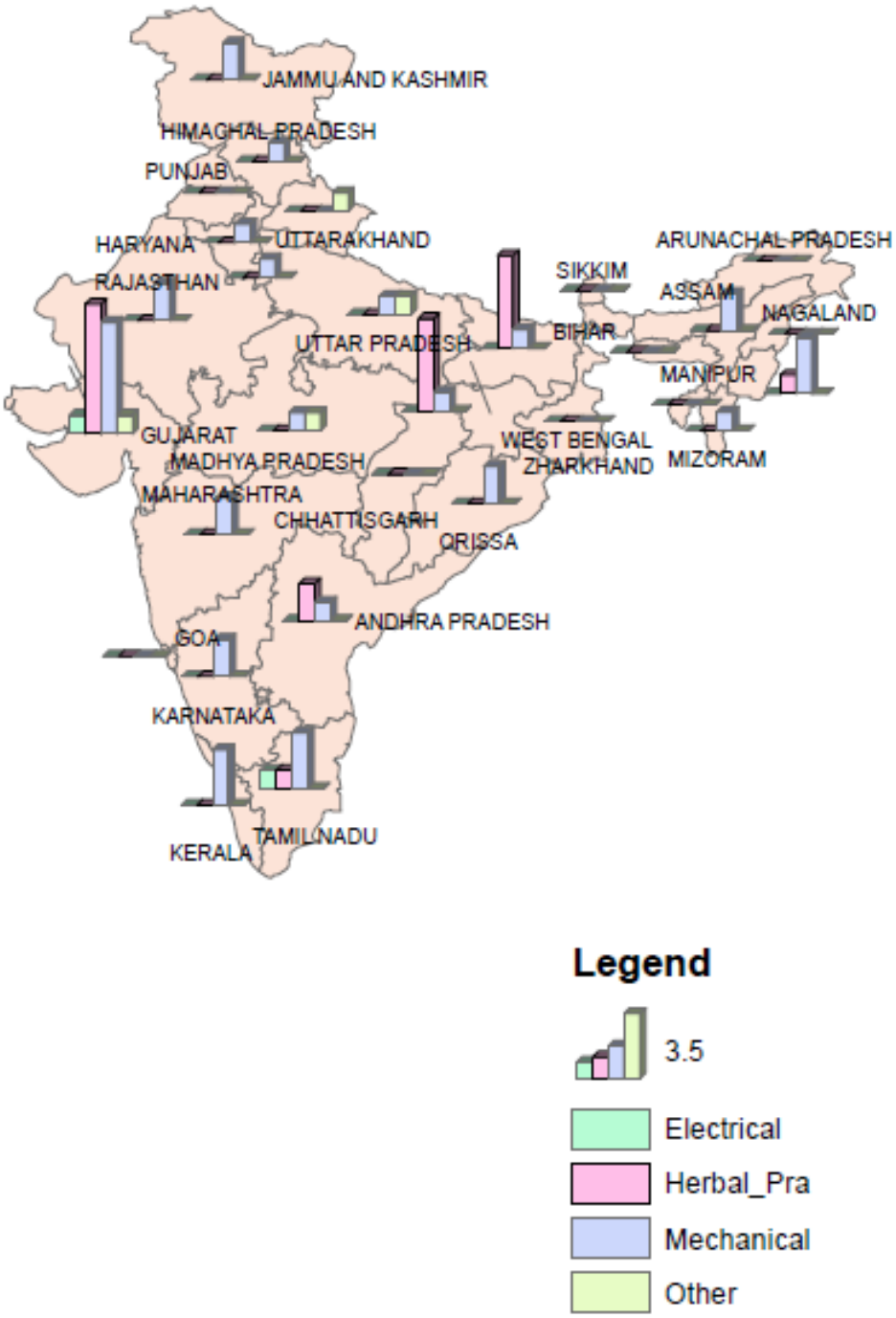

Figure 1.2: State-Wise Distribution of Various Types of GI in India

(Not to scale)

(Inspired by the work of Bhaduri & Kumar 2011)

1.3 Research Purpose and Objectives

Little is known about the innovation experience of grassroots innovators. This research reveals the essence of the GI phenomenon by exploring the lived experiences at its ideation, opportunity recognition, prototyping and scaling stages. The purpose of the study is to provide insight into nature and spirit of GI, what it takes to be a grassroots innovator, and to give a bottom-up, holistic understanding of the essence of the phenomenon. The study's objective is to give voice to the experiences of innovators whose knowledge, practices and innovation have been recognised by the broader community for commercial purposes. This research takes a constructivist view in studying grassroots innovators' lived experiences and the essence of the GI phenomenon.

Through a phenomenological approach, grassroots innovators' innovation experiences and their views on being grassroots innovators are explored. Phenomenology is a mode of qualitative inquiry that helps gain deeper insights into experiences, based on individuals' accounts and their understandings of their circumstances (Creswell 2008). This approach provides a fitting framework for eliciting the lived experiences of grassroots innovators in India, which is attuned to storytelling.

The specific objectives of this study are:

1) To understand the lived experiences of the grassroots innovators in India.
2) To describe grassroots innovators' views towards developing their innovations.
3) To discern the essence underpinning innovation decisions and actions of grassroots innovators.

1.4 Research Questions

The main research question of this project is:

- What is the essence of the lived experiences of GI for grassroots innovators in the Indian state of Gujarat?

Critical to this inquiry is gaining insight into participants' experiences, their interactions with their environment, the opportunities or events affecting their innovation decisions and actions, and the meanings they attach to the GI experience. The sub questions are in response to a failure in the literature to consider the exchange dynamics, interpersonal relationships that facilitate ideation, opportunity recognition and scaling of GI. Thus, I seek to draw out the experiences of these innovators in a manner that would uncover the GI phenomenon, through the following research questions:

1) What is Indian grassroots innovators' understanding of their lived experiences of innovation?
    a. How do socio-cultural and personal characteristics affect opportunity recognition, ideation and the scaling-up stages of GI?
2) What do grassroots innovators perceive at the opportunity recognition, ideation and scaling-up stages of GI?
    a. How do grassroots innovators recognise opportunities, develop prototypes and scale up GI?
    b. What sorts of exchange relationships do grassroots innovators experience for opportunity recognition, ideation and scaling-up of GI?
3) In what circumstances are commercial exchanges experienced positively, as inhibitory or constrained by grassroots innovators?
    a. How do these incidents affect their perceptions, expectations and obligations?
    b. How are communitarian values or commercial imperatives balanced in their innovation behaviour and actions?

1.5 Outline of the Thesis

Against the backdrop of innovation, management and development studies, this thesis will unearth the essence of the GI phenomenon, as experienced by grassroots innovators in India. GI, or bottom-up innovations, is increasingly seen as an alternative to mainstream, formal, high-technology innovations that have dominated innovation

studies and development theory and practice. It is argued that innovations from grassroots people not only emancipate through local development, design ownership and control of technology, but may also help challenge mainstream innovation agendas and development pathways (Smith, Fressoli & Thomas 2014). Further, there is the need to gain the perspectives of the poor and marginalised, and to encourage their involvement and participation in the inclusive development process (Smith, Fressoli & Thomas 2014).

This research aims to give voice to grassroots innovators' perceptions, expectations and obligations for fostering GI. The outcome of the analysis will be used to provide insight into the GI phenomenon and to develop a better understanding of the issues of consideration that should be considered by developmental agencies and policymakers working towards building inclusive GI eco-systems beneficial to grassroots innovators.

This thesis is comprised of seven chapters (see Figure 1.3). Following this introduction, Chapters 2 and 3 present a literature review and the theoretical orientation, respectively. Chapter 4 presents the research approach, and a profile of the participants is provided in Chapter 5. Discussion of the findings occurs in Chapter 6. Chapter 7 analyses and interprets the results. Finally, Chapter 8 summarises the findings and discusses the limitations, research implications, opportunities for future research and personal reflections.

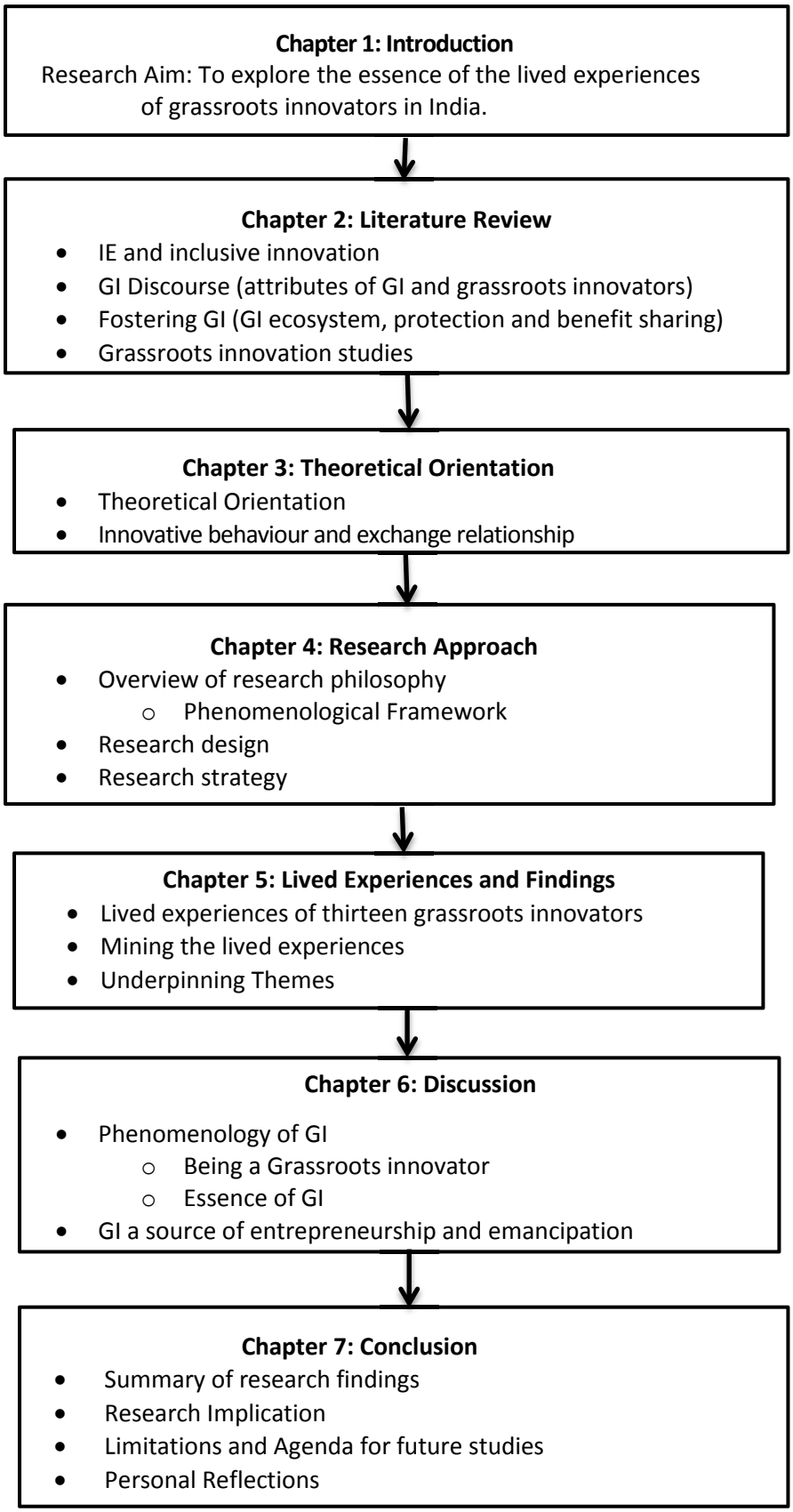

Figure: 1.3: Thesis Structure

Chapter 2: **Literature Review**

2.1 Introduction

In this chapter, the discussion of GI, including definitions and characteristics of grassroots innovators, follows after deliberating on Informal Economy (IE) and inclusive innovation. Subsequently, discussion of fostering these innovations is dominated by encapsulating the prevalent GI eco-system and the protection and rewarding mechanisms, such as benefit sharing. This discussion provides insight into how country-specific regimes and institutional frameworks affect the diffusion and development of GI and the need to foster it; the role and challenges of IPR; the GI network and benefit-sharing mechanisms. Finally, a summary of studies on Indian GI reveals the gaps and scope of research in the GI field.

2.2 Informal Economy and Inclusive Innovation

Informal work and informal business comprise IE (Cozzens & Sutz 2012). More than half of the output of developing nations is the result of informal economic activities (Godfrey 2011). IE enterprises are undercapitalised and operate on a small scale (Godfrey 2011). IE economic activities are usually governed through personal ties (Godfrey 2011). The theoretical conceptualisation of the IE comes largely from W. A. Lewis' (1955) dual economy model, made up of the formal and informal sectors operating in a country (Godfrey 2011). While the formal sector encompasses capital-intensive firms, high marginal productivity, wage labour and economic activities in urban areas, the informal sector includes labour-intensive firms, low wages and economic activities mainly in rural areas (Godfrey 2011). From a legalist perspective, Becker (2004) argues that the IE comprises informal work arrangements that are a rational response of micro-entrepreneurs to over-regulation by government bureaucracy.

The International Labour Organisation (ILO 1993) defines the informal sector as one in which enterprises are owned by individuals or households for whom no complete

accounts are available that permit a financial separation between the production activities of enterprise and the other activities of the owner/s. Based on this definition, the ILO (1993) characterises firms within the informal sector as those with:

1) low entry requirements, in terms of capital professional qualifications;
    4) small-scale operations, often with fewer than five employees;
    5) unskilled labour or employees with skills often acquired outside of formal education;
    6) labour-intensive methods of production and simple or adapted technology;
    7) scarce capital, low productivity and minimal saving;
    8) an unregulated and competitive market;
    9) family ownership.

The literature contains various perspectives on IE activity, making it an ambiguous concept that lacks conceptual clarity. Outlining the inconsistency in IE activities, Godfrey (2011) states that on the one hand, dualists view IE activity as temporary and irregular, but on the other they stress that these activities persist, even growing over time. Likewise, although structuralists argue that the IE oppresses individuals and classes, they also see in informality a flexible and adaptive arrangement (Godfrey 2011). Similarly, although legalists view the IE from a regulatory lens, they often fail to acknowledge the critical supporting role of norms and worldviews (Godfrey 2011). Overall, in the extant academic literature, IE is grouped in two categories, old view and new view (Kumar & Bhaduri 2014). While, the former perceives IE marginally productive, illegal and problematic in terms of employment growth, capital accumulation and development for the formal economy, the latter views IE as the major contributor to the gross domestic product and it provides cheap labour and job opportunities (Kumar & Bhaduri 2014)

IE was coined in the 1970s, gaining attention in 1972 when the ILO defined it based on the legal status of an economic enterprise in a sector (Cozzens & Sutz 2012; De Beer, Fu & Wunsch-Vincent 2013). People participate in the IE in response to involuntary unemployment and informal employment. The former relates to people excluded from

formal jobs due to high entry barriers or the lack of qualifications, and the latter relates to employment in the informal sector by choice or volunteer participation (Becker 2004; De Beer, Fu & Wunsch-Vincent 2013; Godfrey 2011).

Table 2.1: Reasons for IE Participation

Exclusion

- Formal economy has limited capability to absorb surplus labour, especially when coupled with structural changes in a society
- Economic hardship and poverty
- Barriers to entry (e.g. high cost, burdensome regulations) into formal economy are high
- Formal institutions fail to provide sufficient education, training and
- infrastructure
- Globalisation is a disadvantage to lower-skilled worker, who cannot migrate easily or at all
- It is hard for undocumented individuals to formalise their businesses

Self-selection/Exit Option

- Demand exists for low-cost good and services
- Barriers to entry into the IE are low
- The desire for undocumented income
- Dissatisfaction with formal employment
- Desire for independence and control
- Competitive advantage, Many believe their success depends on being able to price below the formal market.
- First stage in the pursuit of formal business
- Desire to strengthen neighbourhood social support networks and economic conditions

Source: Becker 2004

Increasing concern for inequity, unemployment and poverty has led policymakers to IE discourse. Research on the informal sector is increasing, from studies on the alleviation of poverty to those on innovation and entrepreneurship (Godfrey 2011). However, there are very few innovation studies that explicitly focus on the IE, on innovations from marginalised people and the informal sector (Cozzens & Sutz 2012). De Beer, Fu and Wunsch-Vincent (2013) argue that while IE literature does not directly address

innovation, even the innovation literature does not integrate much existing research or data on the IE. Erika and Watu (2010) assert that innovation studies on the informal sector have potential, because the sector's dynamics are different from those of the formal sector but work alongside it. They stress the need to study the dynamics of innovation in this sector because it is big, linked to the formal sector and the underlying forces of innovation are likely to be different from those of the formal sector (Erika & Watu 2010). This indicates the scope and importance of research for understanding the dynamics of innovation led by grassroots people in developing countries' IE.

Innovation by individuals or small firms in the informal sector is gradually being recognised and emphasised for inclusive development discourse (Cozzens & Sutz 2012). Since the 1980s, a growing number of development studies have focused on the struggle for survival and issues of poverty in least-developed settings (Cozzens & Sutz 2012). Examining innovation in developing countries, Johnson and Andersen (2012) propose studying theories, policy and development strategies for work organisation and competence building in the informal sector. Overall, the ideas for inclusive innovation as a tool for socio-economic development are gaining momentum because such innovation is integral to inclusive development.

The definition of inclusive innovation is evolving in management literature (George, McGahan & Prabhu 2012). Individuals and communities trapped in a cycle of poverty and disenfranchisement are classified as living at the bottom of a pyramid (BoP) (Prahalad & Hart 2002). The focus of inclusive innovation activities is to enhance the social and economic well-being of people at the BoP by rendering innovative solutions for affordable access to quality products and services, to reduce the living standard gaps between rich and poor or to create livelihood opportunities through outreach programs (Utz & Dahlman 2007; Paunov 2013; Ansari, Munir & Gregg 2012; George, McGahan & Prabhu 2012). It also deals with business model breakthrough, which enables participation in high-growth, high-profit ventures by individuals at the BoP (George, McGahan & Prabhu 2012). These innovations must be inclusive and

empowering in nature, for the achievement of comprehensive economic development benefiting all of society.

The extent to which innovations are inclusive depends on their effect on peoples' capability to perform certain social functions (Papaioannou 2014). The equalisation of resources, welfare or capabilities that prevent people from becoming marginalised and deprived are termed inclusiveness (Papaioannou 2014). Inclusiveness in innovation is not a politically neutral concept, according to liberal and non-liberal ideologies (Papaioannou 2014). For example, liberal inclusive innovation might be translated as the formal right of everyone to be included in market processes and outcomes. In non-liberal ideologies, inclusive innovation might be the substantive and equitable participation of everyone in innovation processes and outcomes that are not necessarily market led (Papaioannou 2014).

Innovations from the informal sector that are believed to solve local problems are also gradually becoming a source of inclusive development (Cozzens & Sutz 2012). Innovations from this sector are low cost, use local materials, employ local skills and labour, are affordable to small groups, create jobs, avoid patent and property rights and do not require Western education (Smith, Fressoli & Thomas 2014; Kumar & Bhaduri 2014). Grassroots innovators can be promoters and providers of inclusive innovation and development because such innovations have the potential to enhance the social and economic well-being of marginalised and lower-income members of society, generating livelihood opportunities for rural people (Pathak 2008). Inclusion in GI can be process-oriented, output-oriented or an attempt to produce structural change (Fressoli et al. 2014).

Increasingly in the past 20 years, grassroots creativity (including TK, practices and innovation) has taken centre stage in the discourse on sustainable socio-economic development and poverty alleviation in developing countries (Gupta 1998; Kohli & Bhutani 2011; Warren 1990). Economist Fritz Schumacher was an early proponent of pro-poor innovation, especially social technologies. Emphasising people over the

market, he argued that instead of mass production the world needs production of the masses (Schumacher 1973). He also posited that developing economies should refrain from emulating developed countries' high technology drives, as this pushes them into poverty and unemployment (Schumacher 1973). His theories challenge design, and negotiate models of innovation, inclusion and development that support GI movements. This is because it is hard to identify stakeholders, propose modes of knowledge production and participation, seek funding and identify solvable problems (Fressoli et al. 2014). Hence, for productive engagement and regional socio-economic development, emerging economies such as India should assess the capabilities and harness the latent potential of grassroots people. To do so, it is important to gain a bottom-up understanding of the GI phenomenon, and to embrace its essence, structure and behaviour.

2.3 Grassroots Innovation Discourse

From the 1960s to the early 1980s there was increasing debate over developing countries and development assistance. Such development paradigm led to varied technological orientation in the developing nations (Akubue 2000). Various terms for technologies emerged from the grassroots arena in these nations such as appropriate, progressive, intermediate, low-cost, labour-intensive, indigenous, light-capital, alternative, radical, liberatory, village, community, convivial and soft technology (Akubue 2000; Smith, Fressoli & Thomas 2014). Developing economies should select such technologies that would free people from poverty and drudgery and provide meaningful work (Schumacher 1973).

Since 1930's such technologies have been part of India's self-reliance movement also known as people-led science movement for the resurgence of village-industries, well-being of the rural people and freedom (Abrol 2005; Akubue 2000; Schumacher 1973). Appropriate technology and people-led science movements established the foundations of GI in development and innovation studies. Moreover, the characteristics of appropriate technology resonates with the concept of GI, and shares commonalities in terms of limited resource requirements, use of local material and

talent, affordability to local communities, reliance on informal knowledge and avoidance of patents and copyright (Smith, Fressoli & Thomas 2014).

Appropriate technology activists emphasised technology as a tool for development. The appropriate technology movement drew international attention to the hidden potential of local knowledge, technology and practices, and laid strong foundations for public participation and local knowledge inclusion, now taken as good practice in development projects (Smith, Fressoli & Thomas 2014). Nevertheless, appropriate technology was not sustainable because its underlying assumptions constrained it, and it struggled to induce broader innovation dynamics and capabilities (Smith, Fressoli & Thomas 2014). Additionally, local innovations under appropriate technology got stuck at solving basic needs and specific production problems (Smith, Fressoli & Thomas 2014).

Appropriate technology had always been contested terrain within grassroots movement because it failed to integrate local innovations with long-term strategies of social and technological capabilities at the local level (Smith, Fressoli & Thomas 2014). Issues surrounding structural readjustment and neo-liberal development ideology and the risks involved in relying on outside support for aid were exposed (Smith, Fressoli & Thomas 2014).

The failure of the appropriate technology movement introduced the concept of justice—social, procedural, distributive and cognitive—in the inclusive development and pro-poor innovation discourse in the global south. Set-backs in the movement led to the inclusion of social justice and structural realignment for global justice, fairness, equity and empowerment (Papaioannou 2014; Smith, Fressoli & Thomas 2014). It not only realised the need to recognise the perceptions of the poor and marginalised in development processes, but also the need for broader structural change strategies for pro-poor innovation, such as GI, to prosper (Smith, Fressoli & Thomas 2014).

Pro-poor innovation has been the subject of increasing interest over the last 20 years. Chataway, Hanlin and Kaplinsky (2014), Kaplinsky (2011), Srinivas and Sutz (2008) and

Prahalad and Hart (2002) have devised models of pro-poor products and services in the informal sector. Pro-poor innovations are classified as BoP innovations (Prahalad & Hart 2002), below-the-radar innovation (Kaplinsky et al. 2009), Jugaad (Radjou, et al 2012) and emergent innovation (Jain & Verloop 2012). However, there are fine differences of focus among these innovations. Pansera (2013) states innovations developing are either for bridging formal and informal economy, or for the market dynamic to alleviate poverty or for social needs. Examining the challenges for mainstream innovation from pro-poor innovation, Pansera (2013) provides determinants of below-the-radar innovations and depicts the substantial differences between these innovations (see Table 2.2). However, these determinants fail to depict the nature and spirit of GI.

Table 2.2: Determinants of the Below-the-radar innovations

	BOP	GI	Inclusive Innovation
Social Needs		✓	✓
Resource Constraints	✓	✓	
Market affordability	✓		✓
Institutional voids			✓
Environmental concerns		✓	

Note: Source: Pansera (2013)

In academic discourse, GI is depicted from various perspectives, such as that of appropriate technology (Schumacher 1973), scarcity induced innovation (Srinivas & Sutz 2008), grassroots creativity (Gupta 1996), grassroots movement or community-led innovations (Seyfang & Smith 2007), TK-based innovations (Dheeraj, Basant & Gupta 2003; Gupta 1998), rural innovation (Jain & Verloop 2012; Seyfang & Smith 2007), empathetic innovation (Gupta 2010; Rajan 2013) and informal innovation (Erika & Watu 2010). GI are scarcity-induced innovations (Srinivas & Sutz 2008) that are mainly

conceived to meet a need that is overlooked by the mainstream (Monaghan 2009). There is a lack of clarity and consensus over the term GI (De Keersmaecker et al. 2013). In this thesis, GI is understood to mean science and technological development at the grassroots level, leading to novel products or services, and mainly conceived and developed through the acumen of rural and marginalised Indians, to solve their or others' problems.

Apart from India evidence of GI is found in many other cultures by different names such as Gambiarra in Brazil, Systeme D in France, Zizhu Chauangxin/folklore innovation in China, independent/user or Do-it-yourself innovation in US, jua kali in Kenya and grassroots innovation in UK (Kumar & Bhaduri 2014). Important research on grassroots activities and marginalised communities is anchored in anthropology, sociology, political science and law. These studies discuss the development, growth and sustainability of grassroots activities and communities. Authors have discussed the significance of GI in terms of how it is placed in the economic and moral spaces for sustainable development (Church 2005; Dutz 2007; Gupta et al. 2003; Seyfang & Smith 2007). Although research on GI has increased in the past 20 years, it is still a highly understudied area (De Keersmaecker et al. 2013; Gupta 2003; Onwuegbuzie 2010).

2.3.1 Attributes of Grassroots Innovation

The term grassroots refers to spatially constrained activities (Davies 2012; Seyfang & Smith 2007). GIs are usually from the informal sector (Erika & Watu 2010; Cozzens & Sutz 2012), demonstrating complex socio-political and economic aspirations of grassroots people, who for innovation rely on their skills and practical experience, rather than on a formal body of technical knowledge (Bhaduri & Kumar 2011). The majority of this innovation is necessity led, and enhances the livelihoods of grassroots innovators and users of GI in local areas (Pathak 2008; Rajan 2013). GI can be defined as informal (Cozzens & Sutz 2012), need-based, user-led, self-generated (Onwuegbuzie 2010) bottom-up innovations that meet local needs and solve rural problems using TK, traditional skills and traditional materials (Gupta 1998; Jain & Verloop 2012).

A unique aspect of GI is that grassroots or lower-income people are the providers of innovation. They spearhead innovation development, production and consumption through the support of institutions such as non-governmental organisations (NGOs) or publicly funded research laboratories (Gupta 1996). Unlike the conventional view of innovation as scientific discovery, GI is perceived as a sociotechnical system, a process of co-construction (Torri 2010) that provides creative technological solutions for the problems that occur in local communities (Rajan 2013). In GI, the innovator can be both the user and consumer of innovation. Such characteristics and purposes of GI differentiate it from other closely associated innovations.

GI is classified as a pro-poor innovation. The attributes of GI are closely associated with other innovations such as frugal/BoP, social, agricultural and green/ecological innovations. Table 2.3 illustrates the authors of GI and associated innovations, and their focus. Though, GI is assumed to be synonymous with these innovations, there are fine differences among the two (see table 2.4).

Frugal/BoP innovations are defined as low-cost, high-quality products and business-model innovations from emerging markets, which serve the purpose of creating value

for an underserved market (Bhatti 2012; Radjou, Prabhu & Ahuja 2012; Krishnan 2010). Grassroots people are the target consumers (Paunov 2013; Bhatti 2012), and these innovations are conceived and developed by large corporations or people from non-marginalised sectors with the aim of enhancing the market reach in developing countries.

GIs that are frugal and systemic in nature are conceived by grassroots innovators to solve problems experienced or observed by them, and are not for profit or mass consumption. These innovations may not be of the highest quality but will be cost efficient, affordable and frugal in terms of resource requirements (Gupta 1996; Seyfang & Smith 2007). They have the potential to improve local productivity (Cécora 1999; Dutz 2007; Pathak 2008), thereby contributing to regional development (Cécora 1999; Church 2005) and social capital at the BoP (Ansari, Munir & Gregg 2012).

GI shares a close relationship with agricultural, green and social innovation. However, there are slight differences between these types of innovations and GI, primarily relating to the source of innovation. For instance, social innovations—largely operationalised through non-profit and NGO organisations—focus on meeting social needs and ushering in social change (Butkevičienė 2008, Mulgan et al. 2007). GI has the potential to contribute to socially sustainable systems of consumption and production (Monaghan 2009; Seyfang & Smith 2007) and also to indirectly usher in social change (Butkevičienė 2008) and contribute to the sustainable development of a country (Church 2005; Dutz 2007; Onwuegbuzie 2010). However, the majority of GIs are not social innovations, as they are not primarily conceived to usher in social change.

The focus of green or ecological innovations is meeting environmental needs and maintaining ecological sustainability (Davies 2012; Longhurst & Seyfang 2011; Seyfang & Smith 2007). Unlike green/ecological innovations, GI may or may not be a source of green sustainable solutions. Likewise, agricultural innovation focuses on technological, market, financial, institutional and other forms of innovation in agriculture, led by

individuals or groups of farmers and intervening bodies (Assefa et al. 2009; Cooke 2001; Rogers 2003; Röling 2006). Agricultural innovations conceived and developed solely for agriculture by farmers or non-farmers from poor and non-marginalised sections of society are part of the GI system (Assefa et al. 2009). GI is largely undertaken to solve local problems, to empower local people and improve livelihoods, differentiating it from other closely associated forms of innovation.

Table 2.3: GI and Associated Innovations

Innovation Categories	Author(s)
Agricultural innovation: focus is on technological, market, financial, institutional and other forms of innovation in agriculture, led by individuals or groups of farmers and intervening bodies **Example**: farming technology, food processing, seeds	Assefa et al. (2009) Knickel et al. (2009) Hall (2007) Röling (2006) Rivera, Qamar & Mwandemere (2005) Rogers (2003) Cooke (2001)
GI, indigenous or TK-based innovation: activities initiated by an individual or group of people from a marginalised, lower-income section of society, and including both agricultural and non-agricultural innovations of grassroots communities. GI has a local dimension and is based on two sources of knowledge: i) TK and ii) externally developed technologies **Example**: groundnut digger, herbal pesticide, herbal medicine	Paunov (2013) Rajan (2013) Jain & Verloop (2012) Onwuegbuzie (2010) Torri (2010) Pathak (2008) Dutz (2007) Srinivas & Sutz (2008) Seyfang & Smith (2007) Gupta (1996)
Social innovation: activities that focus on meeting social needs or solving social problems. Such innovations are diffused through non-profit organisations. Communities also lead these innovations **Example**: microfinance	Butkevičienė (2008) Mulgan, Tucker, Ali & Sanders (2007)
Green/eco innovation: activities designed to meet environmental needs and to maintain ecological sustainability **Example**: community gardens	Davies (2012) Seyfang & Smith (2007) Longhurst & Seyfang (2011)
Frugal, BoP or pro-poor innovation: conceived to provide low-cost and high-quality products and business models to emerging markets, with the purpose of creating value for an underserved market **Example**: India's Tata Nano car	Radjou, Prabhu & Ahuja (2012) Prahalad 2005 Bhatti (2012) Wooldridge (2011) Krishnan (2010) Kaplinsky (2011) Chataway, Hanlin & Kaplinsky (2014) Schumacher (1973)

Source: Self Compiled

Except for GI, none of the other innovations are primarily developed to solve the local problems faced by grassroots communities. GI, according to Kumar and Bhaduri (2014), are informal sector innovations that generate economic, social-psychological

and knowledge value. Moreover, it is the only innovation that is directly conceived by the poor and marginalised people based on the problems and needs that they sensed and empathised in their local context. An individual grassroots innovator conceptualise, experiment and implement new technologies without any support from the state (Bhaduri & Kumar 2011). Thus, there are subtle differences between these innovations, as they approach the grassroots sector from a different perspective and with a different purpose. Table 2.4 presents different dimensions of allied innovation and GI, and depicts how these innovations are different in terms of purpose, focus and actors.

Table 2.4: Dimension of GI and Associated Innovations

Dimension	Agri-innovation	Social innovation	Green/eco innovation	Inclusive innovation	Frugal/BoP innovation	GI
Focus	Agricultural goods and services to fulfil food and livelihood needs	Enhance access to basic social needs and eliminate social problems	Environment and ecological conservation and development	Socio-economic well-being of all marginalised groups	Provision of low-cost, high-quality products and business models to emerging markets	Needs and interests of the poor and marginalised. Socio-technological solutions to local problems
Purpose	Increase agricultural production/ yield	Social change and well-being of citizens	Products and processes that decrease adverse environment effects	Inclusion of those left out of mainstream development	Create value for underserved market	Solve local problems or necessity-led issues
Actor	Multiple	NGO, activists and social entrepreneurs	Multiple	Private and public firms, international development agencies, government, civic bodies	Private firms and multi-national corporations	Marginalised and poor people

Source: Self Compiled

In general, GI that is informal, frugal and systemic in nature is envisaged by grassroots innovators to solve problems experienced or observed by them, and not intended to generate profit or be used for mass consumption. GI may not be of the highest quality but it is cost efficient; affordable; frugal (in terms of resource requirements); stems

from experience and informal knowledge systems; and involves unique sociotechnical phenomena that are embedded in communitarian values. Further, GI is driven by social need and ideologies that supersede the economic motives of grassroots innovators (Seyfang & Smith 2007).

2.3.2 Attributes of Grassroots Innovators

Grassroots innovators can be recognised by their origin, and are usually associated with rural, marginalised communities and the informal sector (Agarwal 1983; Cozzens & Sutz 2012; Jain & Verloop 2012; Gupta 2010). Church (2005) defines grassroots innovators as an innovative network of activists who are locally based and assisted by wider networks with shared interests. Conversely, Bhaduri and Kumar (2011) argue that grassroots innovators work outside of formal organisations—such as research institutes or businesses—in order to undertake innovative activities and solve localised problems. Pansera (2013) states that grassroots innovators innovate with very limited capital but with the help of local communities. They are not driven by commercial motives, but rather innovate to solve some of the daily problems faced by themselves or their communities, disregarding the prospect of private appropriation or monetary gain (Bhaduri & Kumar 2011).

Farmers/peasants and people from the marginalised and informal sectors have long exhibited grassroots creativity and knowledge, practices and innovations that lead to the resurgence of rural economies. Creative people at the grassroots have the potential to foster social inclusion and empowerment (Butkevičienė 2008; Church 2005). Some grassroots innovators are single entrepreneurs who own micro-firms, which are labour intensive and low on technology (Pansera 2013). The majority of grassroots innovators are illiterate and not formally trained in a technical field, but base their practices on their local knowledge and can innovate with frugal resources (Agarwal 1983, Gupta 1996; Gupta et al. 2003; Onwuegbuzie 2010; Srinivas & Sutz 2008; Rao 2006). They innovate in order to adapt and adjust to scarcity, rather than to transcend it (Gupta et al. 2003), and create income-earning and employment

opportunities, as well as improve local productivity (Cécora 1999; Dutz 2007; Pathak 2008).

Through the profiling of grassroots innovators based on their economic conditions, Abrol and Gupta (2014) provided three categories of grassroots innovator: the poor, who struggle hard for daily sustenance; the self-subsistent, who have some income to meet their basic needs; the financially stable, who have reasonably good sources of income or financial support. Overall, grassroots innovators are defined according to their socio-economic status, geography and skills. Table 2.5 outlines the main characteristics of grassroots innovators.

Table 2.5: Characteristics of Grassroots Innovators

	Grassroots innovator characteristics
Education	Illiterate
	Lacking formal education
	Lacking formal technical training
	School drop-out/ leaver
Experience and expertise	Inherited TK
	Possessing practical know-how
	Possessing experiential knowledge
	Observant
Occupation	Farmer
	Farm labourer
	Fabricator
	Traditional healer
	Potter
	Mason
	Weaver
	Driver
	Hawker
	Daily wage labourer
Socio-economic status	Marginalised and poor
Resides	Rural, small town or city (as a migrant)

Source: Self Compiled

2.4 Fostering Grassroots Innovators

The innovation agenda and policies relating to science and technology (S&T) have always focused on conventional and mainstream innovations from the formal sectors. In the formal and mainstream science, technology and innovation circuits, GI is rarely taken into consideration (Smith, Fressoli & Thomas 2014). Further, some systemic and structural challenges limit the success of GI in the commercial sphere, such as transaction costs; agency costs; lack of co-ordination and interaction between grassroots innovators, companies and other players; improper incentives; lack of funding (Kieff 2005; Krishnan 2010) and lack of skills to up-scale innovations (De Keersmaecker et al., 2012). Therefore very few grassroots innovations successfully diffuse or grow, or are put to wider market use (De Keersmaecker et al. 2013; Kieff 2005). Moreover, the public domain and moral rights stance makes the interpretation and use of such innovations controversial (Ghosh 2003).

The grassroots innovators' attitudes and motivation towards innovation (Bhaduri & Kumar 2011; Krishnan 2010) and lack of entrepreneurial culture (Gupta 2013) are assumed to be major impeding factors in the commercial and non-commercial diffusion of GI. Furthermore, limited support for grassroots innovators and poor institutional arrangements for product development, design, testing, calibration, user trials and risk capital further thwart the development of innovations (Gupta 2013). It is essential to strengthen and deepen grassroots networks, to effectively develop GI (Dutz 2007; Utz & Dahlman 2007). Moreover, in developing countries, lack of opportunity prevents grassroots people from progressing through learning by doing, solving processes and entrepreneurial action (Hartmann 2012). Therefore, there is the need for opportunity creation and strong institutional arrangements that not only facilitate the mobilisation of GI but also enhance the social and ethical capital of the nation (Gupta et al. 2003). It is also important to link local specificities to wide-scale diffusion, to strike a balance between the appropriate existing situation and seeking transformation, and to work towards project-based solutions that focus on structural change and ensure social justice (Smith, Fressoli & Thomas 2014). Overall, India needs

to encourage and foster innovations from the formal and informal sectors, and build a cohesive innovation eco-system that facilitates the dovetailing of various dimensions of innovation.

2.4.1 Grassroots Innovation Eco-System

Gupta et al. (2003) posit that transformation takes place at the grassroots level due to networking among innovators and other creative forces in society, which are segmented, polycentric, loosely integrated and co-ordinated. In Asia there are multi-faceted networks of a variety of agencies that facilitate the confluence of Western science and indigenous knowledge (Wilson et al. 2006; Berkes 2009). This network is into knowledge co-production, trust building, sense making, learning, vertical and horizontal collaboration and conflict resolution, and is similar to a Western bridging organisation (Berkes 2009). Innovation networks entail context-specific skills, actors, practices, routines, institutions and policies; they enhance capacity building and put knowledge to productive use in response to evolving challenges and opportunities from technical and institutional contexts (Hall 2005). Although grassroots innovations are mobilised through such networks, access depends on technological and cultural factors. The former relates to dissemination of information, and the latter relates to the willingness of knowledge holders to share and place it in the public domain (Sen 2005).

Innovation networks represent GI eco-systems in the nation's innovation system. The Indian GI eco-system comprises S&T policies, an individual (innovator) and institutions that are part of the national innovation system (NIS) (Joshi & Chelliah 2013). The NIS is a useful embodiment of institutional analysis (Nelson 1993), where all aspects of the economic structure and institutional set-up affect learning, as well as searching and exploring (Lundvall et al. 2002). The NIS facilitates understanding of the context of interdependencies of all stakeholders, exchange rules, relationship and policies for fostering GI. Figure 2.1 depicts the relational dependencies for mobilising and diffusing GI. For instance, the development institute can scout, provide market reach and

conduct research and development (R&D) to add value to the TK and innovation. Networks of agencies also play an important role in governance, scouting, validation, value addition, product and enterprise development, IPR protection, licensing and diffusion of knowledge/innovation (Dheeraj, Basant & Gupta 2003; George, McGahan & Prabhu 2012, Gupta et al. 2003).

Innovation systems are 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies' (Freeman 1987, p. 1). They have been instrumental in recognising and creating a commercial platform for innovations that have the potential to succeed in the marketplace. Actors in this form of exchange are bound by personal ties, social structures and relationships (Polyani 2001; Coleman 1988; Granovetter 1985). Eco-systems share implicit and explicit network relations and facilitate the development and diffusion of GI. Varied actors within the eco-system—such as individual scientists, development agencies and private companies—build networks and relationships with TK holders and grassroots innovators, to mobilise GI. However, ongoing network relationships can constrain, enable and affect the behaviour and social relations of economic agents and institutions (Granovetter 1985).

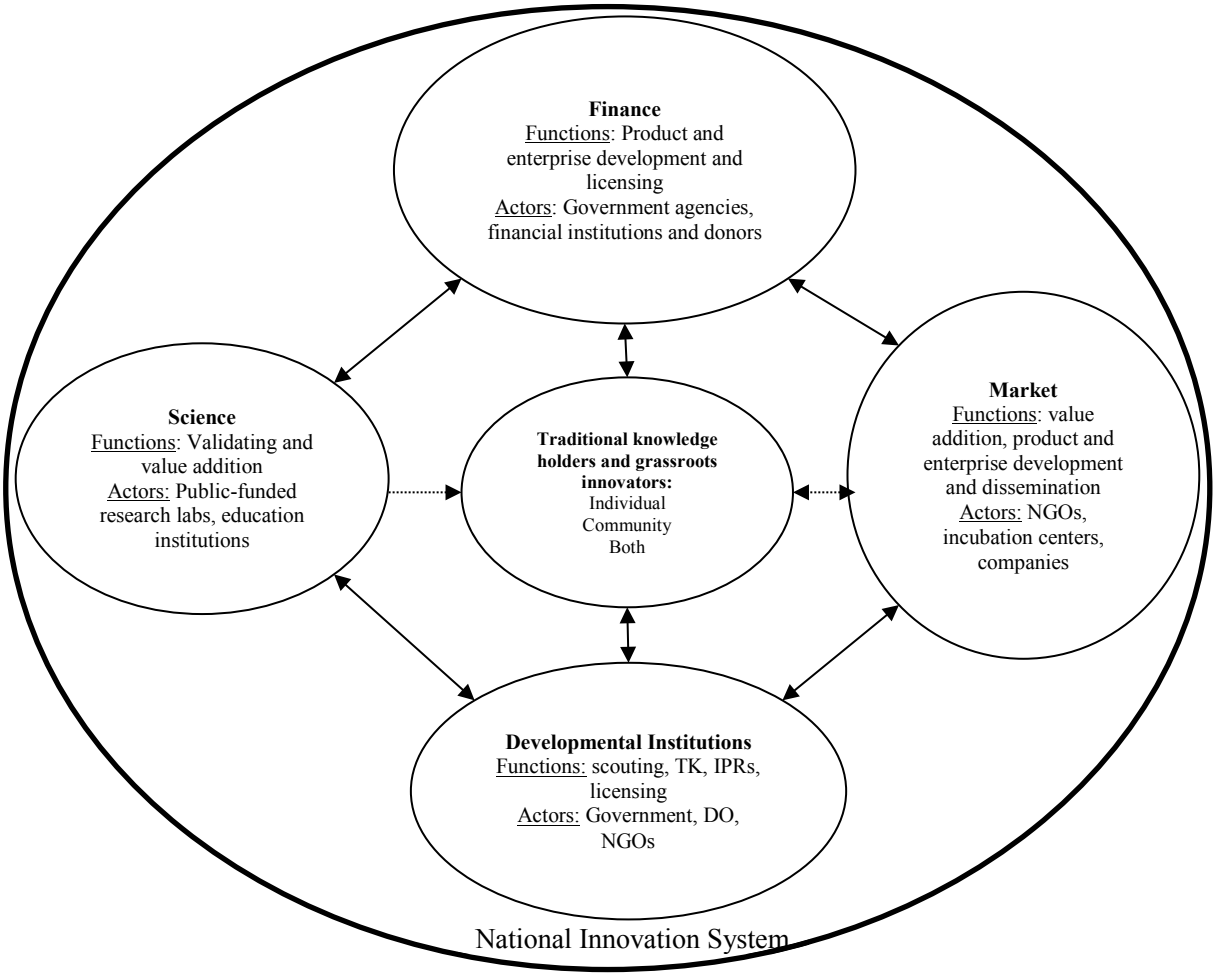

Figure 2.1: Innovation network for mobilising and diffusing GI (Joshi & Chelliah 2013)

2.4.2 Protection

Intellectual Property Rights are an important aspect of any innovation. They serve as incentives for innovators who have worked on ideas/concepts for a product or process innovation. These rights also maximise innovation access for public interest, enhance the diffusion of innovations, and safeguard innovations and knowledge from technology, market uncertainties and imitation threats (Dheeraj, Basant & Gupta 2003). However, there are conflicting views on the use, access, property rights and ownership of TK and associated innovation.

The meaning of protection is two-fold. One relates to conferring rights over TK, and the other to protecting this knowledge from destruction or loss, and encouraging its use through mechanisms other than intellectual property (Correa 2001). Despite the divided views on property rights, nations have started to take measures to protect their intellectual property from misappropriation, which is increasing. For instance, the NIF—an autonomous body of the Department of Science and Technology, Government of India, headquartered in Ahmedabad of Gujarat State, India—provides institutional support to grassroots innovators and TK holders for the informal and unorganised sectors. The NIF has filed over 550 patents on behalf of grassroots innovators and outstanding TK holders. Although such institutional mechanisms are important in developing countries, to safeguard their intellectual assets and foster local creativity, they still face misappropriation (Scaria & Dedeurwaerdere 2012). Panagariya (1999) argues that the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement is a welfare-reducing proposition for developing countries.

According to Ghosh (2003), the public domain, moral rights and appropriation position makes the interpretation and use of such innovations more controversial. TK-based products have a cultural value (Subbiah 2004), while Western philosophy is based on an individual-based rights system and the commodification of natural resources (Bijoy 2007). TK is considered to be connected to the sacredness and reciprocal nature of life (Tauli-Corpuz 2004), and has a symbiotic relationship with the beliefs, habits and customs of communities (Scadifi 2001). These differences challenge the innovation

diffusion, determination of IPR, benefit-sharing norms, exchange rules and relationships, and access to and use of TK (Joshi & Chelliah 2013).

Busingye and Keim (2009) argue that indigenous communities are not opposed to technological advancement but to patent rights and the dynamics of the free market. Alternative methods of economic exchange are necessary, those that are close to the culture and system of exchange of communities and their grassroots creativity. Similarly, Vermeylen (2007) examines how the San communities of South Africa, Namibia and Botswana perceive the trade and commoditisation of TK. This work highlights the essence of trade, culture and community perceptions, and how the economic structures of communities are affected through changing environments and perceptions. She suggests that there is widespread acceptance of commoditisation, but the cultural, symbolic and economic values of intellectual assets should not be undermined. The results demonstrate that the communities studied want to maintain control of their knowledge, and do not want to part with it for economic benefits, such as royalties.

Dheeraj, Basant and Gupta (2003) provide strategic options for small and medium enterprises for the commercialisation of TK-based technologies. They argue that TK-based entrepreneurial activities have significant potential in India, provided the regime is strong and that innovators understand the complex game of intellectual property protection and technological commercialisation. These researchers identified the need for clear property rights on such innovations, a conducive IPR and venture-capitalist environment and government investment to foster innovations. They also drew attention to the reward and payback policy for innovators, and how governments can facilitate such arrangements. The major limitation of this work is its assumption that the entrepreneur expects only economic returns, and the factors that govern an innovator's ability to capture profits generated by TK-based innovation have strong market appropriation.

Examination of Indian grassroots innovators' motivation to innovate, Bhaduri and Kumar (2011) found that pure extrinsic forms of motivation—such as intellectual property protection and fiscal incentives—drive only a fraction of individual innovative behaviour. Similarly, Gupta (2003) posits that IPR protection is just one step in the value chain of GI, and that without accompanying institutional innovations and a variety of non-monetary incentives, IPRs alone may be of limited significance. Moreover, although patents are a key conventional indicator of innovation output, they do not apply to GI because they contradict the aspirations of grassroots innovators (Bhaduri & Kumar 2011; Abrol & Gupta 2014). Innovators battle with different belief systems, motivations, resource scarcity and conflicting interests (Erika & Watu 2010; Joshi & Chelliah 2013).

The mobilisation and commercialisation of GI is assumed to be beneficial, fair and easy, but this is not necessarily the experience of those from the grassroots sector. The belief system of the traditional knowledge holders and innovators from these communities is contrary to Western philosophy which is based on individual-based rights systems, utilitarianism and the commodification of natural resources (Bijoy 2007). These elements challenge innovation diffusion, determination of IPRs, benefit-sharing norms, exchange rules, exchange relationships and access and use of TK and associated innovations in the current capitalist, globalised world (Joshi & Chelliah 2013).

2.4.3 Benefit-Sharing

The liberalisation, privatisation, globalisation, and development of, international flows the development of information and communication technology (ICT) is like double edge sword. All these offer both opportunities and risks, through interdependence and interconnectedness. On the one hand, globalisation provides the market reach to grassroots creativity, while on the other; it exploits assets and communities by not sharing the benefits with communities, knowledge holders or innovators (Gupta 2003). GI encompasses TK and traditional practices, including herbal practices and medicine.

Although this thesis does not focus on traditional medicine or herbal practices; it does examine the existing institutional and governance mechanisms that facilitate all GI, including herbal medicinal innovation. Such understanding can be a comprehensive guide for the GI landscape which is driven by economic, moral and social aspects of exchange relationship and appropriating knowledge of the grassroots innovators for innovation development in commercial space.

According to Peterson (2001), benefit sharing is a pseudo-legal concept designed to compensate marginalised communities and indigenous people for their intellectual contributions to the bio-prospecting of large, wealthy public or private organisations. It is a complex notion, as multiple stakeholders are involved in the value diffusion of TK and associated innovations. This is evident in the Tropical Botanic Garden and Research Institute (TBGRI)-Kani case, which is an example of benefit sharing arrangements for TK-based innovation, in which the Kani tribe's TK exchange led to the development of the herbal drug, Jeevani, in 1994. The case also demonstrated the limitations of the TBGRI-Kani benefit sharing arrangement, which failed to foster TK-based innovation and overlooked the experiences and expectations of TK holders. There are deep socio-economic issues, as TK-based innovation—the anti-fatigue drug Jeevani—is derived from grassroots creativity that is both the way of life and source of livelihood for grassroots people. Moreover, the benefit-sharing model is predominantly based on an economic model of incentivisation, and overlooks the cultural, ethical and long-term views driving the TK system and GI (Schroeder 2007; Vermeylen 2007). However, for the equitable and fair distribution of commercialisation benefits accruing from GI, Joshi and Chelliah (2013) have proposed a benefit-sharing model that encompasses both economic and moral factors of exchange dynamics.

The main factors that should be taken into consideration for fair and equitable exchange arrangements vary (see Figure 2.3). Nevertheless, for benefit-sharing mechanisms to survive and function smoothly, capacity-building initiatives and good governance structures are essential (Torri 2010). It would also be beneficial for

policymakers to model socio-economic exchanges that have 'reciprocal fairness' between grassroots innovators and members of GI ecosystem. According to Bowles et al (1997), reciprocal fairness entails strategic interaction of majority of individuals and their propensity to cooperate with conditional retaliation and kindness. It is the phenomenon of altruism and reflects the sentiments of an egalitarian society built on a culture of reciprocity (Bowles et al. 1997).

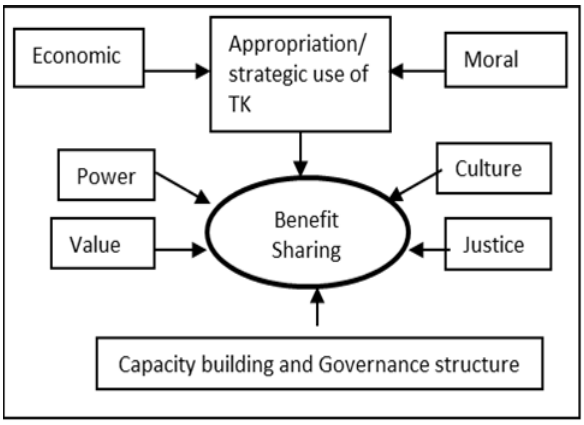

Figure 2.3: Key Factors Affecting Benefit Sharing and Exchange Mechanisms in GI (Joshi & Chelliah 2013)

Grassroots creativity—which includes TK, traditional practices and innovation from marginalised sections of society—is gaining significance amid the sustainability, development and green-economy movements (Seyfang & Smith 2007, Gupta 2003). It is a sought-after intellectual asset in the capitalised world because it takes into consideration the resource constraints, reusability and moral aspects in the creation of the novel beneficial products. The literature and views from the field on the compensation and protection of innovation and knowledge also suggest something more than the economic and monetary aspects of exchange in innovations from grassroots people. Therefore, it is important to explore grassroots innovators' lived experiences, because GI, TK and traditional practices are the source of livelihood for grassroots innovators and are strongly embedded in their way of life. The following section discusses empirical studies on GIs and grassroots innovators, and demonstrates the need for future research in this area.

2.5 Grassroots Innovation Studies

Studies relating to grassroots communities and movements are numerous. Seyfang and Smith's (2007) research on GI and sustainability spaces has opened up the potential of such research. However, their definition of GI is anchored in community-based and green innovations, and largely relates to the creation of new green market niches and innovative practices among farming communities in the United Kingdom (UK). Therefore, their work is more suited to studying GI in the UK and other developed countries, but their notion of GI as a socio-technical innovation system can be used to comprehend GI that is green/ecological and agricultural.

Fressoli et al. (2014) discuss how social inclusion, grassroots innovation movements (GIMs) can engage with mainstream innovation and development institutions and policies. Through three case studies, the authors framed two modes of engagement– insertion and mobilisation. The former relates to adapting the rules of dominant institutions or technologies and/or fitting grassroots creative capacities in a manner that make it legible and useful for existing innovation systems and product markets (Fressoli et al 2014). The latter is an attempt to transform the spaces of innovation by challenging dominant practices, technologies, power relations and discourse (Fressoli et al 2014). Mobilisation happens in the case of resistance of the grassroots to dominant regimes. Fressoli et al.'s (2014) study is an important guide to build pathways to alternative for the design of models of inclusive innovation and sustainable development. However, their model of engagement overlooks the role of individual grassroots innovators and their social relations. However, their model of engagement and their case studies require deeper exploration, in terms of strategies for the empowerment of the grassroots innovators through the convergence of GIM and mainstream S&T institutions.

Assefa et al. (2009) studied the dynamics of grassroots agricultural innovation systems in Sub-Saharan Africa. Although their work focused on the agricultural innovation system at the grassroots, it illuminates the complex dynamics of endogenous and

exogenous innovations systems for developing countries. Exogenous innovation systems at the grassroots relate to all innovation interventions which are initiated and controlled mainly by outsiders with an intention to improve local livelihood and environment (Assefa et al. 2009). Endogenous refer to new initiatives and innovation processes of the local people to solve the livelihood and environment issues (Assefa et al. 2009). The sources of the innovations and the goals of the actors differentiate these two systems (Assefa et al. 2009).

Wamae's (2009) work offers an understanding of the innovation and commercialisation process in developing countries. However, it is silent on how the process can be beneficial to knowledge holders and grassroots innovators. The author discusses the lack of non-R&D-specific capabilities in developing countries, but fails to provide insights on processes and strategies to enhance innovations for commercial purposes. Moreover, the study is silent on grassroots innovators' views on their innovation in commercial spaces, and their expectations.

The literature on sustainability transition and strategic niche management (SNM) provides an analytical framework for scaling-up GI and implementing technological niches, such as electric cars (Longhurst & Seyfang 2011). However, there are limitations to this approach and framework, as they relate only to radical innovations involving environmental benefits. In reality, not all GI are radical or green innovations, so there is the need for a different analytical approach for incremental GI. Subsequently, Longhurst and Seyfang (2011) also show that little empirical work has been done on the technological niches originating from civil society and, therefore, the application of SNM is lacking. Nevertheless, SNM provides understandings on the development of innovation projects and the flow of resources to scale-up GI from three sets of processes:

1) shaping heterogeneous social networks;
2) articulating shared, tangible and specific expectations;
3) broad and second-order learning (Raven 2005; Schot & Geels 2008).

Providing an overview of the alternative innovation paradigms emerging from the developing world, Pansera (2013) draws insights on the new challenges for mainstream innovation theories. He also outlines how innovation is planned, designed and deployed outside of the comfortable territory of the Western paradigm. Nevertheless, the paper lacks empirical evidence and its conclusions are prescriptive. The discussion of frugal innovations and GI is convoluted, so clarity in relation to the essence of GI is missing. For instance in the conclusion, citing example of GE and TataNano, the author stresses on the developing countries' capability in frugal and grassroots innovation in resource-constrained environment but fails to portray developing countries' capabilities in GI.

Dheeraj, Basant and Gupta (2003) studied the commercialisation of TK-based innovation in small and medium enterprises. Their work draws some practical insights from marketing and strategy perspectives. However, they assume that economic rationales drive actors' expectations and relational obligations. Further, the protagonist in their case is not the grassroots innovator or TK holder, so the commercial exchanges perception would be different to that of GI. This study is rather narrow, and generalises the commercialisation phenomenon from a single case study.

Abrol and Gupta (2014) examine the patterns and determinants of diffusion and up-scaling by HBN-supported innovators. Their findings are based on judgements from desk research, using online information made available by the HBN and NIF. The authors observed that GI are not socially diffused because of lack of finances, insufficient entrepreneurial strength or a lack of buyers for technology. To mitigate diffusion issues, they recommend that the HBN devise a mechanism of co-operation among innovators. The authors further recommend building a new socio-cultural lifestyle and a new political economy that cultivate new values at the grassroots level, promote self-reliance and redistribution. Although Abrol and Gupta's (2014) research is an extensive secondary study, it requires theoretical grounding and evaluation. Extensive discussion of linkages for the diffusion and dissemination of invention and social change is totally missing.

Generally, until now, pro-poor innovations (including GI) in the informal sector were examined from a classical economic and utilitarian perspective. For the study of GI, which is based on empathy and social responsibility, the prevalent rational, economic models of competitive innovation for profit are not appropriate (Rajan 2013). Overall, there is a lack of broad theory or integration of multiple theories elucidating the purpose and process of innovation at the BoP, and very few studies examine the links between innovation, empowerment, inclusiveness and poverty (George, McGahan & Prabhu 2012; Cozzens & Sutz 2012; Papaioannou 2014). There is a need for in-depth qualitative studies, in order to understand the social and market economy setting underpinning the germination and scaling-up of GI (Seyfang & Smith 2007). Such findings and views are indicative of the fact that there is more to GI than that objectively portrayed in the literature, and there is a need for a holistic view of GI through a humanistic approach.

Research on Indian GI and grassroots innovators is still nascent, and overall the theories and empirical studies of GI are scant. A few relating to this research are discussed subsequently. Table 2.6 summarises the most prominent empirical research on Indian GI and grassroots innovators.

Table 2.6: Research on Grassroots Innovators

No.	Author	Participants	Methodology	What is known	Gaps
1	Bhaduri & Kumar (2011)	87 award-winning grassroots innovators	Survey questionnaire and quantitative data	Many grassroots innovators are motivated by intrinsic motivations There is a motivation shift in the idea generation, experimentation and application stages of GI In the early stage of innovation, when uncertainty is high, the importance of intrinsic innovation is greater The effectiveness of extrinsic motivations increases when uncertainty is low For GI, the policy thrust based on extrinsic incentives has a seriously adverse effect on innovation and interpersonal co-operation	Survey methodology relies on an objective framework and may omit important aspect of innovators' experience and beliefs grassroots innovators' expectations are overlooked as the study has taken an objective stance to motivation
2	Torri (2010)	Case study of the joint initiatives of two Indian ethno-medicine NGOs	Individual and group interviews, complemented by participatory observations	Innovation capacity building and social learning are effective strategies to help village entrepreneurs' gain technical and managerial capabilities and enhance their self-confidence Community-based approaches that build on local medicinal plant knowledge systems must be encouraged by a supportive policy and legislative measures at the national and global levels	The findings and suggestions cannot be generalised to other GIs and grassroots innovators' life experiences as the views are bound to an innovation network perspective The study does not address the grassroots innovators' livelihood or social issues adequately Makes assumptions about features underpinning successful innovation processes

No.	Author	Participants	Methodology	What is known	Gaps
3	Rajan (2013)	Ethnographic research at 25 physical sites in two Indian states Eight primary informants	Participant observation, interviews of innovators' family members, peers and collaborators within and outside the local community and archival data on the primary informants	At the grassroots, technology design is situated, empathic and reflexive Grassroots technologies can be adapted flexibly to diverse heterogeneous uses The organisation of grassroots innovators represents a community-based, user-driven model of innovation based on empathy and social responsibility	The moral and emotional aspect of the organisation of GIs and the challenges faced by innovators are missing Overlooks or undermines the relational aspect of actors, which is the heart of the community-based model of innovation A clear definition of grassroots communities is missing
4.	Abrol & Gupta (2014)	Analysed the online profiles of 188 NIF-awarded innovators in 2001, 2002 and 2005	Desk research based on online information and quantitative data	Diffusion of GI is a major challenge. Three preferred modes of diffusion: (1) grassroots innovators capitalising on the economic potential of their innovation by becoming entrepreneurs; (2) innovations transferred to a company or organisation for commercialisation; (3) diffusion of innovation via open sharing, lectures, mentorship or informal discussions Out of 188 innovations, 150 do not appear to require significant financial or technical investment, and are of the kind that would be more easily diffused through open sharing Incubation strategies should be based on co-operation and local contexts	Desk research-based judgments are made on the basis of online information available via HBN and NIF. Such judgements may not reflect the intrinsic and subjective aspects of the diffusion of innovation Authors have used invention, innovation, grassroots innovator and informal innovator interchangeably. Clear definition of diffusion and commercialisation is missing. Social diffusion is discussed but conceptual and theoretical clarity is lacking Information relating to the age of the innovators and the number of innovations of serial innovators is missing

No.	Author	Participants	Methodology	What is known	Gaps
5	Kumar (2014)	15 award-winning grassroots innovators from across India were interviewed over seven years	Interviews and quantitative methods	Networks keep changing at different stages of innovation, with vital effects on informal sector innovations There is gradual movement from informal to formal linkages, and continuous interchange between strong/weak and positive/negative ties	The quantitative analysis is only related to the frequency of variables An operational definition of the core construct linkages and collaboration is missing. If the study was undertaken over seven years, the effect of ties over time is missing

Source: Self Compiled

From the various studies on Indian GI and grassroots innovators it is clear that, increasingly, GI is associated with sustainable livelihoods more than the economic consequences of innovation (Cozzens & Sutz 2012). Grassroots innovators have the potential to drive socio-economic change and be active agents in the development process. GI is recognised for its potential to empower and enhance the socio-economic well-being of grassroots people. However, diffusion of these innovations is still a major challenge at the local market level. The capacity to empower them to become producers cannot come without improving the arrangements of intermediation and redirecting them away from making each grassroots innovator competitive as an individual producer (Abrol & Gupta 2014).

2.6 Conclusion

The extant literature on the GI field was discussed in this chapter. On reviewing the literature it was found that the discourse on the IE is significant in understanding the rationale of grassroots people's economic activities and the structure and nuances of informal, grassroots economic activities. Overall, the IE also provides an understanding of how grassroots people structure their economic lives with moral and economic values. The convergence of the IE, inclusive innovation and development was also discussed.

The literature on the genealogy of GI and grassroots innovators, their definition and attributes demonstrated that there is the potential for research to further understandings of the GI phenomenon, as experienced by grassroots innovators. The notion of GI, as discussed in this chapter, is elusive, and is operationalised differently by researchers from different fields of study. Much more should be done, as the existing conceptualisation of GI requires a more critical and engaging form of analysis. Grassroots innovators are at the intersection of the social, moral and market economies. Further, grassroots innovators are constantly negotiating formal and informal settings and modern and traditional belief systems.

On examining the literature on fostering GI it was also demonstrated that GI is a complex phenomenon, and that there are structural impediments to developing GI for commercial purposes. A humanistic, bottom-up, inside-out approach to understanding the essence of the GI phenomenon is absent in the literature. Three major gaps have been identified in the literature:

1) Innovation and management studies on GI are in a nascent stage.
2) Empirical contributions are limited to the significance of GI for a sustainable environment, and reaching out to grassroots people for and with sustainable solutions.
3) Currently, the structure and essence of GI as experienced by grassroots innovators, is not comprehensively studied in business management and innovation discourse.

The research on GI is at an embryonic stage. There is also a lack of empirical research giving voice to the innovation experiences of grassroots innovators, their forms of exchange for innovation development and their innovation behaviour. Thus, this thesis attempts to address these gaps by understanding the subjective reality of grassroots innovators' lives and discerning the structure and essence of the GI phenomenon. The theoretical orientation of this study is discussed in the following chapter.

Chapter 3: **Theoretical Orientation**

3.1 Introduction

GI is rooted in socio-economic, informal and scarcity-induced environments. In the innovation and management literature, theories and operational indicators for individual-level GI processes and innovative behaviour of grassroots innovators are scant. In the context of Indian GI, there have been only two indicative studies: Bhaduri and Kumar (2011) illuminate the motivations and innovative behaviours of Indian grassroots innovators, and Rajan (2013) discusses the organisation of GI in India. These studies, and others, delineate some features of GI and grassroots innovators, but do not encompass the 'doing' and 'being' aspects of the GI phenomenon.

The discourse on GI has been focused on the socio-economic (Seyfang & Smith 2007) and moral contexts (Gupta 2010). Further, concerns for equity, inclusive development, freedom, justice and socio-economic well-being have converged in innovation and development studies. This has generated discourse on inclusive and pro-poor innovation, learning capabilities and development as freedom. Advocating development as freedom, Sen (1999) states that development is not limited to market-oriented freedom, but is inclusive of the freedom to innovate, to create opportunities and to expand capabilities. According to Sen (1999; 2003), freedom is an individual's capability to choose between different ways of living and exercising their potential for individual well-being.

Well-being is usually defined in terms of utility, income or capability (Sen 1999; 2003). The measure of utility and income are limited to endowments and aids, whereas they should involve freedom of choice and capability enhancement (Sen 1999). Development studies allow further understandings of the changes induced by S&T. However, for the development of human capital, the innovation system should primarily focus on innovation capability rather than just S&T capacity (Hall 2005). This key lesson is evident in the failure of Schumacher's appropriate technology movement.

The purpose of this thesis is to make available a holistic, bottom-up understanding of the GI phenomenon in the current dynamic economy of an emerging country like India. A dynamic modern economy, according to Phelps (2013), is consistent with ideas of economic justice and the concept of the good life. Such dynamism is exhibited in GI, where freedom is a necessary condition for individuals to propose, test and exploit new ideas and new ways of doing and being (Phelps 2013). This reflects Sen's (1999) view on theories of development, in which the 'achievement of development is thoroughly dependent on the free agency of people' (p. 4). Such notions of development further assist links between innovation-driven change and the socio-economic and moral well-being of innovators at the grassroots level. Keeping in mind the convergence of innovation studies with development studies, this thesis attempts to examine the GI phenomenon from the economic and sociological theory of innovation and development.

A theoretical orientation taken to explore the GI phenomenon is discussed in this chapter. The structural and relational embeddedness and human elements of innovation are briefly discussed, followed by a theoretical lens through which the structure and essence of the lived experiences of grassroots innovators are explored. Individual innovative behaviour, exchange and interpersonal relationships are also discussed, as they lay the groundwork for understanding the intrinsic and extrinsic elements of the innovation phenomenon.

3.2 Theoretical Orientation

Uncertainty supplements innovation, and the latter is the outcome of continuous struggle between individual entrepreneurs (who advocate novel solutions to particular problems) and social inertia (Schumpeter 1934; 2012). Following a Schumpeterian, humanistic theory of innovation, Tzeng (2009) proposes three schools of innovation: capability, corporate entrepreneurship and cultural. Taking the economic outlook of innovation, the capability school denotes innovation as the institutionalised capability

of evaluating the decision to innovate or not, and evaluating technological change (Tzeng 2009). The corporate entrepreneurial school is based on the social perspective of innovation, whereby innovation emerges from a sense of identity and grassroots impulses, emphasising improvisation in action (Tzeng 2009). Grounded in a cultural perspective, the cultural school of innovation indicates that innovation—a product of a deep sense of temporality—is a craft driven by vision, intergenerational relationships and affective identification (Tzeng 2009). These three schools suggest that innovation is not only a technical and scientific pursuit of beneficial novelty but also an economic, social and cultural endeavour.

Innovative behaviour is at the core of entrepreneurial actions. The implementation of novel ideas when starting a new venture is entrepreneurial creativity (Amabile 1997). The pre-requisite of entrepreneurial creativity is the novelty that has functional value in the real world. The individual must be attentive to real-world problems and demands, and to the passion felt for the novel idea they have conceived (Amabile 1997). As entrepreneurial creativity involves significant novelty in marshalling support or effectively implementing novel and appropriate business ideas, it requires a larger skill and experience-set than any individual typically possesses (Amabile 1997). Therefore, entrepreneurial creativity is more likely to entail team effort than just individual effort (Amabile 1997). Entrepreneurial outcomes may be guided by individual or collective access to resources, or the ability to marshal resources and convert them into investment, with or without keeping social and ethical capital in mind (Gupta 2013).

Necessary and sufficient conditions for entrepreneurial activity to take pace are perceived opportunity and intent to pursue such opportunities (Audretsch 2012). Entrepreneurs, according to Krueger and Brazeal (1994), are those who pursue opportunities irrespective of existing resources. Defining potential entrepreneur, Krueger and Brazeal, state their potential is latent, causal and temporal and entrepreneurs need not have any salient intentions towards starting a business.

Entrepreneurs are made through a perception-driven enactive process which further shapes the potential for entrepreneurship (Krueger & Brazeal 1994).

Entrepreneurial decision making involves seizing and exploiting contingencies in the limited resource environment. Entrepreneurial behaviour entails ability to recognize, create and exploit or commercialise an opportunity (Audretsch 2012). Effectuation process, according to Sarasvathy (2001), allows entrepreneurs to realize several possible effects and construct and shape their goals in uncertain and contingent environment.

Discussing the antecedents of the entrepreneurial potential Krueger and Brazeal (1994) states that entrepreneurial behaviour depends on relative credibility of alternate behaviour and propensity to act. Further, potential or self-efficacy and intentions influence the entrepreneurial behaviour (Krueger & Brazeal 1994). The model of entrepreneurial potential allows identification of the beliefs and attitudes in an enacted entrepreneurial environment. Potential entrepreneurs take the initiative to accept the personally attractive opportunity (potential) without any intentions towards starting a business (Krueger & Brazeal 1994).

Innovators and entrepreneurs are seen as active agents affecting development. Hartmann (2012) argues for the need to introduce Schumpeter's economic development and Sen's people-oriented development, because innovation-driven socio-economic change affects capabilities. The new dimensions of freedom to innovate are capabilities and opportunities for networking, learning and engaging in entrepreneurial action (Hartmann 2012). GI is perceived to be part of a solidarity or social economy because it is driven by social needs and ideologies that supersede economic motives (Seyfang & Smith 2007). It can be a useful guide for the reorientation of mainstream innovation policy (Smith, Fressoli & Thomas 2014) towards GI, to promote pro-poor innovation and inclusive development (Dutz 2007; Hartmann 2012; Gupta 2013).

Schumpeterian economics used to be the basis for understanding economic development as innovation. However, it has proven to be myopic in terms of the role of incremental innovations (Phelps 2013), human development (Hanusch & Pyka 2007), ethics, justice and social change. In the current knowledge economy, innovation is important for sustainable socio-economic life because nations are shaped through innovation capacity and capability. A Schumpeterian innovation economic framework stresses novelties, creative destruction, qualitative change and open and uncertain developments in socio-economic systems. Critiquing Schumpeterian innovation, Phelps (2013) argues that it is catering only to conventional innovation and excludes the innovation process, new knowledge and human ingenuity of grassroots people. Further, Phelps proffers that in the dynamic modern economy, innovation should relate to the central aspects of economic justice and the concept of the good life, in which individuals are free and able to propose, test and exploit new ideas and new ways of doing and being (Phelps 2013). Sen's idea of development as freedom resonates with Phelps' (2013) idea of mass flourishing within a dynamic modern economy. Through the concept of mass flourishing, Phelps (2013) argues that the relationship between human creativity and the freedom of the market is at the heart of individual self-fulfilment.

Contrary to neoclassical economics, neo-Schumpeterianism considers the social side of innovation, and advocates for a bottom-up approach (Hartmann 2012). It is concerned with all facets of open and uncertain developments in socio-economic systems (Hanusch & Pyka 2007). Neo-Schumpterian economics is widely and increasingly applied to innovation and development studies because of its focus on the endogenous aspects of change (Hartman 2012; Tzeng 2009; Hanusch & Pyka 2007). Human development and freedom are undermined in neo-Schumpeterian economics, but its integration with Sen's (1999) people-oriented development approach can offset this weakness. While the former focuses on interactive learning and structural change, the latter relates to needs, capabilities and development as freedom. Such integration further allows linkage of the micro (individual), meso (institutional) and macro (national) levels.

Anchored in the literature on sociology, innovation economics, psychology of innovation and development studies, this thesis explores the structure and essence of the GI phenomenon. Cozzens and Sutz (2012) recommend theoretical pluralism for the study of innovation in informal settings. In this thesis, along with diffusion theory, socio-economic exchange relationship experiences are investigated, using the lenses of exchange theory, including psychological contract. While exchange theory explains the dyadic socio-economic reciprocal interdependency, the psychological contract provides a view on the perceptions and expectations embedded in exchange and innovation activities. In exchange theory, the equivalence of return to both parties is not an issue in social norms of reciprocity. However, the consistency between what is promised (or understood) and what is received *is* an issue in the psychological contract (Rousseau 1989). Both exchange and diffusion theories help understand the socio-economic relations underpinning GI at the micro level and social structure. Diffusion theory facilitates understandings of innovators' experiences in manifesting exchanges and innovation benefits through social systems of innovation.

Exchange and social relationships are central to the functioning and sustainability of socio-economic activities, including innovation. Exchanges result from socio-economic relations. Social relations are embedded in economy, and such embeddedness is more significant for the economy than market forces (Polyani 2001). The market, according to Polyani (2001), is only one form of exchange structure. Elaborating on the concept of embeddedness, Granovetter (1985) argues that all economic actions, outcomes, institutions and environments are inherently embroiled in social and structural relationships. The relational and structural aspects of an individual's economic actions are central to the notion of embeddedness. While relational embeddedness has a somewhat direct effect on an individual's economic action, structural embeddedness has a less direct and more subtle effect (Granovetter 1985).

Further, personal interactions are determined from the history of interaction and the consequent mutual expectations (Granovetter 1985). The content and structure of

relationships embedded in economic actions affect the outcome of these actions (Granovetter 1985). Likewise, levels of socialisation, trust and solidarity in social networks, inclusive of personal ties, reveal how economic institutions are generated and function (Granovetter 1985). The notion of embeddedness further allows an interrogation of the notions of exchange and network of relations, affecting the innovative and entrepreneurial behaviour of grassroots innovators. This thesis uses exchange theory—including a psychological contract and diffusion theory lens—to frame comprehension of the forms of exchange relationship embedded in the lived experiences of GI.

3.2.1 Exchange Theory

Exchange theory studies the series of interactions that generate reciprocal obligations. This theory provides insight to the socio-economic behaviours and macro-micro economic structures existing in the form of a network of social relations. The form of the network of social relations is considered, in exchange theory, as the product and constraint of social structure. These structures entail a configuration of social relations among actors exchanging valued items. Thus, in studying the forms of exchange in GI, it is important to understand how social relations and market economies are situated.

Homans, an early proponent of social behaviour and exchange theory, defined social exchange 'as the exchange of activity, tangible or intangible, and more or less rewarding or costly, between at least two persons' (1961, p. 13). Although Homans has been criticised for his reductionist approach to behavioural phenomena and his over-emphasis of psychological aspects, his framing of social behaviour in terms of reward and punishment had helped understandings of dyadic relationships and the consequences of behaviour. Further, Homans' 'value proposition' and aligned normative concept of distributive justice to a fair rate of return in dyadic exchanges provides insight into the psychology of influential behaviour (Emerson 1976).

Blau (1964), another prominent scholar of exchange theory, provided insights on micro-exchanges and economic and social exchanges. He emphasised technical economic analysis (Emerson 1976), in which economic and utilitarian behaviour were the dominant aspects. Contrary to Homans, Blau (1964) stressed rewards and costs, and also posited that too much emphasis on psychology can blind us to the emergent aspects of social exchanges (Emerson 1976). Comparing social and economic exchanges, Blau (1964) states that exchanges are those unspecified personal obligations whose nature of return cannot be bargained as they do not have an exact price, in terms of quantitative medium.

Exchange theory is a useful guide to studying the prevalent social structures that affect the economic actions of an individual or firm. Social structure can be a:

> "configuration of social relations and positions, or the foundation that underlies all of social life and history, and a multidimensional space of the differentiated social positions of the people in a society or other collectivity." (Blau 1975, p. 14).

Explaining exchange theory, Collins (1988, p. 412) states that:

> "human beings have the capacity to create or negotiate whatever they can at any moment in time, they are free and constrained actors but they act in structured situations, so that the consequences and conditions of their creativity and negotiation are nonetheless patterned by larger relations which are beyond their control."

Thus, exchange theory is a useful guide to understanding an individual's actions and social structure.

Social exchange entails non-contractual behaviours (Chen & Choi 2005) based on reciprocal social obligations, whereby such obligations beget feelings of moral obligation and trust (Blau 1964). In general, exchanges are bilateral and bear reciprocal obligations, involving a transactional pattern of interdependent exchanges, a folk belief and a moral norm (Cropanzano & Mitchell 2005). Reciprocity in exchange is not manifested for individual gratification, and therefore strict accounting of such exchanges is difficult (Blau 1964). However, trust can serve as a governing mechanism because it can facilitate the identification of expectations of actors and the outcome of economic and social exchanges, thereby providing an understanding of exchanges (Blau 1964). Trust is also important because it provides a foundation for the

development of stability in social and economic relations, and creates enduring social patterns of reciprocity (Blau 1964).

Meeker (1971) proposed six social exchange rules: reciprocity, rationality, altruism, competition and status consistency. These can help discern the obligations and rhetorical promises, and give insight into the relational aspects of exchange for GI. According to Meeker (1971), rationality relates to the use of logic to determine the likely consequences (outcome/ends), and how to achieve the things that are valued. However, the rule of altruism proposes that an individual does not always behave rationally, but also seeks to benefit another person, incurring a cost to the self (Meeker 1971). Status consistency relates to benefit sharing, based on one's position in terms of race and status in a social group. Moreover, the character of a relationship between exchange partners affects the processes of social exchange and the types of exchange (Blau 1964).

Exchange theory explains exchanges from utilitarian and behavioural orientations, and how this exchange relationship shapes macro and micro aspects of socio-economic relationships in society. Further, at the micro-level, exchange theory has the potential to provide a unitary framework for a social system, the behavioural aspects of actors and their obligatory relationship with other actors. This theory is criticised for its over-reliance on a utilitarian conceptualisation of the exchange relationship, generalisation of exchange behaviour, undermining of cultural aspects and disregard for the intrinsic aspects of social behaviour. Further, it presumes a set of understood societal obligations, is too static and fails to negotiate the practical moral dilemmas in encounters (Thompson & Hart 2006).

Conversely, the strength of this theory lies in its explanation of social and economic relationships. Cropanzano and Mitchell (2005) posit that theorists agree on the key tenets of exchange theory: that social exchange constitutes actions contingent on the rewarding reactions of others, and that over time it provides mutually rewarding transactions and relationships. This theory also helps to discern the extrinsic

motivations of the socio-economic actions of an actor. Hence, in this research, exchange theory is used to understand the reciprocal obligations operationalising GI. Exchange theory combines the constructs of reciprocal obligation and psychological contract. Additionally, understanding how patterned role expectations govern an individual's actions provides insights on innovators' behaviour (Cécora 1999), and equity-based expectations embedded in psychological contracts allow for understanding the notion of fairness and equity in exchange (Rousseau 1989).

3.2.1.1 Psychological Contract

Psychological contracts are beliefs or perceptions that are ongoing, dynamic and implicit in nature, based on the principle of reciprocity and exchange. Thompson and Bunderson (2003) state that psychological contracts primarily driven by economic exchange are transactional in nature, whereas those driven by socio-emotional aspects are relational in nature, and exchanges not limited to self-interest or driven by principle or cause are ideological in nature. According to Rousseau (1989), psychological contracts evolve from the value people generally place on reciprocity. Psychological contracts are useful in discerning the intrinsic aspects of the exchange relationship at the interpersonal level, and are useful in analysing both the expectations and outcomes of the exchange relationship. However, the analytical value of the theory is highly dependent on an individual's interpretation of obligations. Ambiguity over the terms expectation, promise and obligation exist in the psychological contract, limiting its application.

Classical and contemporary social theorists—such as Weber (1978), Schutz (1967), Mead (2009), and others—have shown that expectations are central to human agency (Borup et al. 2006), and exchange objectives can be discerned through the understanding of expectations. The rational expectations literature of traditional economics views expectations from an objective and positivist stance. However, S&T studies take a more constructivist stance and view expectations as performative, attracting the interest of necessary allies (actors in innovation networks, investors,

regulatory actors, users etc.) and for defining roles and building mutually binding obligations and agendas (Borup et al. 2006).

Expectations are central to mobilising resources at the macro, meso and micro levels of innovation networks (Borup et al. 2006), and play a pivotal role in the innovation process (Brown & Michael 2003), including the exchange relationship. They refer to images of the future and effectively link technical and social issues, and the inner and outer worlds of techno-scientific knowledge communities and fields (Borup et al. 2006). The analysis or examination of expectations provide insights on the anticipation of the future but also gives an account of the rhetoric of promises, hopes and fears ingrained in tacit contractual relationships (Brown & Michael 2003). Expectations guide activities, provide structure and legitimatise, attract interest, foster investment, offer a shape of what to expect and how to prepare for opportunities and risks (Borup et al. 2006).

The promissory obligation dimensions of the psychological contract provide insight into the cognitive implications of contracting at the individual level (Thompson & Hart 2006). Here, the psychological contract is a useful guide to discerning the factors affecting actors in construing their personal relationship with institutions (Rousseau 1989; Rousseau & McLean Parks 1993; Thompson & Hart 2006), contractarian ethics (Donaldson & Dunfee 1994) and their perceptions of mutual obligations (Thompson & Hart 2006).

3.2.2 Diffusion Theory

Diffusion theory explains how, over time, new ideas, beliefs, knowledge, practices, programmes and technologies spread and are adopted through various channels of a social system. As Rogers (2003, p. 35) writes: ‘Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system’. Until 1969, diffusion research occurred largely in the field of rural sociology. Later, it was applied to other fields, such as medical sociology, public health,

education, communication, geography, marketing and management, economics, political science and psychology (Rogers 2003).

Sociologist Gabriel Tarde was the first to draw attention to the diffusion phenomenon, which he called imitation. Tarde (2010) suggested that diffusion is a society-level phenomenon of social change. Further, Georg Simmel's work on how interpersonal relationships and social or communication networks are affected by individuals' reactions to innovation provided a micro view and a different dimension to diffusion studies. The terms diffusion and diffusion of innovation gained momentum only after Bryce Ryan and Neil C. Gross' (1943) seminal work on diffusion of hybrid seed corn in two Iowa communities. They conceptualised the notion of stages in an innovation-decision process, and laid the foundations for future diffusion studies, especially by emphasising the locus of decision, role of change agents and importance of different communication channels in the innovation decision process. In 1962, Rogers Everett—the father of the diffusion of innovation—provided a general diffusion model that connected various diffusion research studies. Rogers' idea of the diffusion of innovation is widely accepted, as he assumed diffusion to be a social system process, in which contextual factors are instrumental in the diffusion and spread of innovation. Since 1962, diffusion studies have evolved, and now encompass various fields of research.

Diffusion research is increasingly becoming interdisciplinary. Diffusion theory is integral to the social sciences and innovation studies, as it not only provides an understanding of change processes but has pragmatic appeal, as a means to the provision of solutions. According to Rogers (2003, p. 130), 'it is also important to understand how socio-economic benefits of innovation are distributed among individuals in a social system'. In this context, grassroots innovators' perceptions of their innovation can further help devise diffusion strategies of innovation in developing countries, and the handling of social change. Communication and social system variables are important in diffusion processes, and are the central aspects of diffusion research. Although this theory has a lot to offer, it is criticised for not taking into

account an individual's socio-economic resources for other innovations, and for being vague in its explanation of the scope of diffusion. All of this makes comparative synthesis difficult for the researcher. In this research, diffusion theory is useful for understanding the social system that spreads GI, and for examining socio-technical change, innovation decision processes and other contextual factors that affect the diffusion of GI for commercial use.

Contextual factor may include a change agent and social identity and socio-economic structure. Social identities not only draw insights on the local and regional systems of power, governance and hierarchy but also relate to caste groups (Dirks 2011). Caste system (hierarchy/sense of rank/ordered difference) has been in existence for thousands of years and it is distinctive feature of the Indian society or rather a foundation or core of Indian civilization (Subedi 2013, Dirks 2011, Srinivasan & Kumar 1999). Social order based on division of labour is the essence of the caste system (Srinivas 2003) However; increasingly the social order which has continued for 2000 years or more is rapidly breaking down in India (Subedi 2013, Srinivas 2003). The nuances of caste were explicitly understood under the British colonial rule as it facilitated the organisation of the social identities and relations of all Indians (Dirks 2011). Caste is not the core focus in this research. However, as the GI phenomenon is explored in the Indian context, the notion of caste cannot be overlooked because caste is the still an important aspect of the social order and social relation in India.

Unlike other parts of the world, the Indian caste system is not individualistic; it emphasizes its totality, not its individual members (Dumont 1980). There are four castes or Varnas - Brahmins, Kshatriyas, Vaisyas (Bania) and Shudras (Srinivasan & Kumar 1999). Such classification into four hierarchical orders is a social fact of Indian history (Dirks 2011). According to Dumont (1980), the organising principle of the caste structure or Varna is based on the concept of purity and pollution aligned with the human goal - dharma, artha and kama (duty, profit and pleasure). The man's purpose in life is derived from the varana's or caste they are born in – for instance dharma corresponds to the Brahman or priest who are mainly into sacrifices rituals, knowledge

creation and teaching; artha to the king or Kshatriyas who are mainly into protecting the kingdom and running business or economic activities,and kama to the others who are mainly into serving the community and had been regarded as untouchables (Subedi 2013). Many have criticised Dumont's view and approach to caste as narrow and driven more from religious than the economic and political frames (Subedi 2013, Dirks 2011). A broader conceptualisation of caste includes hereditary specialisation, hierarchy and repulsion (Lunheim 1993). The hereditary association of caste and a specific trade or profession is majorly embedded in birth and local context (Lunheim 1993). The hierarchy entails personal status, as rights and duties which is unequally divided and determined by the rank of the group to which one belongs (Lunheim 1993). The phenomena of mutual repulsion between social groups, division into opposed fragments, isolation at the group level and mechanism to prevent alliances and relations across group boundary such as food taboos or pollution concept (Luneim 1993). The thread that binds all the caste is the doctrine of Karma the key principle of cosmic reality.

The seminal theories discussed here are taken as a framework for exploring lived experiences, which are broad and dynamic. The GI phenomenon through lived experience can be understood through innovation actions and behaviour, social relations and structure and the background and personal characteristics of grassroots innovators. These aspects are intertwined, and their interaction and assimilation is the source of lived experiences.

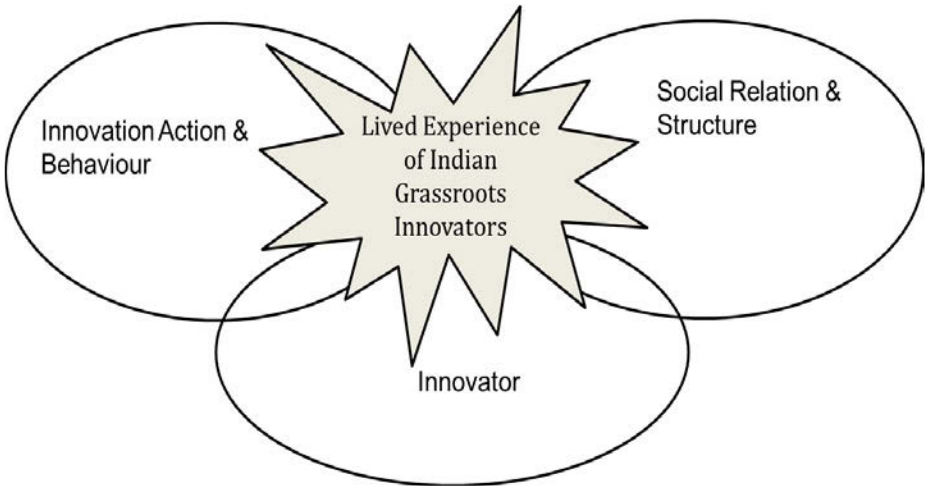

Figure 3.1: Lived Experience of Indian Grassroots Innovators (Self Compiled)

Innovative behaviour is directed at generating beneficial change in order to grow the product or organisation, altruistic concern and creativity (Kleysen & Street 2001). The innate psychological needs affecting the innovative behaviour of Indian grassroots innovators are the joy of work, confidence, autonomy and duty (Bhaduri & Kumar 2011). These are best conceptualised not as personality traits or general abilities but as a behaviour resulting from particular constellations of personal characteristics, cognitive abilities and social environments (Amabile 1983). The seminal literature on innovative behaviour and the exchange relationship relating to this thesis are discussed next.

3.3 Innovative Behaviour and the Exchange Relationship

In general, innovation studies have emphasised only scientific, engineering, marketing and commercialisation pursuits as the building blocks of innovation, and have undermined the human and social elements. Nevertheless, over the past two decades, 'social studies of technology' have emerged to deal with innovation and technological change from a sociological perspective (Weber 2007). Moreover, in the past 25 years, the human and social elements embedded in innovation actions have been studied, and two themes are emerging in innovation studies: (1) the diminishing role of

scientific knowledge and methods in the innovation process, and (2) the increasing role of co-operative and unconventional individuals in the process (Steiner 1995). Thus, innovation is increasingly considered to be a basic social/cognitive activity and not just a functionalist process (Hellström 2004).

Examining innovation as social action, Hellström (2004) argues that the term innovation carries certain semantic contradictions, and requires further exploration from a social action perspective. Innovation is at the intersection of action as a mental activity and physical work (Hellström 2004). It is a social act of ideating a concept/mental object and/or desired goal and then physically acting to create and disseminate a product or unit of adoption (Hellström 2004). There are subtle differences in the notions of behaviour and action. Innovative behaviour denotes the cognitive, reflective and physical response of the innovator for ideating, developing and diffusing innovation.

Hellström (2004) conceptualises innovation as a social action embroiled in a dialectical relationship between actor and action. Here, actors have a practical engagement with purposive action, and such engagement may go before or after the rationality of purpose (Hellström 2004). Work and change are dialectics not only reifying innovation into a set of norm-driven social expectations, but also generating practical consciousness and a normative foundation for action, related to the actor's purpose and practical engagement (Hellström 2004). The normative action (production) and practical consciousness (concept) results in the realisation of the physical manifestation of the preconceived goal and intention (Hellström 2004). Alongside innovation as a normative action, Cécora (1999) states that social roles and status encourage regional innovators to take up the challenges arising from their social and economic environments (Cécora 1999). Social status involves the designated rights and obligations of an individual (Cécora 1999, p. 69).

Innovation is a social phenomenon involving mental activity and physical work (Hellström 2004). Figure 3.2 illustrates Hellström's conceptualisation of innovation as a

social action, where actor is involved in a key act of purposive action individually or as a group (Hellström 2004). The key act is priesis, language of action, which is imperative for the genesis of innovation (Hellström 2004). Overall, the interaction of actor's priesis and purpose generates practical consciousness and a normative foundation for action leading to work and change (Hellström 2004).

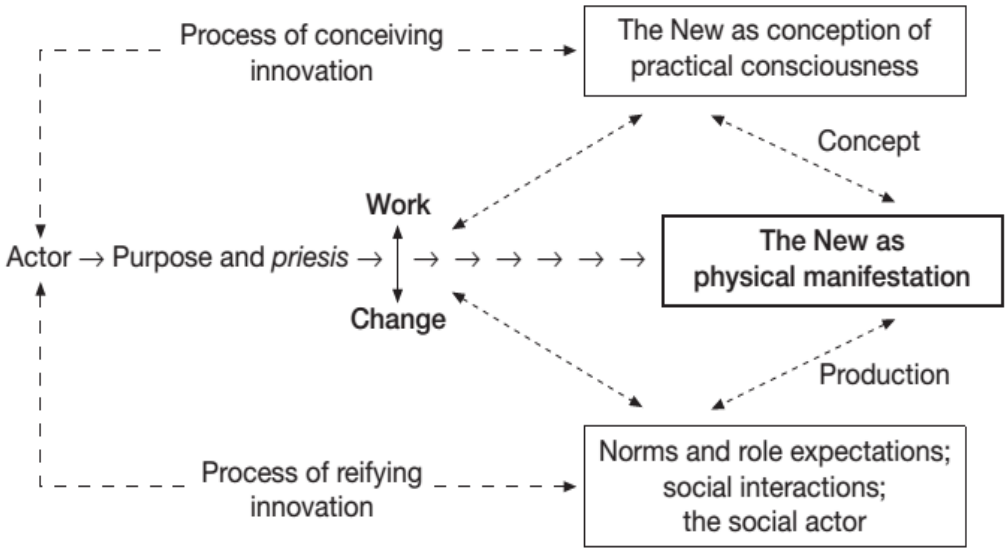

Figure 3.2: Innovation as Social Action (Hellström 2004)

Innovation, which results from the creative idea conceptualised by an individual (Amabile 1983; 1997), is a multi-stage, non-linear process entailing a wide variety of specific behaviours at different stages of innovation (Scott & Bruce 1994). Innovative behaviour is founded on the action of an individual for the generation, introduction and application of beneficial novelty, inclusive of new product ideas or technologies to improve efficiency and effectiveness (Amabile 1997; Scott & Bruce 1994; Schumpeter 1934).

Innovation behaviour involves the generation of ideas and solutions to opportunities, representations and categories of opportunities, and association and combinations of ideas and information (Amabile 1983; Kleysen & Street 2001). Creativity is a precursor to innovation, especially in the generativity stage of innovation. The generation and implementation of new ideas can be driven by many factors. Moreover, the transition

of novel, creative thought to innovation is built on the cognitive abilities and personality of an individual (Amabile 1983). Innovative behaviour also entails opportunity exploration, which relates to paying attention to opportunity sources, seeking opportunities to innovate, recognising opportunities and gathering information about them (Kleysen & Street 2001; Rogers 2003; Amabile 1997). Akin to attentiveness, mindfulness aids the implementation of the idea of innovation and venture creation (Capel 2014).

Formative investigation—an innovative behaviour—relates to the formulation of ideas and solutions, experimenting with and evaluating them (Amabile 1997; Cleysen & Street 2001). Championing relates to mobilising resources (Amabile 1997), persuading and influencing, pushing and negotiating, and challenging and risk-taking (Kleysen & Street 2001; Amabile 1997). The application aspect of innovative behaviour includes implementing, modifying and routinising (Rogers 2003; Kleysen & Street 2001).

Innovative behaviour is based on the creativity-relevant cognitive process and domain-relevant knowledge (Amabile 1983). The former entails a problem-solving approach that helps devise various alternatives, and has been described as an individual's searching of their mind and surroundings to generate potential responses to solving problems. The latter relates to an individual's contextual knowledge of a problem, and their technical expertise and experience necessary in order to devise feasible solutions to a given problem (Amabile 1983). This resonates with the construct of practical intelligence, which entails meta-cognitive abilities (Baum, Bird & Singh 2011). Practical intelligence is a situation-specific, experience-based accumulation of skills, tacit and explicit knowledge and the ability to apply these to solving everyday problems (Baum, Bird & Singh 2011). It shares some commonalities with expertise, decision-making and judgment, and enables problem solving (Baum, Bird & Singh 2011).

Domain-relevant skills, creativity-relevant skills and task motivation are necessary and sufficient constituents of creativity (Amabile 1983). Domain-relevant skills are a composite set of innate cognitive, perceptual and motor abilities with formal and

informal education in the domain of endeavour. However, creativity increases through these skills only if domain-relevant information is organised appropriately (Amabile 1983). Moreover, motivation depends on the work environment, evaluation of expectations, the nature of work, expected rewards, feedback on actual performance and autonomy (Amabile 1997).

Innovative behaviour involves tacit and explicit knowledge, experience, creativity-relevant and domain-relevant skills, practical intelligence with learning orientation and meta-cognitive abilities. The tacit knowledge acquired through one innovation process often provides ideas for successive innovations (Kumar & Bhaduri 2014). Learning orientations are very important for the development of both the innovator and the innovation. Learning orientation (Kolb 1984) relates to individuals' preferred ways of taking in direct and indirect experience, and transforming such experiences into knowledge (Baum, Bird & Singh 2011). The seminal work on innovative behaviour professes that creativity and innovation are essentially cognitive and social processes.

Before discussing exchange and interpersonal relationships, it is important to grasp knowledge production at the grassroots and mobilisation of GI. Smith, Fressoli and Thomas (2014) identified three broad frames of inclusion and knowledge production in the GIM. First is grassroots ingenuity, which emphasises grassroots knowledge and products that cater to the needs of communities, and that are not provisioned through existing markets and state processes (Smith, Fressoli & Thomas 2014). Second is grassroots empowerment, concerning the prospects for transforming local situations by framing innovation as empowering the grassroots to have greater control over their futures (Smith, Fressoli & Thomas 2014). Third is structural transformation, which emphasises the raising of awareness of structural impediments to alternative pathways of innovation (Smith, Fressoli & Thomas 2014).

Informal-sector innovation (such as GI) is mobilised through instrumental (e.g., expertise, skills and capital), relational resources (e.g., reciprocity, status) and an innovator's ability to negotiate collaboration between these resources (Rajan 2013).

These innovations are constantly moving from informal to formal linkages (Kumar 2014).Various actors appear and disappear and affect the nature of social relations at different stages of the innovation process (Kumar 2014). Such issues call for an examination of the forms of exchange and social relations underpinning the GI phenomenon.

3.3.1 Exchange and Interpersonal Relationships

Economists and anthropologists discuss exchange behaviour from rational and relational stances. The former relates to optimising behaviour, and the latter thinks of exchanges in terms of reciprocating behaviour (Meeker 1971). In agrarian societies, livelihood activities are aligned with the need to reciprocate, redistribute and safeguard social standing and status (Polanyi 1957). Exchanges in pastoral communities are usually based on reciprocity, co-operation and fairness. According to Bowles et al. (1997), the individual in this society is *homo-reciprocans*, a conditional co-operator and neither the selfless altruist of utopian theory nor the selfish hedonist of neo-classical economics.

Freeman and Soete (1997) state that innovation is in action only when there is a commercial transaction of a new or enhanced product, process, system or device. The notion of transaction used here is skewed towards a contract that is usually short-term, referring only to monetary, economic and market facets, and overlooking relational, emotional and other moral aspects such as altruism, group gain and community well-being. Transactions are sub-sets of commercial exchange and the later are functional only through exchange relationships and rules that can be explicit or implicit, cognitive, formal and normative (Raven & Geels 2010). Transactional exchanges are usually contractual, impersonal, rational and short-term, and guided solely by economic and monetary exchange objectives. Conversely, relational exchange is long-term, strategic and affects both transactional and relational aspects of institutional arrangements (Haeussler 2010; Kaufmann & Dant 1992; Kaufmann & Stern 1988; Williamson 1985). Therefore, to comprehend the exchange and

interpersonal relationship that expedites GI development, this thesis uses the concept of commercial exchange, as it combines relational behaviour with social, economic and emotional aspects of contracts for innovation.

Commercial exchange is driven by the effectuation of consent, in which the benefits of negotiated deals are reaped through the enactment of exchange relationship (Kaufmann & Dant 1992). A unique governance structure for commercial exchange can be garnered by combining three control mechanisms: price, authority and trust (Kaufmann & Dant 1992). It is important to note that trust is a psychological contract that results from a belief that contributions will be reciprocated and that a relationship exists where the actions of one party are bound to those of another (Rousseau 1989). Trust is a relational manifestation of solidarity, and is integral to relational continuity and governance (Kaufmann & Dant 1992).

Discussing the anatomy of exchange, Anderson, Challagalla and McFarland (1999) argue that the objective of exchange defines and directs the relevant exchange network, process and content. There are two types of exchange: relational and transactional. Table 3.1 presents the differences between relational and transactional exchange objectives, process, content, rules and network. The basics of relational exchanges are widely adapted to studying marketing exchanges (Kaufmann & Dant 1992).

Table 3.1: Features of Exchange

	Transactional	Relational
Exchange objective	• Short-term • Monetary • Rational	• Long-term • Reduce risk • Reduce governance cost • Socio-emotional • Ideological
Process	• Impersonal • One-party investment • One-way communication • Terminates on operationalising exchange	• Personal and partnered • Joint investments and rewards • Two-way collaborative communication for building trust, solidarity and commitment • Continuous or terminates upon mutual agreement
Content	• Economic	• Economic and non-economic
Rules	• Explicit • Rational • Reciprocal • Competitive • Status consistent	• Implicit • Altruistic • Group gain
Network	• One-to-one • Linear	• Many-to-many • Dynamic

Notes: Source: Anderson, Challagalla and McFarland (1999).

The above theoretical foundation facilitates systematic interpretation of the broad elements of the lived experiences of the GI phenomenon: personal, economic, moral and social. These elements are intertwined with the actor (grassroots innovator), their actions (GI) and their interplay (exchange relationship and expectations), which facilitate GI. Personal elements largely relate to an individual's capability, attitude towards innovation and belief system of rights, duty and responsibility, affecting innovation action. The sources for GI lived experiences are the innovators' everyday experiences of innovation and their interaction with the environment for opportunity recognition, ideation, prototyping and scaling of innovations.

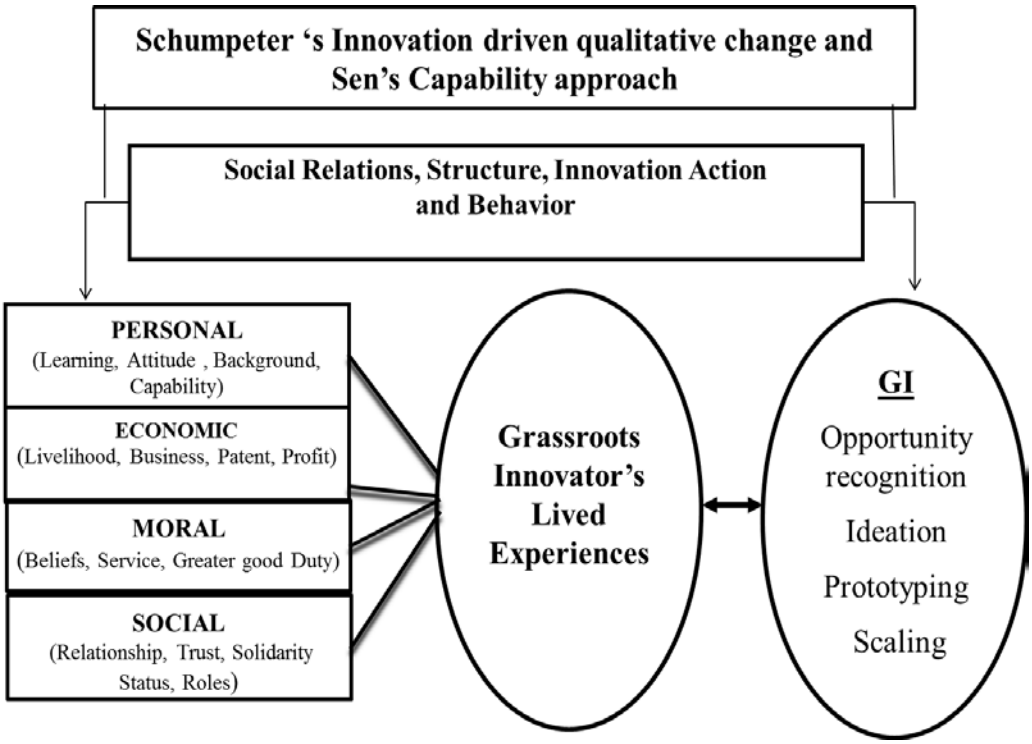

Figure 3.3: Theoretical and Conceptual Framework (Self Compiled)

3.4 Conclusion

Innovation, development and management studies are anchored in social and economic theories. Although informal-sector innovation—such as GI differs on certain aspects from mainstream innovation, it does apply the core concept of innovation studies (Cozzens & Sutz 2012). In this chapter, the theoretical orientation was discussed and analytical spectrum discerned for the systematic exploration of the essence of the GI phenomenon. To further explain and relate the findings of this research to an inclusive innovation and development policy context, neo-Schumpeterian innovation economics and Sen's development ideology were taken as the overarching theories. Therefore, this chapter drew on existing seminal theories and also discussed the macro-micro aspects of innovation action and theories.

Examination of cognitive and social-relation dynamics and the dominant form of exchange and socio-economic organisation embedded in innovation action provide an understanding of the nature and spirit of the GI phenomenon. Innovation is

operationalised through individual innovative behaviour and interpersonal relationships, and is also affected by socio-economic structures. Cognitive psychology and economic sociology stress the human element and social relations and structure affecting innovation conceptualisation and operation. Deeper insights into the innovation experiences of grassroots innovators are gained by exploring the narratives of individuals and their circumstances (Creswell & Miller 2000; Schipper 1999). These will be discussed in detail in the next chapter.

Chapter 4: **Research Approach**

4.1 Introduction

In the academic and policy debates on development, the essence of the GI phenomenon and the voices of grassroots innovators have been overlooked. Little is understood about the phenomenon from the perspective of grassroots innovators. By understanding grassroots innovators' innovation experiences, their interpretation of the innovation phenomenon and their feelings about being grassroots innovators, this thesis explores the nature and spirit of the GI phenomenon. The overarching research question is: What is the essence of the lived experiences of GI for Indian grassroots innovators? Deeper insights into the innovation experiences of grassroots innovators are sought by taking into account individuals' narratives and exploring their circumstances (Creswell & Miller 2000; Schipper 1999). This thesis is anchored in the phenomenological research tradition, and it explores the phenomenon through the eyes of grassroots innovators. The purpose of this chapter is to explicate the philosophical and methodological framework that underpins this study, to outline the phenomenological approach and research strategy to discern the essence of GI through the lived experience of grassroots innovators.

A phenomenological research approach describes an experience, rather than explaining it. It also illuminates the meaning that individuals derive from their experiences (van Manen 1997), and draws on a phenomenological philosophical research approach. Lived experience, although subjective in nature, is a social reality rooted in existential phenomenology. Experiential stories provide opportunities for suggesting and reflecting on practice (van Manen 2007). Taking into account the macro and micro sociology of the GI phenomenon, this thesis analyses what grassroots innovators do, say and think in the actual progression of their experiences. Grbich (2007) defines phenomenology 'as an approach that attempts to understand the hidden essence of an experience of the phenomenon under study'. It is suitable for

discerning the complexity of the meaning rooted in one's time and place and the doing and being aspects of a phenomenon.

Utilising a phenomenological approach to uncover GI experiences, this research attempts to describe and interpret the essence of innovations through the eyes of grassroots innovators. The term 'research' refers to the investigation of a topic with a justifiable theoretical and methodological approach. Research is an intricate interplay between researcher, environment, research purpose and methodology. Systemic research recognises the researcher's own worldview and understands the research's paradigm or theories, strategies and methods. Four basic elements—epistemology, theoretical perspective, methodology and methods (Crotty 1998)—help align the research tenets with the research design and process. Understanding the research paradigm is integral to any research project, as it affects the research enquiry and design decisions. Figure 4.1 provides the blueprint of the research paradigm, outlining an area of study, a key research question, the epistemological stance, theoretical perspective and data analysis and collection methods. Qualitative research is intrinsically exploratory in nature, and is a valid form of research that focuses on subjective reality. Denzin and Lincoln (2011) describe qualitative research as having a multi-method focus involving an interpretive, naturalistic approach to studying the subject, and attempting to make sense of or interpret phenomena in terms of the meanings people bring to their natural settings.

Epistemology	Theoretical perspective	Research approach	Data analysis strategy	Methods
Constructivism	Interpretivism	Phenomenology	Interpretive and descriptive analysis	Open-ended, in-depth interviews
Area: GI Key research question: What is the essence of the lived experiences of GI for grassroots innovators in the Indian state of Gujarat? Data collection: Exploring the innovation journey of Grassroots innovators through open-ended in-depth interviews Data analysis: IPA through the analysis of narratives.				

Figure 4.1: Research Paradigm (Self Compiled)

4.2 Overview of Research Philosophy

Social science research can be conducted using various research paradigms. There are two major research paradigms: positivist and phenomenological (Guba & Lincoln 1994;Smith 1998: Robson 2002). The former includes logical positivism and uses quantitative and experimental methods to test hypothetical-deductive generalisations. The latter relates to phenomenological inquiry, based on the use of qualitative and naturalistic approaches to understand human experience inductively and holistically (Robson 2002). These two paradigms help align the research methodology to the research question (Crotty 1998), link the questions being investigated to the research purpose and available resources, and help the researcher be situationally responsive (Patton 2002).

The paradigmatic distinction of positivism and the interpretive view is prominent in the philosophy of science. The subject-object duality and perception of reality as the objective truth, separate from the subject or *a priori* meaningful entities or institutions, is the basis of Descartes' (1960) Cartesian philosophy of duality, subject versus object/mind versus reality. The epistemology of traditional sociology has been criticised for such dualism and its absolutist stance towards the study of natural phenomena (Adler, Adler & Fontana 1987). Further, the positivist stance and procedure of objectification, detachment, control and manipulation of abstracted concepts and variables in social science research violates the integrity of the phenomena under study (Adler, Adler & Fontana 1987). Such objectivist and detached approaches to sociology tend to view reality as a physical structure or process, with humans responding or adapting to reality in a mechanistic manner (Morgan & Smircich 1980). Concurrently, the basic tenet of the constructivist paradigm is that reality is subjective and constructed by and between people (Guba & Lincoln 1994). Realities, according to Morgan and Smircich (1980), are not concrete, but are the projection of human imagination. The naturalistic approach seeks to understand phenomena within their own context-specific settings. Moreover, social realities are reflexive and contextual in nature (Weber 1978). The focus of phenomenology is not to

find ‘new facts’ but to generate enriched interpretations of the familiar in the ‘real world’, which are usually taken for granted (Steiner 1995).

Researchers within a positivist paradigm have also sought to reify innovation as an object. Innovation in such studies is taken as a physical thing, that which is ‘outside’ of the people emphasising innovation management, rather than interpretation-driven innovation dynamics (Hellström 2004). Consequently, such views lead to a calculative treatment of innovations and social relations (Hellström 2004). Regarding studies relating to Indian GI, it is observed that the majority of studies on GI and grassroots innovators contain a subject-object duality. For instance, a survey on motivations with predefined variables (Bhaduri & Kumar 2011) leads to a deductive examination of the objective nature of innovation, and understands innovation to be separate from the innovator, thereby undermining the individual nature, social action and social structure in which innovation and individual perceptions are embedded. It can also be asserted that perceptions cannot only be grounded in positivist thinking, in which reality is considered fundamental and not reliant on individual meaning (Creswell & Miller 2000). Rather, it should be gathered through exploration of the intentionality and subjective reality of those with first-hand experience of the phenomenon.

Similarly, studies relating to network relations in GI largely explore the phenomenon with predefined variables, and treat innovation as an objective reality. Moreover, the objective reality of GI phenomena is usually gained from examining contracts, transaction records and archived notes on innovations. These records also fail to provide insights into the intentionality of the innovators and their worldview. Intentionality refers to the internal experience of being conscious of something (Moustakas 1994). To understand and interpret the human nature of innovation projects, the philosophy of human nature can be a useful framework (Steiner 1995).

4.2.1 Phenomenological Framework

Use of the term phenomenology in philosophical texts dates back to Brentano (2012), Kant and Hegel (1977). The word 'phenomenon' comes from the Greek *phaenesthai*, meaning to flare up, to show itself, to appear (Moustakas 1994). Edmund Husserl (1999) formally stressed the importance of phenomenology to scientific inquiry. The core tenet of the phenomenological philosophical tradition is the inseparability of the essence and the phenomenon.

Phenomenological research is anchored in the philosophical traditions of Husserl (1999), who described phenomenology as the way that knowledge comes into being, from an individual's experience with a phenomenon (Schipper 1999; Thévenaz & Edie 1962; van Manen 1997). As van Manen (1997, p. 9) wrote:

> "Phenomenological research is the study of lived experience…Phenomenology aims at gaining a deeper understanding of the nature or meaning of our everyday experiences. Phenomenology asks, 'what is this experience like?…Anything that presents itself to consciousness is potentially of interest to phenomenology, whether the object is real or imagined, empirically measurable or subjective field."

Lived experience, according to van Manen (1997), is purely experience-as-we-live-through-it in our actions, relations and situations.

Epistemological, ontological and methodological issues within phenomenological research have led to a variety of different methodological applications for phenomenology. Despite the diversity of phenomenological forms of inquiry (Crotty 1998; Seidman 1998; Thévenaz 1962), all forms converge in their goal to gain in-depth understandings of the phenomenon at hand (van Manen 1997; Williams 2008). A major point of difference in each of the varied phenomenological traditions is the manner in which lived experience is explored. For instance, classical phenomenology stresses the objective aspects of lived experience, whereas new phenomenology emphasises the subjective aspects (Crotty 1998).

Unlike Husserl (1999), Heidegger (1962) stressed the understanding of lived experience through its interpretation, which is that a fundamental sense of things fits naturally

into our ordinary, everyday activities. Meaning resides in referential totality, which relates to historically learned practices and background understandings of the world as a holistic web of interrelated things (Heidegger 1962). According to Heidegger (1962), our being is inseparably woven into the wider context of the world and community, and we exist in an already-interpreted world. Further, being is inseparable from doing, and we are always practically engaged in the context of life (Heidegger 1962; van Manen 2007).

Based on such an ontological view, Heidegger stressed hermeneutics as a research method. Hermeneutics—the theory and practice of interpretation—offers a way of understanding lived experiences as captured through language and in context (van Manen 1997). It is useful for interpreting and determining the intention and meaning of experiences (Moustakas 1994).

Experiences are contextual, so cannot be inferred with pre-defined variables and categories. Experiences are integral aspects of our life stories. They are manifested through mind, which is not directly observed but only inferred. An experience implies consciousness and perceptions of sensory, physiological events. According to Boud, Keogh and Walker (1985, p 18):

> "experience is the total response of a person to a situation or event and it constitutes what he or she thinks, feels, does and concludes at the time and after".

Where do these stories start, and what makes them? What should be included in and elaborated on in life stories? Hermeneutic phenomenology seeks to bring to the essence of a lived experience an interpretive, descriptive text that acknowledges the complexity of the experience (van Manen 1997).

An essence is what makes a thing what it is, and without which it would not be what it is (van Manen 1997). Hermeneutics allows for the interpretation and articulation of how practitioners, or the person-in-context, make sense of their lived experiences. While the focus of hermeneutics is on how we know, the ontological focus of phenomenology is on what it means to be. Combining these two basic tenets of an

experience in the phenomenological tradition, a hermeneutic phenomenological research method is employed to understand GI phenomena as it is experienced by grassroots innovators. Therefore, keeping in mind the purpose of this research, a hermeneutic phenomenological form of inquiry—which investigates the interpretive structures of experience—is considered most appropriate for analysing the qualitative data and adding rigour to the investigation. Here, the sources for the essence of grassroots innovators' lived experiences of GI are the everyday experiences of innovators, their background and interaction with the environment for opportunity recognition, ideation and scaling of GI. Thus, interpreting phenomena in terms of the meanings grassroots innovators bring to their natural settings (Denzin & Lincoln 2011) renders rich insights into the phenomena.

Innovation constitutes innovators' self and dialectical action of innovating, inclusive of human nature and innovation artefacts (Hellström 2004). Innovation embodies human endeavour that is unique, unconventional and co-operative, and not just an intellectual scientific pursuit (Steiner 1995). Therefore, innovators' views on their innovation experience are important, because such views reflect the values and beliefs of individuals in a social system (Rogers 2003). A social system is a 'set of interrelated units that are engaged in joint problem solving to accomplish a common goal' (Rogers 2003, p. 23). Structure can be defined as 'patterned arrangements of the units and social relationship among the members in a system' (Rogers 2003, p. 24). Thus, to explore the individual experiences of participants in detail, qualitative methods within interpretive paradigms are very useful (Denzin & Lincoln 2011). The constructivist episteme and interpretive perspective are compatible with this research inquiry, in which grassroots innovators and GI are constantly evolving, affecting each other and generating the essence of the phenomenon.

The phenomenological conceptions of truth, inference, rationality and consciousness echoes Indian psychological conceptions of states of mind. There is practical, emotional and moral significance to these states, which can only be explained through introspective examination (Mohanty 1992). The convergence of phenomenological

philosophical traditions and Indian philosophy provides a valid ground for the findings, and facilitates the proper contextual inference of the narrative accounts shared by Indian grassroots innovators.

Echoing the Heideggerian hermeneutic phenomenology of being-in-the-world, van Manen (1997) suggests that to ask for the being of something is to ask for the nature or meaning of that phenomenon. Hence, being-in-the-world refers to the way humans exist, act or are involved in the world (van Manen 1997). Further, Heidegger's existentialist philosophy suits the exploration of innovation phenomena because innovation is manifested through humans, embedded in the social action of an individual (Hellström 2004). Thus, a phenomenological grounding can provide holistic and deep insights into the essence of grassroots innovators' lived experiences of GI phenomena.

4.2.2 Role of the Researcher

The focus of phenomenological study is to bring out the conscious experiences of respondents through their perceptions, and present their essence as perceived by respondents. According to van Manen (1997), the purposes of phenomenological inquiry are description, interpretation and critical self-reflection of the world as world. Therefore, researchers should bracket the understandings, beliefs, biases, theories and assumptions they hold about the phenomenon being studied (van Manen 1997) so as to allow them to eliminate everything that represents presupposition. Thus *epoche,* or freedom from suppositions, is central to the phenomenological research approach, as it allows more accurate insights and in-depth understandings of lived experiences from the participant's own perspective (Moustakas 1994).

A researcher's reflective journal allows the researcher to not only be aware of and check their own biases and presumptions, but also to engage in the experience without preconceived notions about outcomes. Reflexivity is considered to be an important dimension in the design and implementation of this research. van Manen

(1997) refers to reflection as hermeneutic alertness, whereby the researcher steps back in order to reflect on the meaning of a situation as it is presented, rather than imposing their pre-conceptions and interpretations. Reflexivity that unveils the understanding and awareness of the researcher is an integral aspect of hermeneutical phenomenology.

Reflexive processes were extensively used in this research. Apart from observation and the taking of field notes after participant interviews, the researcher also reflected on the literature, methodology, sampling and key themes. Thus, by constantly reflecting on the research questions, methods, and the researcher's and participants' experiences, research can present a detailed account of the essence of a phenomenon, as situated in the lived world of the person-in-context. These reflective processes helped the researcher maintain a personal reflection, which led to honest and transparent records.

Although a phenomenological frame of inquiry is believed to resist the tendency toward constructing a predetermined set of fixed procedures, techniques and concepts that could govern the research, which should be without presuppositions (van Manen 1997), the literature acknowledges diversity within phenomenological forms of inquiry (Seidman 1998; Thévenaz 1962). Therefore, this research explores GI experience through a broad conceptual framework, but does not aim to validate or generate theories.

4.2.3 Phenomenological Approach in Innovation Studies

In the philosophy of innovation, Steiner (1995) emphasises the role of individuals in innovation. She suggests that unconventional individuals are more central to innovation than to the conventional science of engineering. Her argument is based on the Heideggerian philosophy of human nature, which is significant for the holistic view of successful innovation and provides a means for understanding and interpreting the human elements of a particular innovation project. Although Steiner's (1995) philosophy of innovation provides a framework for assessing organisational or

personal approaches to innovation, the approach is discussed only in the context of mainstream, formal and lab-based research. In this thesis, the Heideggerian philosophy was extended to operationalise the essence and structure of the GI phenomenon spearheaded by unconventional individuals from the rural and marginalised sector.

The majority of studies relating to innovation and technological development involving the role of individual and agency are ethnographic or quantitative. There are few studies on innovation using a phenomenological philosophy, so there is a scarcity of knowledge on the role of human nature and innovation dynamics. The lack of theoretical and methodological literature can be both a limitation and opportunity for this study, which attempts to comprehend the GI phenomenon through a phenomenological approach.

4.3 Research Design

Decisions regarding research design in the social sciences relate to creating knowledge for understanding (Scott & Shore 1979) and knowledge for action (Majchrzak 1984). It is beneficial to turn research questions into projects (Robson 2002), and to align strategies of inquiry and data collection to answer specific research questions appropriately (Creswell 2008; Maxwell 2012). The two integral elements in any research project are purpose and data, and the research framework decision hinges on these elements. Hence, the commonly known research frameworks—quantitative, qualitative or mixed—are based on the logic of purpose, types of data and field of study. Here, qualitative research refers to a particular research design, rather than the looser meaning of any research that does not produce quantitative data (Miles & Huberman 1994; Patton 2002). Alternatively, Strauss and Corbin (1990) define qualitative research as any research that produces findings not arrived at by statistical procedures or other means of quantification. However, qualitative research has no clear-cut definition, and is ascribed to various research paradigms, methods and characteristics. Qualitative research is emergent (Denzin 1970; Patton 2002) and

possesses a series of non-linear interactions involving design, data collection, preliminary analysis and re-design (Gray 2013). It is not built upon a unified theory (Flick 2014), adopts various theoretical stances and methods, and uses a set of interpretive material, observations, interviews, questionnaires and document analysis (Denzin & Lincoln 2011; Gray 2013).

Keeping in mind the principles of research design and the purpose of the study, this thesis explores the essence of the GI phenomenon, utilising a phenomenological approach. The researcher's role was to gain a deep, intense and holistic overview of the study's context. The life stories of the grassroots innovators were audio-recorded and notes and a reflective journal were maintained. A few grassroots innovators allowed video recording or still photography, so image and video files were also kept. Further, some grassroots innovators provided additional artefacts, such as printed documents, about their innovation or firm (where they had turned entrepreneur).

4.4 Research Strategy

A suitable approach within qualitative research and hermeneutic phenomenology—as informed by the work of Max van Manen (1997)—was chosen for this research. The phenomenological nature of this research fits Indian culture, which is attuned to storytelling. To encourage the participants' storytelling, unstructured and open-ended interviews were conducted. The questionnaire helped the researcher retain focus on the purpose of the study, and to guide participants when they required prompts. The aim of phenomenological research is to borrow other peoples' lived experiences, as rich, experiential data from a few productive individuals is more valuable than a large number of experiences. The literature on phenomenology gives a range of between five and 25 as the norm for this type of research (van Manen 1997).

There are various opinions on the minimum number of interviews required in qualitative research, and sample sizes range from one to 150 (Baker & Edwards 2012). Adler (1987) suggests aiming for a sample of around 30, as this medium-sized pool

offers the advantage of penetrating beyond a very small number of people without imposing the hardship of endless data gathering, especially when researchers are faced with time constraints (Baker & Edwards 2012). In phenomenological research, only a limited number of people should be interviewed, as the focus is on qualitative matters (Hycner 1985, van Manen 1997).

All participants were sourced through the NIF, which maintains a database of grassroots innovators and publishes a National Innovation Award that cites grassroots innovator details. Grassroots innovators (the participants) were recruited through a community workshop arranged and run by the NIF. The NIF has established community workshops in rural areas so that grassroots innovators in the region can access fabrication facilities and learn from the experiences of such innovators. The participant recruitment plan was devised and followed with the research purpose in mind. The search was narrowed down through purposive sampling, which is important as phenomenological exploration's strength comes from the type of participants chosen and their ability to fully describe the experience being researched (Hycner 1985). Next, a list of participating grassroots innovators was prepared and discussed with the NIF mentor, particularly regarding the feasibility of interviewing the listed participants through community workshops. NIF personnel assisted the researcher in co-ordinating and scheduling interviews.

Fourteen interviews were scheduled, but only 13 participants were interviewed (one participant was admitted to hospital with a stroke, so the researcher refrained from interviewing this person). The researcher approached all 13 participants with the information sheet and consent letter in the local language. A few participants asked the researcher to read the information sheet and consent letter as they were barely literate. A copy of the information sheet was given to all participants. They agreed to be interviewed, member checked and signed-off.

4.4.1 Sample and Data Collection Procedure

The participants of this research were Gujarati grassroots innovators from agricultural and non-agricultural backgrounds, who were willing to share their stories of innovation. Grassroots innovators' stories from Gujarat were the target. The reason for selecting this region was consistent access, proximity and language. The researcher is from the same region and ethnic background, simplifying the operationalisation of interviews. The researcher's familiarity with the region and people aided deep and rich insights into the phenomenon under investigation (Strauss & Corbin 1990). Budget constraint was also one of the reasons for limiting data collection from a single state only.

Data was collected through purposive sampling, as participants with experience of the investigated phenomenon were required. The stories were grouped based on farm implements (bicycle sprayer for watering small farms, cotton stripping machine, groundnut digger-cum-separator) and others (air curtain, healthcare chair, incense stick machine). The cases selected represent opportunity recognition, ideation and the commercial scaling-up aspects of GI.

Taking into consideration the life story research inquiry and length of time, the innovation journeys of 13 grassroots innovators were taken as the sample pool. As this research took a phenomenological approach, this sample size allowed in-depth engagement and detailed examination of each case. Seidman's (1998) approach to phenomenological interviewing was followed. This allows in-depth access to a participant's experience and an opportunity to reflect more closely on the essence of the experiences of the phenomenon investigated. This interviewing approach suggests structuring the interview process to meet each participant on three separate occasions, making it possible to bring together a participant's life history and their experiences with the meaning they make of these experiences. However, due to time constraints and access issues, the researcher interviewed participants just once, but incorporated the three-stage process (proposed by Seidman) through an extensive

interview of 30 to 90 minutes at each stage. The researcher unassumingly examined participants' life experiences, allowed herself to be guided by the participants' responses (as suggested by Seidman 1998) and followed the interview protocol advised by van Manen (1997). Thus, this research took a phenomenological approach and incorporated it into a broader qualitative interview, to explore how participants' lived experiences were situated.

The lived-experience stories that respondents told, stories found in the data and narrated in the research reports were subject to qualitative data analysis. Baker and Edwards (2012, p. 106) suggest that stories are the 'preferred sense making currency of human relationships'. Thirteen lived stories of grassroots innovators were collected through semi-structured interviews, which were conducted in the local language and translated and transcribed into English by the researcher who speaks, reads and understands both. Specialist software—such as NVivo version 10—was used for data management, coding and modelling (Richards 1999). To record the data collected through interviews, field notes, a reflective journal and audio recording were undertaken. Analysis of this data not only uncovered experiences but also discerned the underlying social, moral, cultural, emotional, personal and economic influences, embedded in GI phenomena.

4.4.2 Interpretation and Analysis

Interpretation, reflection and sense-making are an integral aspect of research analysis and reporting. Hermeneutics adds an interpretive element, revealing the meanings and assumptions within respondents' narrative accounts. The origin of meaning is situated in an individual's action and physical aspects of the inhabited world (Heidegger 1962; van Manen 2007). Further, hermeneutic phenomenology allows abstraction, interpretation and articulation of the lived experiences of the person-in-context. To make sense of meanings embedded in lived experiences, interpretive phenomenological analysis (IPA) is useful, so was used in this study.

Usually, IPA study is undertaken with a small number of respondents, and involves detailed, intensive analysis of narratives produced by the respondents. According to Robson (2002), exemplary IPA studies concentrate on specific individuals, as they are the person-in-context dealing with specific situations or events. Here, specific individuals were grassroots innovators, and the specific situations were in relation to GI experience and other life events shaping GI action. IPA processes consist of two interpretations: participants' meaning-making or interpretation of their own experiences, and the researcher's sense-making or interpretation of the participant's account (Smith & Osborn 2003). The focus of IPA is on understanding the lived experiences of people-in-context, and the meanings these people attach to their experience of the studied phenomenon.

The researcher's sense-making of participants' experiences and reporting of the meanings participants attach to these experiences involves reflecting on the complex task of interpreting and describing narratives. The text consisting of grassroots innovators' lived-experience narratives was interpreted using Hernadi's (1987) hermeneutic triad, entailing explication, explanation and exploration. Explication is an initial scanning or naïve reading of the text, whereby the reader tries to make sense by asking what the text says. At this stage, the researcher sifts through and decides which meanings to reproduce and which to ignore. The second step is explanation, where the reader critically deconstructs conflicting logics, implications and inconsistencies embedded in a text. The third step, exploration, includes the researcher's reflections on their construction of their own story through textual analysis. Table 4.1 presents Hernadi's (1987) hermeneutic triad for interpreting text.

Table 4.1: The Hermeneutic Triad (Hernadi 1987)

Explication	Explanation	Exploration
Standing under	Standing over	Standing in for
Reproductive translation	Inferential detection	Existential enactment
Reconstruction	Deconstruction	Construction

In this thesis, grassroots innovators' positive and negative narratives of their lived experiences of GI were reproduced through explication. Explanation was undertaken by analysing the narratives in the context of individual attributes and deeper structures facilitating or inhibiting innovation experiences. Finally, exploration was undertaken through the researcher's personal reflection on her research practice, as she existentially constructed and enacted meaning from the GI lived-experience narratives.

The major challenge in hermeneutic phenomenological studies is to ensure the credibility of the study, and maintaining rigour in the findings and discussion. This research first provides thick descriptions, or detailed accounts, of the innovators' experiences (Creswell & Miller 2000; Miles & Huberman 1994). Then, it turns to the participants—in this case, grassroots innovators—to ensure that the findings reflect their perceptions of their experiences (Smith & Osborn 2003).

The constant cross-checking of interpretations against the original transcripts allowed maintenance of the closeness and authenticity (Denzin & Lincoln 2011) of the findings. The researcher's role is integral to the provision of authentic and valid accounts of lived stories. Determining validity is a challenging task in phenomenological study, and relies on thorough and true reflections of the essence of a phenomenon experienced by participants and member checking. Through member checking the validity procedure shifts from the researchers to participants in the study (Creswell & Miller 2000). For establishing credibility member checking is an important aspect of qualitative research (Guba & Lincoln 1994). This process of validation involves taking data and interpretations back to the participants in the study and checking and confirming with them the accuracy and the credibility of the information and final narrative accounts (Creswell & Miller 2000). Validity and authenticity can be added by reporting a few sets of raw data and allowing for a holistic interpretation of participants' understandings of experiences.

Analysis and interpretation started by organising data, reading through it, coding it and describing categories or themes. Once the study phenomenon was selected, the lived

experiences of the phenomena were investigated via open-ended interviews. During the interview, researcher made a note of non-verbal cues: body language, gestures, facial expressions and paralinguistic elements of communication such as pauses, emphasis, tone, rate and volume. These non-verbal communications were deciphered using my own understanding of the Gujarati culture. Furthermore, these cues were interpreted, analysed and explained through Hernadi's (1987) inferenctial detection method. While translating and transcribing the recorded interviews, verbal and non-verbal cues were noted and verified from the field notes. After transcription, initial scanning and interpretation was performed, with the aim of getting a sense of the data-set. van Manen (1997) calls this process 'immersion' in data, and considers it very important because not only does it provide a 'sense' of the collected data, it also facilitates coding. After an iterative reading of the text, the dataset was organised into text. Simultaneously, preliminary interpretation was undertaken, which facilitated understanding of the text and subsequent coding. The first order of respondents' constructs were identified through thematic coding, and on preparing the list of phrases used by respondents. Then, abstraction and ordering was performed through the grouping of units of meaning and themes.

4.4.3 Coding Procedure

According to Strauss (1987, p. 27):

> "Any researcher who wishes to become proficient at doing qualitative analysis must learn to code well and easily. The excellence of the research rests in large part on the excellence of the coding."

Hence, coding is an important aspect of qualitative research that allows analysis (Miles & Huberman 1994) and linking of ideas (Richards & Morse 2007). According to Coffey and Atkinson (1996), coding enables the breaking of data apart in analytically relevant ways, in order to point towards further questions. Thus, codes are essential to capturing elements of the research story that facilitate the development of themes and analysis of connections (Saldaña 2012). Therefore, extracting and categorising themes from the stories is an integral aspect of making sense of the data collected. As van Manen (1997, p. 88) has stated: "Themes represent the needfulness or desire to

make sense [through] the process of insightful invention, discovery, and disclosure [providing] the means to get at the notion of the experience."

For coding, the transcripts were read and filtered many times. Notes were made in the transcripts, and a few important phrases and words were underlined. This immersion in the data and close interaction with the text helped the researcher analyse and interpret the data. Transcripts were examined thoroughly, and were divided into statements organised into knots of essential themes, using Creswell's (2008) horizontalisation process. Each unit of meaning embedded in the transcripts was coded, keeping in mind the purpose of the research.

Based on the research questions, a list of *a priori* codes was prepared. However, while coding with list, transcripts revealed some concepts, ideas and meanings that were different from the *a priori* codes. Therefore, a list of emergent codes was also prepared. Codes were selected based on the theoretical coding for conceptualising the studied phenomenon, and were used as representations of the phenomenon. All codes were then linked and grouped together with a hierarchy, as they shared an associative relationship with the phenomenon. Memorable quotes and recurring phrases were marked and coded separately under the headings 'Quote' and 'Phrase List'. There is no standard for the number of codes to be used in qualitative research. However, Creswell (2008) recommends lean coding, with five to six major themes. Similarly, Wolcott (1994) advises three as an elegant number for reporting qualitative work (Saldaña 2012). Initially, this research used 30 codes, which were then grouped and collapsed during the second cycle of coding to three primary and 20 secondary codes. Coding was performed using NVIVO version 10 software.

A directory of participants' phrases was prepared, because such a directory supports the related themes and also helps when translating themes into a narrative account (Smith & Osborn 2003). Certain terminology used in the findings is from the respondents own words and hence retained. Thick descriptions were provided, to reflect the relationship between themes or common meanings that emerged from the

data. Thick description also provides the collected data with credibility, and contextualises the applicability of the finding (Creswell & Miller 2000). Thereafter, synthesis of themes through a connecting strategy and thick description was undertaken to compare themes across the data set. Last, the essence of the phenomenon was illustrated by linking the literature to the themes identified, and reconstructing interpretations into stories. An overview of the stages and processes of data analysis is presented in Figure 4.2.

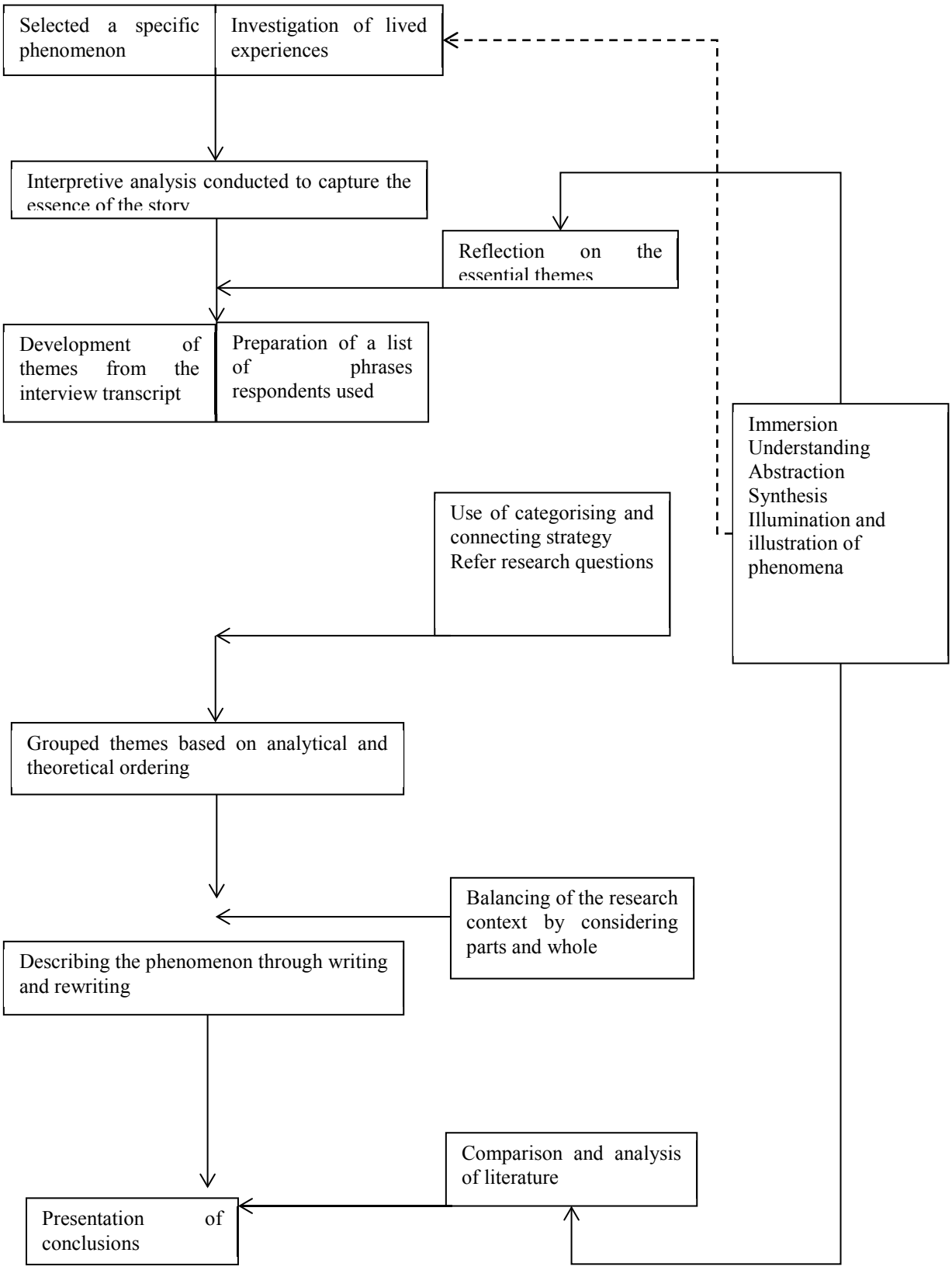

Figure 4.2: The Stages and Process of Data Analysis (Self-Compiled)

Through focus, deep immersion and thorough reading of the narrative accounts of grassroots innovators, themes and meaning is scouted, to describe the essence of a phenomenon. Sense-making is done through storytelling; therefore, snippets of the storied life of the GI take readers to the situated reality of the GI. According to Weick (1995), sense-making is reliant on storytelling as a way of comprehending experiences, ascertaining causes of events, talking about things that are absent, providing knowledge or a guide to action, and conveying shared values, meanings and beliefs. The researcher continuously reflected on the experiences shared, and was involved in making sense of the narratives in context. Sense-making involves reflection, and is the social process of telling, interpreting, analysing, writing and reading (Riessman 2003). van Manen (1997) posits that a reflective attitude is gained only through writing and re-writing. As the researcher moved between description of the grassroots innovators' lived experiences and her own reactions and interpretations of these experiences, the information seemed to naturally evolve, reflecting the journey grassroots innovators had experienced. A deeper and layered reflection of the experiences and the essence of the phenomenon were presented through rich descriptive language in the research report. This research is driven by the primary assumption that all humans feel a need to be connected, able to grow, develop and contribute meaningfully to life.

4.4.4 Limitations

The phenomenological approach brings out thoughtful, attentive and reflective practices from the shared experiences. However, interpretation is highly dependent on the interpretive ability of the researcher, and the descriptive ability of the participant. These issues were overcome through proper reporting and member checking. The focus of this research is on the experiences that are unique to the respondents in their individual setting. This makes it hard to generalise the findings generated from the research, and to further use these findings for broader policy decision. If the hermeneutic process is not operationalised effectively, it can lead to misinterpretation of the meanings and experiences of the participant. Additionally, a retrospective viewpoint of lived experiences can alter narratives, making them different from the experiences (Hycner 1985). However, the passing of time allows a much fuller verbal

description because the participant has had an opportunity to reflect on the experience and integrate it, consciously and verbally (Hycner 1985). Moreover, the researcher's understanding may not blend with the participant's perspective, and this can hinder the researcher's interpretation. However, this issue was overcome as both the researcher and participants spoke the same language, and were from the same ethnic background. There were a few instances of misunderstanding, which were corrected through re-questioning and member checking. Phenomenological researchers have been criticised for drifting too far from phenomena and focusing on individuals' subjective experiences of phenomena (Crotty 1998).

4.4.5 Ethical Considerations

As the research involved interviewing human participants, the University of Technology Sydney Research Ethics Guidelines for Research Involving Humans were followed during data collection, analysis and sharing of the research findings. Ethics approval for this research was granted on 18 October 2013. (Human Research Ethics Committee approval number 2013000563)

4.5 Conclusion

This chapter has elaborated on the research paradigms and approach that formed the basis of the fieldwork conducted to study the lived experiences of grassroots innovators. With the research inquiry in mind, this chapter argued that a phenomenological research approach is ideal for studying the nature and spirit of the GI phenomenon. In this exploratory qualitative thesis, the Heideggerian hermeneutic phenomenological approach was taken, with an aim to explicating lived experiences and revealing meaning through a process of understanding and interpretation. This thesis is developed on the core belief that innovation is a social action; society is constantly being remade and is a network of heterogeneous elements. The purpose of this research is to study the grassroots phenomenon, describe the world-as-experienced by grassroots innovators who participated in this inquiry and discover the essence of the GI phenomenon. This research approach allowed grassroots innovators'

experiences to be presented in both a direct and referential manner, thereby encouraging the reader to enter imaginatively into the experiences related in the narrative accounts. This chapter has outlined the various facets of phenomenological philosophy and lived experiences, and has commented on the research operationalisation strategy inclusive of sampling, participant recruitment and ethical considerations. The following chapter will report the empirical findings from the fieldwork.

Chapter 5: **Lived Experiences and Findings**

5.1 Introduction

The purpose of the research was to understand and discern the essence of the GI phenomenon, as experienced by the innovators. Lived experiences are those that are situated in reality and enacted through feelings, memory, choice, settings and context. The 13 grassroots innovations are all different, and the experience of each is unique. Therefore, assuming that all grassroots innovators have the same experiences of innovation generation, development and diffusion is erroneous. An attempt has been made to identify the seemingly unique experiences of the innovation phenomenon, and each grassroots innovator's innovation experiences have been taken as individual cases, broadly categorised as innovation action, environment, interaction and actor. The findings and analysis are further validated through member checking, to ensure the integrity, authenticity and credibility of data.

Thirteen individuals involved in innovation pursuits at the grassroots level and who were recognised as grassroots innovators were interviewed for this study. Data was coded and interpreted using Hernadi's (1987) hermeneutic triad of explication, explanation and exploration. Through hermeneutic phenomenology, the coded data was interpreted in order to determine themes and sub-themes. Three themes and several sub-themes emerged from the analysis of the findings.

Along with the structure and constituents of innovation experiences, the grassroots innovators' thoughts on the GI phenomenon are broadly and systematically deliberated in this chapter. The chapter begins by discussing the lived experiences of each participant. Then it discusses the setting of the innovation action, and the background and capabilities affecting the innovation behaviour of the innovators. Subsequently, the chapter discusses the themes highlighted in their lived experiences.

5.2 Lived Experiences

All grassroots innovators who revealed their lived stories experienced trials and setbacks in their innovation journeys. Their ages ranged from the 30s to the 60s. All were males, and the majority were school dropouts but highly skilled fabricators and rural entrepreneurs. Every participant was linked to the HBN, SRISTI, NIF and GIAN. Today, they are recognised nation and region-wide for their innovations. There were male participants only because majority of the female grassroots innovators of Gujarat were having innovation in horticulture and veterinary practices, which was outside the scope of this thesis. Hence the female grassroots innovators have been excluded from this research.

The participants shared their lived experiences with passion, candour, humour and sometimes melancholy. They were generally open about their lived experiences; however, instances of silence and short, intentional detours during interviews led to certain informed assumptions and conclusions. In this thesis, their lived experiences are presented in the narratives and other tangible ethno-artefacts, such as photographs. I hope to honour the events that shaped the grassroots innovators' lives through accurate accounts.

5.2.1 Amrutbhai Agrawat (AA)

Mr Amrutbhai Agrawat (AA), a fearless, 68-year-old serial grassroots innovator, is a mentor and beacon for many Indian grassroots innovators. He lost his father when he was seven years old, and was raised by his single mother. She had to work on farms all day to feed him and his elder sister. To support his family, AA stopped studying after the fourth grade and joined his mother as a farm labourer. He is from the Brahmin community. As well as being a farm labourer, he served as a temple priest. AA experienced and observed the hardships of those working on farms and in rural areas. Although he discontinued his formal education, he evolved as a learned individual with experience, rich knowledge, technical expertise and immense problem-solving creativity. Today he is one of the oldest and most committed members of the HBN and

SRISTI; a pioneer of Indian GI who has scouted, connected and mentored more than 100 grassroots innovators. With the help of SRISTI members and other farmers, AA initiated the Shodhyatra (a journey for the search of knowledge, creativity and innovations at the grassroots) in the Saurashtra, a region within Gujarat. He identifies himself as a SRISTI friend and innovator.

AA has two sons and a daughter, and lives with his older son, who is also a grassroots innovator and currently looking after their workshop. His family has always supported him. His wife passed away 13 years ago. She had supported AA's pursuits immensely. He imparted his knowledge of the maintenance and development of farm implements to his older son. Many workers trained by him have started their own repairing businesses. AA has earned goodwill in the local community. He believes in sharing knowledge, co-learning and encouraging youth to innovate and solve current issues. He was happy when farmers replicated one of his innovations because it was benefiting the farming community. He has placed pulley stopper design on open source basis (no IP protection), so that it can be beneficial to all. For AA, innovations should be useful to the community.

For the past decade he has taken a back seat in innovations, and learns from his son about new developments and contemporary ideas. Although not actively innovating, AA is a life-long active learner and mentor. He still enquires about innovations and innovative methods in nearby villages, and at times farmers approach him with their innovations in farm implements and practices. He conducts community workshops at his fabrication unit and in remote towns, providing guidance and innovation and distributing literature on SRISTI, HBN, GIAN and NIF. He scouts, mentors and connects rural people and communities that have made something innovative or applied innovative practices that have helped agricultural production or cattle. In Saurashtra, a region within Gujarat, he created 18 *mandals* (groups) to foster GI, and identified around 100 grassroots innovators and TK holders in the region. He believes in being instrumental in uplifting others' standard of living, and that his innovation is God's gift, which should be shared for the greater good of the community. He won a lifetime achievement award for his innovations from HBN and NIF.

5.2.1.1 AA's Innovation Profile

AA's innovation journey began in 1965 in a remote village of Junagadh District, Gujarat. His financial condition was very weak, and he had had to borrow money to pay for his sister's marriage. He began innovating with the intention of reducing his mother's workload on farms. In 1962, he established his Ramkrishna Engineering workshop, where he repaired agricultural tools without proper machines. The farmers' hard work dealing with cattle prompted him to think about how he could ease their strain. Such experiences and observations led him to consider the problems and provide solutions through innovative farming implements. He made five agricultural tools that he registered with Junagadh Agricultural University (JAU). His first innovation was a success, so thereafter he made a few more novel, useful agricultural tools. His first farm implement innovations were held in the JAU records, leading him to connect with professors at the Indian Institute of Management-Ahmedabad (IIM-A). A meeting with IIM-A professors propelled his quest for innovative solutions. In 1965, he borrowed money from farmers and was awarded Indian Rupees (INR) 25,000 (i.e. approximately US $382.19 as per August 2015 exchange rate) from the Junagadh Udhyog Kendra. With this money he bought a simple lathe, grinder and welding machine, and enhanced his repairing services.

All of AA's innovations have a purpose, and the majority of them emerged from his life experiences as a farm labourer. A few of his innovations are empathetic, as the idea to solve a problem was conceived after encountering the pain, struggle and hardships of farmers, animals and women. In 1972, AA developed 'Janak Santi', a multi-purpose agricultural tool used for all types of crop and soil. Fifteen different agricultural operations—from sowing to harvesting—can be performed with this tool. In 1980, AA developed the groundnut digger 'Mini Kaliu', a twin bullock-drawn implement, used to harvest the groundnut crop under severe drought conditions. It can be used easily by one or two persons, reduces time and labour and improves the harvesting rate. He sold over 250 units of Mini Kaliu in Saurashtra and the nearby region. In 1990, AA made a wheat-sowing box that helps the equal and uniform distribution of wheat

seeds on farms. Farmers copied this device and benefited, but AA did not complain about this replication as he was happy that his innovation was benefiting farmers.

In the mid-1990s, a tilting bullock cart was conceived out of concern over eroding the strength of bullocks, their efficiency and health. As a farm labourer, AA had observed traditional bullock-cart mechanisms, and noted their shortcomings. The traditional cart had two wheels, so part of the load is borne by the bullock's shoulder. The harnessing system of the traditional bullock cart made it difficult for bullocks to carry loads at sharp bends in the road. These design issues caused galls on bullocks' shoulders, which caused them to suffer. AA began working on the idea of a tilting bullock cart, but had to leave it unfinished due to social and family obligations. Initially, AA used his own savings, but the development of a prototype was expensive and time consuming.

At around the same time, he was associated with the HBN and contributed to this institute and attended meetings. In one meeting, in which SRISTI was to be established, he explained to the committee members his idea of the improved bullock cart, and also mentioned his weak financial condition and lack of funds to work on his idea. The committee liked his idea and decided to support the development. This was SRISTI's first initiative and it boosted AA's morale. He submitted a written proposal to SRISTI, then—through mutual consensus—it was agreed that SRISTI would support the development of a prototype, and if the design was economically profitable, AA would share part of his profits with SRISTI for a certain period. If the innovation was not to succeed, the advance given by SRISTI would be treated as a grant.

AA made many mistakes designing the bullock cart. Initially, he went for a hydraulic system but purchased the wrong size tank with a hydraulic jack, and had to procure another tank. Later, the tank burst because the outlet became clogged with dust. This made him realise that his thinking was flawed, as farmers cannot always keep carts in dust-free places. Instead, he decided to test the original tank. He returned the hydraulic system for a refund, but was determined to complete the project, working on it at night when there was no disturbance. He thought of using a horizontal gear as

a lifting device as he had seen such a system used to lower the motor into a bore well. He experimented but it was not effective in lowering the cart.

This failure cost him INR 2000 (i.e. approximately US $30.58 as per August 2015 exchange rate), but he continued to work on the design. He mounted vertical gears, which was successful, and gradually increased the number of gears and checked the operational effectiveness. With eight gears, the cart he designed functioned properly. Later, with the help of SRISTI, his bullock cart was patented and his innovation was recognised nationwide. His tilting bullock cart was similar to a tractor, with a hydraulic system to lift the trolley. The traditional cart was used to pour compost in the furrow, but this had its shortcomings. The body of AA's tilting cart would be tilted gradually, so that the compost fell directly and uniformly into furrows. The four wheels and a harness rotating device enabled bullocks to work easily on sharp bends.

The sales of the tilting bullock cart were very good, prompted by a government subsidy on them. AA's tilting bullock cart was named 'Aaruni'—the son of an Indian sage—known for checking the erosion of soil. According to AA, his cart is analogous to Aaruni's skills, and is useful for slowing the erosion of a bullock's power. The carts were sold across India, but in the past few years sales have reduced because farmers prefer mini tractors over bullock carts, and the rearing of bullocks is becoming very difficult.

In 1997, AA made a pulley with a stopper. The idea for this came from a workshop in which he heard that there are no innovations relating to wells, even though wells are integral to rural lifestyles. He recalled this when he observed a weak old lady struggling to draw water from a well, and decided to find a way to ease the task. AA observed the pulley, and then placed a stopper on it so that movement of the rope towards the well was prevented. He made three types of pulleys—'Ganga', 'Yamuna' and 'Saraswati'—with each costing INR 500 (i.e. approximately US $7.65 as per August 2015 exchange rate). The Ganga pulley is like a ratchet, and there is no loss of rope or bucket. The Yamuna is a detachable pulley and can be used at multiple locations with a beam. The Saraswati is a roller-type pulley. The pulley with a stopper offered a safe and easy

method of drawing water from a well, and reduced the chances of injury or stress. At a summit of world scientists in Ahmedabad, AA's creative, simple and useful innovations were appreciated, and a patent was awarded for the design of the pulley stopper. Later, for the same innovation, AA received a Sardar Krishi Puruskar from the Government of Gujarat. AA made this an open-source technology so that anyone can copy and use it. Despite a good response from individuals and NGOs, the spread of this innovation has remained limited.

5.2.2 Bharatbhai Agrawat (BA)

Mr Bharatbhai Agrawat (BA) is a serial innovator and second-generation rural entrepreneur. His greatest inspiration is his father, AA. He firmly stated that his ideas come from inherited knowledge and skills. The world of innovation unfolded for BA at a young age. His curious mind, observation and work ethic helped him innovate. Ideas come to him through his repairing work, through the observations and feedback from farmers and discussions of the problems they face. Unlike his father, BA has not worked on farms but helped his father in their fabrication workshop from the age of 15. He studied until year 10 and strongly believes that higher education constraints individual's exploration of other fields and ties a person to monotonous work.

BA is 47 years old and the father of two daughters and a son. He is a very sociable, family oriented man who encourages his children to finish their formal education so that they can be independent and sustain their family. He wants his son to be helpful to him in the future and take over their business eventually. He is proud of his cultural background and believes that being a Brahmin has been important in accumulating, sharing and imparting knowledge. He ascribes his innovation and problem-solving skills to his genetic makeup and hereditary background. He also acknowledges the encouragement and support from institutions like the HBN, SRISTI, GIAN and NIF.

His inclination towards innovation once led him to a large financial crisis. As a result, his wife resents his pursuit of innovation. However, BA and his father did not stop innovating. Eventually, his father's innovations achieved nationwide recognition,

earning him a lifetime achievement award for innovation, which helped financially. BA believes that he inherited his problem-solving skills from his father, and like AA believes he has an eye for problem-solving. He considers his father as God, and draws inspiration from him. BA was exposed to the innovation field in childhood. His father's major innovation, the Aaruni bullock cart, was a great experiential lesson for BA. He discontinued formal education as he felt that it was preventing him from following his passion, and joined his father in the repair, maintenance and development of agricultural tools and machines. Although he was an average student, he is very adept at fabricating and repairing machines and tools.

During a 1986 drought, BA worked as a welder for six months, and not only learned the art of welding but also was exposed to modern, heavy farm machines. At present, he feels that it is too expensive to develop an idea without proper machinery or institutional support. As a child he witnessed a financial crisis, but also observed his father's hard work on farms, in the temple and through innovating. He is proud of his father's achievements and the training he has given him and his brother. Like his father, BA has many innovations to his name and has received many awards. He believes in natural energy, eco-friendly solutions and environmental sustainability. Therefore, the majority of his innovations are embedded in these core beliefs and his innovations are respected.

5.2.2.1 BA's Innovation Profile and Journey

BA is respected and trusted by village people, farmers, other grassroots innovators and SRISTI and HBN members for his eco-friendly, sustainable solutions. His innovations are driven by his focus on the environment, rural development and energy optimisation. In 1999, he made a windmill-powered water pump; then in 2000, to reduce the drudgery of farmers and bullocks, he made 'Rolarmadh', a bullock-drawn implement with a drum and attached pegs that break hard soil. He has also made, a groundnut seeder, a hybrid tractor and wooden stove. Currently, he is developing the idea of power generation through mini windmills for rural areas. He is also involved in the redesign of his hybrid tractor, which not only consumes fewer diesels but also has

longer-wearing tyres, saving farmers money and time. BA is associated with natural things, and has been given awards for making a wooden stove that consumes less wood, saves time and prevents smoke inhalation.

Since childhood, BA has been fascinated by windmills, which he first saw when he was in the fifth grade. He observed that most windmills are in a non-working condition and wondered the reason for this. He found that such windmills were availed through subsidies, so people invest in them but as they frequently break, they then sell them as scrap to recover investment costs. Most windmills are imported, so in case of breakage, unavailability of parts is a major issue. Overall, the amount of water drawn by these windmills is little.

Cognisant of such challenges, BA began work on a model windmill in 1999. His idea was to develop a windmill to pump water from a well at a rate of 2000–2200 litres per hour. His design is based on the weight-balancing gearbox system, and was given for testing to a voluntary organisation that works on environmental issues. In his latest design, BA has removed the gearbox and placed the handle of the hand pump on his windmill. This is because he observed that there is always a wind blowing at two kilometres per hour, so with a slight push of the handle the windmill begins working and water is constantly pumped to farms. His windmill models were tested by the Gujarat Energy Development Agency (GEDA), Vadodara. Satisfied with the performance of the windmill, GEDA recommended it to the owner of a private salt farm in Kutch. Initially, the salt farm owner purchased two cylinder windmills, and then ordered an upgraded four-cylinder version for installation next to the two cylinder models. BA received national awards for this innovation, but more than recognition from such an award, he values the respect and recognition he received when he was asked by NIF and SRISTI to modify the damaged, non-working windmills that were manufactured by foreign multi-national firms.

5.2.3 Bachubhai Thesia (BT)

Mr Bachubhai Thesia (BT) is a 62-year-old serial innovator and farmer from the Patel community. He is from a village named Kalawad, in the Jamnagar district of Gujarat. He studied until class 10, and did a six-month radio and television repair course. He has practical knowledge of the mechanical, electronic and electricity fields. In 1984 he opened Jyoti Radio Service, a radio repairing service in his village that operated for 15 years. He later opened Bhagyalakshmi Televisions, providing television repair services. After his father's death, BT had to shut his television repair shop and take up farming. While working on farms, he experienced and observed hardships. Now, most of the time BT and his wife stay in Rajkot with their two sons and their family.

BT has many electronic magazines, which are in English. He asks his sons to read and translate them for him. From these magazines BT realised there is much more he can do. For the last few years, his family have been very supportive and value his innovations, which earlier they considered to be a waste of time and money. He was accused of turning their house into a garage, with his experiments and scraps lying around. Instead of despairing over his family's resentment, he made machines that were useful in the kitchen. BT stated that one should have strong will-power to withstand discouragement. If he fails in an experiment, he reuses the resources for another experiment or makes something useful in the household. BT is grateful for institutions like the NIF for their ongoing support and guidance, as well as to his friends Mr Ghanshyan Mystry and Mr Kasundra of Jamnagar, who brought attention to him when they were reporters for *The Times of India* newspaper. Essar Petroleum invited him to give a lecture to their engineers.

At present, BT and his two sons have a small factory, where they manufacture a solar and power operated shock-box that protects crops from cattle, and long lasting personalised light bulb for farmers that BT innovated. He strongly believes in ethical conduct and earning through the right means. BT is a God-fearing man who, with his wife, conducts social work in the Saurashtra region of the Gujarat state in India.

5.2.3.1 BT's Innovation Profile and Journey

People in BT's village call BT as an explorer of crazy ideas. BT has had many innovations. The majority of his innovations are farmer-centric, as he is committed to working on ideas that are useful to farmers and the farming community. His innovation journey started when he was a child, and innovating is his hobby. As a self-taught expert in the mechanical, electronic and electric fields, BT is often invited by universities and companies to hold lectures. He has created many things, including a groundnut pod-breaking machine, a motor coil-winding machine, a manual pipe bender, a mini sugarcane-juice extractor, a slide projector for schools, a windmill, a small-range radio transmitter, a voice-amplification system, a motor-lifting machine, a motor-operated mini model aeroplane, a metal comb, a shock box, a seed-sowing rolling device, a motorcycle plough scooter with rear wheels, a modified lightbulb inscribed with the owner's name and a herbal rust remover.

One of BT's favourite innovations is a long-lasting lightbulb imprinted with the owner's name. He modifies ordinary lightbulbs so that they last longer and are effective on farms. The small circuit that he places in the lightbulb is unique, and to curb theft he places the name of the owner on the bulb. He has been making these for the past 20 years, and has received awards for them. The idea came to him when he discovered that ordinary lightbulbs used on farms do not last long, and frequently changing them is expensive. It took four to five months to discover the cause of lightbulbs blowing so often. In this time he met the managers of the Gujarat Electricity Board (GEB), discussed the problem and requested to solve the problem for the whole farming community. The GEB managers declined to help him as it was not in their capacity to solve the issue for the whole farming community. Frustrated, BT decided to solve the problem himself. He began work on the idea and designed a circuit and placed it in the ordinary lightbulbs used on farms. He placed these lightbulbs on farms and tested their performance. His lightbulbs lasted longer than ordinary bulbs, which encouraged him to discuss his lightbulbs with the other farmers in his village. He told them the minimum cost to produce the bulbs and sold new lightbulbs to the farmers. Through word-of-mouth, sales increased. Forty years ago he used to sell 100 lightbulbs per

month to farmers in nearby villages. Gradually, sales increased to 200 lightbulbs per month. For the past eight years, BT and his sons manufacture the bulbs through job-work, and sell to farmers via their company, Vimox. At present, they sell around 10,000 lightbulbs per month.

After the death of BT's father, their farms were divided up, making bullock rearing difficult. BT gave away his bullocks and decided to cultivate the land using his motorcycle. He has received India-wide recognition and awards for this necessity-based innovation. BT tinkered with his Suzuki Max 100 motorcycle, fitting a scooter tyre at the rear for more stability and placing two smaller wheels on the sides for balance in the field. In 2003, these modifications cost him INR 4000 (i.e. approximately US $61.18 as per August 2015 exchange rate). His experience ploughing fields with a bullock cart helped him conceive of such a machine, as he got the idea of making a lever-operated farm machine from the rope tied to the bullock cart. This rope is like a rein that controls movement and directs the animal. It took nine months to complete the machine, costing INR 90,000 (i.e. approximately US $1376.70 as per August 2015 exchange rate). BT first cultivated his own land with this machine, and was later invited to demonstrate it to other farmers. He could not scale-up the innovation because of resource constraints and livelihood issues, so he sold the design and today, 25 people manufacture this motorcycle-operated farm equipment. He is happy with this as it is helping others earn a livelihood, and farmers are benefiting from his design. Today, BT is still passionately pursuing his hobby to experiment and innovate.

5.2.4 Ganesh Dodiya (GD)

Mr Ganesh Dodiya (GD) is a passionate 67-year-old farmer from the Rajput community, living in a village called Gadhada Simada, population 2,500. He lacks formal education but attended an adult education programme at the government-run night school, so can now read his language's script and write his name. Since the age of 12, GD worked on farms. He has witnessed the challenges of agriculture, such as labour shortages, crop protection and a reduction in the size of farms. He inherited 4.8 hectares of farmland, owns a tractor and a cattle shed that houses buffalos, cows and

goats. He has three sons and a daughter, and has tremendous support from his family, especially his sons. Currently, he is retired. Although he has an interest in innovating, his sons do not encourage him to innovate because of his age. He loves reading HBN publications and shares information with the villagers. He accredits his ability to innovate to his intellect and observation skills. His innovation was recognised after 17 years, through Shodhyatraa. He has demonstrated and displayed his spraying machine at many fairs, with the support and encouragement of SRISTI. GD is a keen observer and a very straightforward, emotional person. He is of reserved nature and not very forthcoming; therefore it was hard to fathom about his lived experiences.

5.2.4.1 GD's Innovation Profile and Journey

In 1975, after an acute labour shortage on his father's 40 acres farm that affected the spraying of pesticides on cotton crops to protect them from bollworms and similar pests, GD decided to make a spraying machine using a motorcycle. He conceived of this idea when he saw a pump driven by a small, portable engine spraying water to cure cement mortar. Later, he thought about how a pump mechanism could be adapted to spray pesticide. His knowledge and experience of repairing farm machinery helped him develop the idea. He fitted a pump to his own motorbike, a standard diesel-based Enfield powered by its five horsepower engine. A nozzle is mounted on the spray boom, which is installed at the rear of the motorcycle, and a 70 litre-capacity, pesticide-filled tank is placed on top of the pump. GD began using this spraying machine on his farms, and made a few for other farmers in nearby villages. The machine is easy to assemble and dismantle, and the height and width of the spraying boom can be easily adjusted. It is an affordable innovation that can be attached to any Enfield Bullet motorcycle. As some crops—especially cotton—require frequent spraying, this motorcycle sprayer is very effective and beneficial, especially during labour scarcity. Moreover, spraying is performed faster and more effectively, as the motorcycle can traverse a farm faster than a person, and overall labour requirements for spraying crops reduces. This innovation spread quickly as it is valuable to farmers, and helps save crops from being destroyed by pests. GD demonstrated his innovation at a few agricultural fairs. He later lost interest in it and

concentrated on his farms. He handed value addition and business development responsibilities to GIAN. In 2010, GIAN made an agreement with a Hyderabad-based company for the sale and manufacture of the machine, with part of the proceeds going to the innovator. However, GD has not received any of the promised royalties yet.

5.2.5 Gopal Surtia (GS)

Mr Gopal Surtia (GS) is a prolific 58-year-old innovator who also writes and sings folk songs. His father was a renowned singer of Gujarati devotional folk songs. GS's main occupation is farming, and he has 35 acres of land. He has had a passion for experimentation since childhood, and making something novel is part of his daily routine. He was an only son, so had to discontinue education after grade nine and help his father with farming. Despite discouragement from his family, GS used to follow his passion at night, when everybody slept. His wife and father considered his experiments stupid and illogical, but he continued to work on his ideas. He believes in positive thinking. He has two sons: the elder is in cotton farming while the younger is a singer and runs an orchestra troupe.

GS is very proud of the innovation that made him famous at the district and state level. He is a humble person, and acknowledges the support of his village and SRISTI. GS identifies himself as a king of farmers and farming innovations, and at writing songs for farmers. He appreciates Professor Anil Gupta's institutional arrangements to scout for and encourage innovators in rural areas, like himself. He firmly believes in sharing knowledge and enhancing the Indian innovation eco-system. For the past few years he has been actively involved in innovation relating to herbal products, such as medicines, shampoo and pesticides. He notifies SRISTI of these innovations, and demonstrates the positive effects of his products. He distributes his herbal medicine for free in the village, and has received great testimonials, which encourage him. In the mornings he sells herbal shampoo and detergents from his small shop. Later in the day he helps his son on the farm, and in the quiet hours of the night he works on his ideas.

5.2.5.1 GS's Innovation Profile and Journey

GS has an inclination towards experimentation and developing novel products. Although he has been recognised and rewarded for the hand-driven sprayer, his herbal innovations have been equally well-received. He is a visionary innovator who has been educating farmers on the advantages of herbal pesticides long before agricultural scientists or the government did.

GS is known for his simple but brilliant and agile innovation, the hand-driven sprayer. He felt the need to develop a sprayer for cotton crops when he faced a labour shortage, and found it difficult to carry the traditional, heavy knapsack sprayer. He started work on the idea of the sprayer in 1997. His hand-driven sprayer can be used by men, women and children, as it is not heavy like traditional knapsack sprayers. He tested the sprayer on his farm and made some modifications. He mounted two bicycle wheels parallel, at a distance of 0.762 metre, on a self-made iron chassis. A small wheel is placed in the middle, at the front. A 20-litre barrel is put on the chassis. Many farmers from nearby villages borrowed his sprayer, and he subsequently sold 10–12 pumps. He modified the tyres of the bicycle so that the farmer does not have to worry about punctures or other issues.

GS's innovation was scouted during one of the Shodyatras. He has demonstrated his hand-driven sprayer at agricultural and other fairs. His innovation has been well-received in the market as it has proven to be a useful, convenient and affordable alternative to spraying pesticide. The sprayer is highly customisable as the nozzle and spray boom can be adjusted, and it is easy to maintain and repair. It is economical as it does not use fuel, and can be easily driven as the cart frame is sturdy. GS named his innovation the 'Kisan King', and he is proud of his innovation as it offers many advantages. His innovation was patented, and later, the technology was transferred by GIAN on a non-exclusive basis to a firm in Ahmedabad, with benefit-sharing arrangements with GS. At present, although he is looking after his farm, innovation is part of his daily routine and he concentrates on innovations relating to herbal products.

5.2.6 Mansukh Jagani (MJ)

Mr Mansukh Jagani (MJ) is a 45-year-old farmer, innovator and fabrication expert. He comes from a middle-class family, and is the eldest of four brothers and two sisters. Due to his family's weak financial situation, he discontinued his schooling and joined his father in farming. For a short time he worked in a diamond cutting and polishing factory in Surat. Unhappy with the monotonous work and conditions there, he left and returned to his village. Later, he worked as a daily wage labourer in shops and on others' farms. He saved some money and bought a drill and a welding box. He undertook informal training from his uncle in fabrication and welding, working with him for a year. MJ then started his own repairs and fabrication workshop, where he repaired diesel engines and farm implements. Gradually, MJ started manufacturing and selling various farm implements, such as harrow, ploughs, seed drills and grills for doors and windows. Later, he had to look after his farms as his father was ageing. He inherited two acres of land, and currently looks after his farm and fabrication workshop. In 1990, in order to run his household, he rented out his innovated farm implements. MJ does not succumb to adversity or discouragement, but rather faces them courageously and works hard to solve farmers' issues. He is father to three daughters and a son, and the sole breadwinner of the house.

Until 2011 he rented his workshop space, but now—with the help of the NIF—he has his own workshop and has been given a loan to buy machines for the manufacture of the 'Bullet Santi'. The Bullet Santi and bicycle sprayer have been patented, and MJ has received national awards and huge media attention for his innovative farm equipment. He was one of seven grassroots innovators to represent India in South Africa in 2012, and now acts as a mentor and guide to many budding grassroots innovators and engineering students. He appreciates and acknowledges the ongoing support of the NIF and SRISTI. He works on ideas that are useful, efficient and affordable to farmers and the community at large. He firmly believes that in innovation and business, money comes second to the usefulness of the innovation. He suggests that innovators and

business-people should take care of their customers' needs, and maintain a work-life balance.

5.2.6.1 MJ's Innovation Profile and Journey

MJ is a serial innovator and has received numerous awards for his various innovations. He has made a motorcycle-driven, multi-purpose farming device, a seed-cum-fertiliser device and a bicycle sprayer. The genesis of the motorcycle-driven, multi-purpose farming device (or Bullet Santi) lies in the severe drought of 1993. This made cattle rearing hard because of the lack of fodder and water. Moreover, at this time there was heavy migration from rural to urban areas, leading to acute agricultural labour shortages. Farmers, including MJ, were forced to seek alternative land-cultivation methods. MJ thought about machine-operated ploughs. He was inspired by a local, three-wheeled taxi. He designed the Bullet Santi from the Enfield Bullet, a sturdy motorcycle whose engine was converted to a 5.5 horsepower diesel engine. The rear wheel was removed and replaced with an attachment with two wheels.

MJ is a fabrication expert. He designed the unique machine to conduct multiple farming operations, like shallow ploughing, furrow opening, sowing, inter-culturing and spraying. He tested the machine on his farm, and it was successful. His Bullet Santi proved to be timely, cost effective and fuel efficient. It could plough an acre of land in just half an hour, consuming only two litres of fuel. This machine is an affordable alternative for farmers who use bullocks and cannot afford tractors or power tillers. It took around 16 months to complete the machine. Initially, MJ used it on his farm, and then sold two machines to other farmers. Later, he modified it further and added reverse gears to the existing design. Farmers from nearby villages applauded his efforts, and he started getting orders via word-of-mouth. To date, he has made approximately 500 machines at his rented workplace. With the support of the NIF, MJ received patents from India and the United States of America for the machine. With the consent of MJ, the machine is part of the technology commons, so there is no restriction on people-to-people learning, imitation or copying. MJ is happy about this

as long as the technology improves, sharing is mutual and farmers and other consumers are able to find solutions at lower costs.

MJ is alert to opportunities and his other innovation—the bicycle sprayer—demonstrates this. While working on farms he faced challenges watering groundnut crops, and he was aware of the problems faced by farmers in spraying pesticides on fields. He began to think of an efficient, affordable solution to the spraying problem. As bicycles are easily available to small and marginalised farmers, he decided to mount the sprayer onto them. He tied a cylinder and attached a pipe with holes, but this did not work. He discussed this with professor Anil Gupta - the founder of HBN and a prominent scholar in the field of GI, and his bicycle and pump was given to the NID for design-related help. After a year, MJ enquired about his project but was told that nothing had progressed because nobody had the time. On hearing this, MJ was annoyed and asked them to return his bicycle. He decided to work on his idea, and developed a bicycle sprayer in just 60 days. The main components of the sprayer are the adjustable boom, tank, chain and sprockets. The sprayer is easy to operate and maintain; it is affordable, convenient and energy-efficient. It is also flexible, as the components can be adjusted according to the spraying requirements. Further, the cost of the sprayer (excluding the bicycle) is INR 2,200 (i.e. approximately US $33.66 as per August 2015 exchange rate). Later, with the help of the NIF, he received a patent for the sprayer. MJ has received many awards and much recognition. He supports many grassroots innovators and students in converting their ideas into innovation. Increasingly, he is becoming a customer (farmer)-centric innovator.

5.2.7 Mansukh Patel (MP)

A farmer's son, Mr Mansukh Patel (MP) is a keen observer, technician, initiator of social change, farmer, innovator and rural entrepreneur. As a child, he would observe a tractor and its mechanics for hours. He is passionate about the mechanical field, and has a keen interest in all types of machines. His two major regrets in life are not having completed secondary education and that he had to force his elder son to leave college half-way through. Although he was unable to complete his education, he has gathered

a lot of experience because he started working at an early age. He has worked as an electrician, and has repaired radios and clocks. MP has four brothers and four sisters, and agriculture is his main source of livelihood. He got married at 18 and moved to Ahmedabad to work as an electrical supervisor at the Sahakar ginning factory.

In his innovation journey, MP has had immense familial support, especially from his wife, sons and brother-in-law. He also acknowledges the support of SRISTI, GIAN and the NIF. He believes in appreciating and encouraging budding innovators. MP is a board member of SRISTI and GIAN, and regularly attends meetings and workshops. He has agreed to support anyone who would like to work at their factory and anyone interested in innovation. Currently, his two sons, brother-in law and nephews look after his company, Chetak Agro Industries, which manufactures and distributes a cotton-stripper machine. His failing health does not allow him to participate actively in the business, so he looks after strategic planning and product marketing. He is a proud grandfather who encourages his grandchildren to be creative, inquisitive and to pursue education.

5.2.7.1 MP's Innovation Profile and Journey

MP always thought about mechanising the tedious process of stripping cotton from its shells. After facing many developmental challenges, he was successful in developing a cotton-stripping machine that mechanically strips cotton lint from the shell and leaves it ready for ginning. This machine speeded up the process of stripping cotton and stripped cotton was of better quality for ginner and in return gave higher prices for farmers. Due to this machine, the process of stripping is faster and results in better quality for ginners and higher prices for farmers. The machine has mechanised the cotton-stripping process and saves on labour costs. The mechanised process improves cotton quality and saves it from deterioration through seasonal changes. Only two labourers as opposed to twenty are required to operate the machine.

This innovation faced many developmental challenges, and the innovator developed seven different models in eight years. It is a classic case of GI incubation. MP's

innovation journey started in 1989. He used to work on his idea after office hours, and discussed the technicalities with two friends to validate his idea and get their views. To develop his innovation, he sourced finance from his friends and family. He developed the first model in 1991 and demonstrated it to his village, and although many appreciated his work, overall he observed that wastage was more than he had expected. MP himself was not happy with the first model. In 1991 and 1992 he worked on developing the second prototype, and in 1992 he presented this to the business and farming community. People appreciated his work and he received orders, along with deposits. In that year he made 25 machines and by 1993 he had orders for 50 machines. Later, buyers complained about faults in the machines and the quality of the cotton, which posed a huge challenge for him as he faced a loss of INR 2.5 million (i.e. approximately US $38234.28 as per August 2015 exchange rate). The machine's wires were not durable so wore down faster than expected. Further, cotton dust reduced the lifetime of the bearings used, and the quality of cotton was not good. From this setback, MP realised the importance of raw material and quality testing.

MP continued to develop an improved model. A friend loaned him INR 150,000 (i.e. approximately US $2293.76 as per August 2015 exchange rate). He also trained his sons to help him. In 1995, MP developed an improved model. He received support from SRISTI, GIAN, NID and the Indian Institute of Technology-Bombay (IIT-B), and financial support from the Technopreneur Promotion Programme of the Department of Scientific and Industrial Research, Government of India. Today, his model is manufactured and distributed by Chetak Agro Industries. MP is the owner of this company, and his two sons look after operations and distribution. MP offers a full guarantee to the customer for one season. The cotton stripping machine contains two five horsepower motors, one of which rotates the blower and the spike shaft, and the other rotates three big rollers. There is another two horsepower motor that is used to run smaller brush rollers. The cotton stripper machine received an Indian patent in 2006 and a US patent in 2003. MP has received many awards and much recognition at the national and state levels. Today he is a successful entrepreneur, and on the governing body of SRISTI.

Traditionally, women and children were involved in the process of stripping cotton lint from the shell, which affected their social life and education because they had to finish this job work along with the household duties. The cotton-stripping machine has been instrumental in ushering in social change as it eliminates drudgery of manually stripping the lint from the cotton ball. Overall, this machine has been beneficial to all stakeholders in the cotton industry, revolutionising India's cotton industry.

5.2.8 Mansukh Prajapati (MPP)

Mr Mansukh Prajapati (MPP), an enterprising innovator from the potter community, is 49 years old. In 1979, there was a severe flood in Morbi and MPP and his family lost everything and were forced to move to Wankaner. He comes from a very poor family, and his father and grandfather used to make and sell earthenware pots. His father also worked as a mason. MPP has witnessed difficult times, and a series of incidents forced him to forge new paths with diligence and enterprise. His father respected his decision not to work as a mason. Instead, his father bought a cart for MPP with an INR 1,500 (i.e. approximately US $22.94 as per August 2015 exchange rate) loan to start a tea shop.

MPP was engaged to a girl from the same village when he was five years old. His future father-in-law ran a ceramic toy factory opposite MPP's tea shop. He was embarrassed and would hide when his relatives, wife-to-be or in-laws passed his tea shop. MPP disliked running the tea business and wanted to run away. However, the seeds of change were planted when the owner of a small, rooftop tile manufacturing factory asked him to look for someone who could work in the factory. Instead of recommending someone, he agreed to work there himself. He guaranteed his father that the cart loan would be paid off from his salary. He joined the factory, worked hard for five years and learnt a lot about roof tile manufacturing. One bad experience with the factory's management led him to start his own business. He borrowed money from a money-lender to start a factory manufacturing clay pans. Traditionally, all earthenware products were manufactured manually using a potter's wheel, but MPP dreamt of making a hand press machine for clay pans. His family wrote-off his idea and

called him insane. After much experimentation he was successful in making a die and hand-press machine for clay pans.

At one point he went bankrupt and experienced a grave financial crisis, but he did not lose hope. He was determined to finish what he had begun, and was supported by his family, especially his wife. He started his own venture, 'Mitti Cool'. He has provided the means of livelihood to 500 members of his potter community. Aside from his family, he is appreciative of the ongoing support he has received from the Government of Gujarat, NIF, GIAN, SRISTI and the HBN. He has received over 25 awards. In 2013 he received a honorary degree from IIM-A and GTU, to teach students about innovation and entrepreneurship.

5.2.8.1 MPP's Innovation Profile and Journey

MPP's innovation has not only helped him progress, but also revolutionised the entire pottery profession, and also uplifted the Saurashtrian potter community. MPP seized the unoccupied spaces in the pottery business, and his innovations have ushered the growth and renewal in the traditional profession. As a clay craftsman he developed a hand-press machine for earthenware products that had been made using a potter's wheel. Apart from traditional clay kitchenware, he also developed clay products for the poor, which were radical in terms of innovation. He made clay water filters, refrigerators, non-stick pans, pressure cookers and other such objects. MPP has faced many challenges—he once incurred huge debt and lost everything to the bank—but he was resilient and continued innovating.

Coming from a potter family, MPP was exposed to the TK of clay making in his childhood. During his school days, before school started, he would load clay from the ponds and fields onto a donkey and ferry it to his house for further processing. Because of this work he was never interested in pottery, but after failing grade 10 he had to join his father's mason work. In those days, work was considered more important than education. One day, while working on a 32 metre tall chimney, a dust particle went into his eye and it took a long time to heal. Although he was cured, he lost interest in the work and told his father that he would not be doing any more

masonry in the future. MPP worked in the roof tile manufacturing company and gained sound knowledge. He dreamt of owning a factory that manufactured clay pans and plates using machinery instead of a potter's wheel, and starting his own business and making a hand press for earthenware. He considered whether roof tiles can be manufactured in large quantities with a machine, and whether one could manufacture earthenware for kitchens in large quantities with the help of a machine. In 2001, two patent officers saw MPP's products at a fair in Ahmedabad and encouraged him to file a design registration and trademark application under the name Mitti Cool.

Each of his innovations has a unique trajectory of conception and growth. In 1988, MPP made the press (machine) for normal clay pans and plates, and received a patent for this. He faced many challenges in making the hand press for clay pans. He had no knowledge of machines and was poor at drawing, so could not tell the carpenter about his idea. There were no machines or technology in the market into which he had ventured. He faced many setbacks and did not succeed until he had made 150,000 clay pans.

MPP continued to make normal clay pots for drinking water. One day he observed that the drops of water that dripped from the pot were cleaner than the drinking water in the village lake. This led him to make a water filter from clay in 1995, for which he received INR 100,000 (i.e. approximately US $1529.53 as per August 2015 exchange rate) from an importer in Nairobi, Kenya. This gave MPP financial freedom, respect and the confidence to continue his clay product innovations. At present he is manufacturing and selling the water filter in different capacities: 0.8 litres, 10 litres and 12 litres.

During the January 2001 earthquake in Gujarat, MPP suffered a huge loss, as all of his products broke. *Sandesh*, a Gujarati Daily, carried an article on the earthquake which depicted MPP's broken water filter with the caption: 'the broken fridge of poor'. This caption was etched into MPP's mind and he got the idea of making a fridge for the poor that did not consume electricity. He took out a loan of INR 700,000 (i.e. approximately US $10,706.78 as per August 2015 exchange rate from a co-operative

bank and started working on his idea. He had no knowledge of the mechanics of refrigeration or ovens. He initiated this idea in 2001 but did not succeed until 2004, after a debt of INR 1,900,000 (including the amount of the bank loan) (i.e. approximately US $29059.20 as per August 2015 exchange rate). He had to sell his father's house to pay the loan. In his clay fridge he applied the cooling principal of the clay pots, and developed the first version with two water chambers: one at the top and the other at the bottom. The fridge does not need an external source of energy to produce the cooling effect. Later, he developed improved versions and received financial, design and packaging support from GIAN and NID.

In 2005, MPP purchased a non-stick pan for his wife and found it to be very expensive. This led him to work on make a non-stick clay pan. He wanted to see the factory in which non-stick kitchenware is made but he was not allowed inside. He did some market research and met a small non-stick manufacturer in another Gujarati city, who helped him perfect the process of adding layers to earthen flat pans. After many trials, MPP succeeded in making a non-stick clay pan using Azo Noble, a food-grade non-stick material similar to Teflon. His non-stick clay pan preserves the natural taste of the food as it has earthen griddles; it consumes less liquid petroleum gas, does not wear off easily and is more affordable than regular metal non-stick pans.

MPP further observed that the eyesight of the current generation of youth is weak and they have their spectacles from childhood, and their hair turns grey at a very young age. One of the reasons for children's deteriorating health is the aluminium and steel utensils in which food is cooked. MPP found a study on this observation that stated that 40 per cent of nutrients are lost via cooking with an aluminium or steel cooker. He got the idea of developing a clay pressure cooker, which he produced in 2009. The former President of India APJ Abdul Kalam called Prajapati a 'true scientist' called MPP a 'true scientist of India'. At present he is working on a Mitti Cool mud house concept and is looking to collaborate with others in this the project, as it is bigger than his previous projects.

5.2.9 Mohanbhai Savjibhai Patel (MSP)

Mr Mohanbhai Savjibhai Patel (MSP) is the innovator of the mobile groundnut thresher-cum-collector. He is a farmer and belongs to the Patel community. He is 58 years old and the father of three sons. His elder son looks after their farm and the younger sons are involved in a drip irrigation service. MSP's main source of income is agriculture, and he owns about 30 acres of land in which he grows cumin, potatoes, groundnut and wheat. His ancestral home is in the Sabarkantha region of Gujarat, from which he relocated to his current place of residence in 1995. He studied until class five and has five elder sisters. Being the only son, he had to perform farming activities from his childhood.

The idea of the mobile groundnut thresher-cum-collector was conceived from a labour shortage that led to a loss of yield. MSP envisaged the usefulness of such a machine for farmers in the area. It took five years for him to complete the machine, and he had huge financial constraints while developing the prototype. He rents out the machine and also takes it to other farms, threshing and collecting groundnuts for farmers. To make the machine he got a lot of monetary support from villagers. For moral support, he acknowledged his three daughters-in-law and his wife. He is also very appreciative of the NIF's support, in terms of the testing certificate and recognition. For the past 25years he has been diabetic, so his sons do not encourage him to further develop the machine or work on his other ideas. At present he is retired and spends time with his six grandchildren. He is self-inspired and self-motivated. The NIF has filed a patent application for the machine in his name.

5.2.9.1 MSP's Innovation Profile and Journey

The idea of making a mobile groundnut thresher-cum-collector came to MSP when he lost his groundnut yield due to a delay in the collection of the dried crop. The delay was due to a labour shortage. There was already a groundnut thresher on the market, but this was not mobile and required around 20 people to collect the harvest in one location. To overcome the labour problem, MSP developed a tractor-mounted, PTO-powered mobile thresher with a separate chamber for the collection of groundnut

pods and stalks. It took him five years to finish the machine, largely due to his ill-health, the availability of resources and the lack of guidance in terms of mechanics. The machine has a field capacity of approximately 0.5 tonnes of crop, consuming 3.5 litres of diesel per hour. Five people are required to thresh four tonnes of crop per day. The NIF provided financial support for quality testing and patent filing. This innovation is unique, as MSP received no guidance nor had any prior knowledge relating to machine development. He received financial support from villagers and moral support from his family, but he could not discuss the technical issues he faced while making the machine with anyone. He rents out his mobile groundnut thresher, charging INR 2000 (i.e. approximately US $30.59 as per August 2015 exchange rate) per acre for two hours of groundnut threshing. MSP received a state award from the President of India, and this recognition and NIF support encouraged him to further help the farming community. MSP strongly believes in community support and running one's own business. He was not forthcoming about his motivations and beliefs but he did mention about the importance of machine innovation for farming due to increasing labour shortage.

5.2.10 Paresh Panchal (PP)

Mr Paresh Panchal (PP), a 42-year-old serial entrepreneur, is from a city, but his innovation has transformed the lives of India's rural poor. He finished school aged 12 to help at his father's fabrication workshop, where he gathered much experience and knowledge relating to engineering technology. When he was 22, his father passed away. The untimely death posed a huge challenge for PP: as the oldest son he had to take responsibility for his two younger brothers, two younger sisters and mother. Once he was settled with his fabrication business he devoted himself to his innovation full time.

PP's innovation journey with the automatic thread winder machine was eventful. He incurred huge losses due to the imitations of his machine, which made him realise the importance of patenting. Professor Anil Gupta is his inspiration, and for his subsequent innovations he ascribes his success to professor's guidance and motivation. His

bamboo strip and incense stick machines are based on the requirements of tribal people. The machines are easy to operate, safe and do not require any formal training. They reduce drudgery of manually splitting the bamboo strip with knife. His machines enhance community livelihood opportunities and improve the cottage industry. PP believes in R&D and has a dedicated room in his house for this.

PP lives in a joint family and runs Dolphin Enginmech Innovative with his younger brothers. He is grateful for his wife's constant support and to professor Gupta for instilling faith in him and encouraging him to think about rural and tribal people. He appreciates the help he has received from the District Forest Officer (DFO) of Udaipur, Rajasthan, who provided an opportunity to learn from the tribals who make incense sticks in the traditional manner without a machine. Exposure to tribal ways of living transformed PP and brought out his need to do something for the rural poor. He is the father of two children but calls himself a mad innovator who sometimes overlooks his social responsibilities.

5.2.10.1 PP's Innovation Profile and Journey

PP has an innovative mind and has always aspired to do something novel. He began innovating in 2000. He developed an automatic thread winder and bamboo strip and incense stick-making machines. PP observed that due to high labour costs in Ahmedabad, the incense stick industry was making a loss and was on the verge of closure. He seized the opportunity to make an electric machine for incense stick manufacturing, which saves labour costs. However, his perceptions about life and innovations changed when he spent time with the tribal people of Rajasthan. He understood that electricity-operated, high-capacity machines are only suitable for industries and not for the rural poor, whose livelihood is based on incense stick making. As the forests of Udaipur have abundant bamboo, the DFO wanted to sustain the tribals' source of livelihood and prevent migration. He and his team had been trying for five years to make a machine that would be useful for these people. They were not successful, and discussed this with PP, asking him to spend time with the tribal people. He did so, and observed the processes and difficulties they faced in

making strips and sticks from bamboo using a knife. He discussed their mechanical requirements and developed the two machines.

The bamboo strip machine is used to slice bamboo pieces to a specific size and length. These slices are fed into the stick making-machine. It took PP three years to make these two machines, which are both operated manually and are suitable for cottage industries and household businesses. They are easy and safe to operate, reduce labour, give good and uniform-quality output and are suitable for livelihood generation purposes. PP received the patent for this machine in 2012. They have reduced migration from rural areas as they provide a sustainable livelihood option. To date, he has sold more than 200 sets, and receives regular orders from all states. The first 50 machines were sold to the Village Forest Protection and Management Committee (VFPMC) in the tribal areas of Rajasthan, through the DFO in Udaipur. PP aims to start mass-manufacturing the machines and to provide quality machines at affordable rates. He collaborates with self-help groups and NGOs to spread his innovation in rural areas.

5.2.11 Sanjay Tilwa (ST)

Mr Sanjay Tilwa (ST) is a 31-year-old commerce graduate with a farming background. He is an innovator, entrepreneur and the son of a retired teacher. He was an average student who regrets the lack of guidance in his village. He went to the city to study and worked while studying to support himself. After graduation, he returned to his village and began farming, but he was restless. This led him to venture into selling and repairing agricultural implements. This work experience and knowledge laid the foundation for his innovation and business skills. He has much support from his older brother, and is appreciative of the guidance of his friends and business partner.

ST is hardworking, and keeps abreast of the latest worldwide developments in farming implements. He actively participates in agriculture fairs, and networks with innovators and the business community. Currently, he is redesigning his groundnut digger so that it is affordable to farmers. His aim is to ease farmers' tasks and provide affordable agricultural tools. He opened his factory in Rajkot three years ago, and resides in

Rajkot with his wife and son but visits their village frequently. He acknowledges the support of his wife in taking care of the household. He prefers to keep his work and family lives separate, and does not discuss work issues at home. He is a passionate innovator and always open to discussing the latest developments in agricultural machinery.

5.2.11.1 ST's Innovation Profile and Journey

ST made the groundnut digger and reverse plough. He was aware of a labour shortage and issues with rainfall, which resulted in huge agricultural-sector losses. He had observed the problems farmers had in digging and picking up groundnuts, which involved high labour costs. With the help of his elder brother, he made a groundnut digger that helps dig out, uproot and clean groundnuts. Later, with the financial support of a relative, he started his own firm in Rajkot, Akshar Agro Engineering.

ST's innovation journey began in 2007, when he first developed a hand-held plough to dig up groundnuts. However, he discarded this device because it was labour-intensive and not efficient. He then developed a tractor-operated plough, but observed that this caused groundnut pods break and left them in the ground, so was not effective. In 2009, he developed a tractor-mounted PTO-powered digger with a telescopic propeller shaft suitable for tractors of 35 horsepower, to dig out and uproot the groundnut. To reduce the load on the tractor, he added wheels to the rear of the digger. A V-shaped harvesting blade is used to uproot groundnuts from the soil. This blade has an adjustable width, and the penetration angle can be altered, making it suitable for different kinds of soil. A conveyor belt is used to transport uprooted groundnuts from ground level to higher levels, for collection. The belt vibrates, which cleans the attached soil from the pods. On average, the machine can harvest 0.4 acres per hour.

Initially, ST tested the machine's operations on his farm and developed it at his home, in Junagadh, which took two years. JAU provided huge support by quality-testing the machine. ST was able to sell 10 to 15 machines in the past two years. The main advantages of the machine are that it saves time, labour and operation costs.

Additionally, it can be used in different kinds of soil. ST also manufactures reversible ploughs, and this line of manufacturing helps him balance his earnings in the case of fewer orders for the groundnut digger, which is in the early stages of development. He is looking for commercialisation avenues, and a patent has been filed by the NIF. Currently, ST is engaged in fabricating and improving the digging machine to make it suitable for more crops. He strongly believes in research, experiential learning, versatile application of farming tools and business acumen. ST participates in agricultural fairs and promotes his innovation.

5.2.12 Sakrabhai Valldas Prajapati (SP)

Mr Sakrabhai Valldas Prajapati (SP) passed the old SSC and did an additional course on physical health. He was a physical health teacher for six years, and then worked in a cloth mill for 22 years. His innovation is the health chair, which he called the 'Maruti Jhula (swing)'. It is a necessity-based innovation, developed for those who have problems doing the exercise recommended by doctors after leg surgery. SP received much support from his family in making the chair. IIM-A lent him INR 25,000 (i.e. approximately US $382.37 as per August 2015 exchange rate), interest-free, which he paid off. It was given to procure raw materials for the manufacture of the chair. SP has his own fabrication unit, Brahmani, where he looks after the marketing and his two sons manufacture chairs. SP identifies himself as a businessman and a proud innovator, whose innovation has a global demand. The chair is not only useful but also helps people of all ages have a healthy and relaxing life. He identifies himself as a businessman with the heart of a social worker, who is devoted and likes to be useful to others. He gives prime importance to health and healthy ways of living.

5.2.12.1 SP's Innovation Profile and Journey

SP's health chair is both a chair and an exercise machine. His knowledge of physical education was very useful in designing an ergonomically appropriate chair, in which a person can recline comfortably and exercise gently. It supports people weighing up to 120 kilogrammes. Soon after his retirement in 2000, SP had a severe accident in which

he suffered multiple fractures and had to undergo leg surgery. On discharge from hospital the doctor advised him to perform regular, gentle exercise for a faster recovery, but he found it difficult to do so because of the unavailability of exercise equipment or services at his home or in his village. Further, exercising lying down in bed came with the problem of support, and exercising in a regular chair was risky.

SP used to put his grandson to sleep in a cradle, which he rocked. One day he observed that the cradle rocked even when he stopped rocking it manually. This inspired him to make a chair that could be used as exercise equipment for health purposes. He physically tested the working and performance of the chair. On observing the chair's benefits he contacted a hotel manager and got a space in the hotel from which to demonstrate the health chair and take orders. A chance meeting at the hotel with Mr Mahesh Patel of GIAN provided his innovation with a wider scope of commercialisation and recognition. GIAN helped SP file the design registration to protect the innovation's IPR. In 2001 he made the chair, which offers many capabilities, functions and settings for various postures and seating dynamics. It facilitates a gentle cardio-vascular workout, helps reduce knee pain, osteoarthritic pain, clots and abdominal fat, and tones the limbs and increases blood circulation. It has proven to be very useful for people over the age of 50, especially those suffering from arthritis and joint ailments. The chair was validated by a team of doctors. A few modifications to the moulding, powder coating, lock placement and cushioned seats were made under GIAN and NID's guidance. He manufactures according to demand, averaging 50 chairs per month. To date he has sold over 3000 chairs. He participates in fairs and takes orders directly from customers, with no salesperson or agent. He aims to increase the manufacture and sales of the chair.

5.2.13 Yagnesh Mehta (YM)

Mr Yagnesh Mehta (YM) is a 47-year-old innovator and entrepreneur from Ahmedabad. At one time he incurred huge debt, which made him think about taking his own life, but when he thought of his only son he realised the purpose of life and changed his mind. His experiences are testimony of his resiliency and courage. He is a

commerce graduate but considers himself a life-long learner. After graduation he worked in a cyclostyle machine manufacturing firm for some time. With his observations and alertness on the job he provided suggestions for enhancing the machine's performance. These suggestions were appreciated and incorporated by the firm. Then he joined a company that made air curtains, in which he looked after the sales and marketing of the air curtains. He liked the product but did not enjoy the work, so left the firm and began manufacturing his own air curtains. His mission was to provide a quality product, but he lacked technical knowledge of his product.

YM accepts challenges, conducts research and provides quality products. He has faced challenges while making air curtains, especially regarding getting his first customer and managing resources. His pillar of support is his wife, who not only instilled confidence during difficult times but was also helpful with the laborious, dangerous task of inserting fins in the air curtains. YM's life revolves around his only son. In 2005 he was given an award for the air curtain. This recognition and appreciation not only encouraged him but also assured him that he is not alone, and that many people value his innovation. As a child, he was attracted to science but succumbed to his family's wishes and pursued commerce studies. Today, he combines the best aspects of all fields and uses them in his research. Apart from his wife, he is also grateful to his two professional associates, who became close family friends. Although he is resentful of social and cultural outlook of Indian people towards those struggling financial, he appreciates the institutional initiatives of professor Anil Gupta, which have awakened the desires of grassroots innovators to give their best to their communities. He is not happy with the overall support from the Indian Government for the enhancement of innovation and entrepreneurial eco-systems. His father was a government servant and a man of principles, and YM follows his lead by running his business with strong ethics.

5.2.13.1 YM's Innovation Profile and Journey

YM's air curtain is used to retain the temperature in an air-conditioned environment. He has also made a hand-disinfector with a micro-processor control. His innovation journey began when he made his blower. Subsequently, he designed and assembled

the air curtain, so he invented a complete product. Initially, his air curtain had many defects and made too much noise when rotating, due to loose blades. Further, the joints of the blowers would become detached. Although YM was not from a technical background and lacked domain knowledge, he kept improvising through observation and research. As he observed issues with the existing air curtains, he searched for alternative materials that could fix the issues. YM calls his blowers as 'miracle blowers' because it integrates and strengths of metal and plastics adding to the efficiency of the air curtain.

At this time, his friend imported an air conditioner from Japan. YM observed that the air conditioner's blower was made from plastic, validating reinforcing his idea to use plastic instead of aluminium in his blower. He used Acrylonitrile-Butadiene-Styrene (ABS) plastic and innovatively designed the blower. He made fins from the plastic with an aerodynamic profile, with edges narrower than the middle portion. To strengthen the blower, he used a special chemical mixed with ABS plastic as an adhesive. This blower had many advantages over conventional blowers. It is cheaper, consumes less power, is stronger (thus reducing maintenance costs) and there is negligible noise or vibration. This innovation can be used in industries dealing with the manufacture of axial fans. The strength of the product is essential.

YM had contacted the Central Institute for Plastic Engineering and Technology, but he was not encouraged to use ABS plastic with the blower. As he lacked knowledge of chemical engineering, YM interacted with the people in this field and gathered knowledge. After a breakthrough in 1999, he contacted Amtrex Hitachi in Kadi. This company was purchasing blowers for INR 1200 (i.e. approximately US $18.35 as per August 2015 exchange rate). YM calculated the costs and found that he could manufacture blowers at INR 200 (i.e. approximately US $3.06 as per August 2015 exchange rate and sell them to Hitachi for INR 700 (i.e. approximately US $10.71 as per August 2015 exchange rate). Hitachi required about 1500 blowers per month, but to manufacture these blowers, a die was required that cost INR 100,000 (i.e. approximately US $1529.43 as per August 2015 exchange rate). YM proposed to Hitachi to share the costs equally, but they took six months to consider this and

reached no conclusion. YM decided to take a risk and pay for the die himself. He had the die made and took his product to Hitachi. However, by this time, Hitachi had changed its policy and all new products had to be approved by their Japan office. YM incurred a huge debt. He had a breakthrough concept and a product that everyone appreciated, but no buyers. He had taken a loan from a financier at four to five per cent interest, and incurred a debt of four to five million rupees. He had to rent out a room in his two-bedroom house and sell his wife's jewellery to pay the bills.

With his wife's support, he continued innovating, with the hope of succeeding eventually. He began making the air curtain and used his blowers in these air curtains. The product was well accepted by the Airport Authority of India, and he became a sub-contractor of Voltas for the air curtains. As he had previously approached Bluestar, Voltas and other companies, everyone knew him and the people in these companies briefed him on the air curtain requirements at Ahmedabad airport. He met the engineer in charge of the airport and demonstrated his product and concept. The team of engineers inspected his product for quality and liked it, but they could not place an order directly, so Voltas purchased from YM. This order not only gave him confidence but was also an important learning experience for YM, and he became good friends with the airport engineer. Together they fixed many German machines used in airports.

In 2001, YM opened a new firm, Sri Aerodynamics Products, which manufactures air curtains. He received an award for the air curtain in 2005. Today his product is sold both in domestic and international market such as Nigeria, Kenya, Ethopia and Germany. As of today he is does not have single salesman. When people want something good they come through referral and inquiry. For the Air curtain, networking with firms like Cadilla and Torrent was useful. According to YM, he is recognized as a 'person with quality product' and as 'a person with quality services' and he tries to maintain this. YM is ready to earn less but will give his life to provide quality product and service to his customers. My competitors are Johnson Control, GE, Siemens and Snider. My product is in competition with their product, they are in automation. He has diversified his business. At present, he is developing a

microprocessor-based instrument that records temperature, pressure and dust particles in a pharmaceutical laboratory. This innovation is at a prototyping stage.

YM believes Bhagwad Gita, the holy book of Hindu, mantra, 'Karmanye vadhikaraste Ma Phaleshu Kadachana, Ma Karma phalaheturbhurma Te Sangostvakarmani'. According to YM, this mantra means that an individual should keep performing their karma/actions without attaching your intentions on the results or fruits of their actions and should not attach to inaction too.

5.3 Mining the Lived Experiences of Grassroots Innovators

The storied lives of the thirteen grassroots innovators revealed that GI has the potential to transform the socio-economic lives of grassroots innovators and the community at large, provided the eco-system is empowering and enabling rather than just providing financial aids and monetary rewards. A need was felt among the grassroots innovators to access learning and network opportunities. They experienced some difficult times, which confirmed the strength of the grassroots innovators' motivation. Their experiences helped shape their innovation and their being, dictating their identities, how they interpret their life journeys and what innovation is to them. All grassroots innovators were vocal about their identities and referred to their castes and social status while sharing their lived experiences.

The lived experiences of 13 award-winning grassroots innovators from Gujarat were documented through phenomenological interviews. The exploratory, open-ended nature of the research approach allowed the uncovering of grassroots innovators' interpretations of their experiences, and their conscious reflections on the essence of GI. Further, phenomenological description—according to Moustakas (1994)—allows the interweaving of a person's conscious experience and the phenomenon, thereby leading to deeper layers of meaning.

> "[the] aim of phenomenology is to transform lived experience into a textual expression of its essence in such a way that the effect of the text is at once a re-living and a reflective appropriation of something meaningful: a notion by which a reader is powerfully animated in their lived experience (van Manen 1997, p. 36)."

During the personal interviews, the innovators revisited their GI experiences and shared their stories so that others can understand the GI phenomenon through their eyes. For instance, YM—who had incurred enormous debt—became very emotional when he recounted his days of hardship, the attitudes of Indian society and government policies towards innovators and start-ups. Some respondents recalled their childhood memories, as they played an important role in their generation of novel, useful innovations. One grassroots innovator, GD, sang two songs that he wrote to educate farmers and communities on the ill effects of pesticides. Through his songs, GD communicates the current issues in agriculture and the importance of TK systems in facing such issues. Such a candid attitude reflects grassroots innovators' multidimensionality and communication skills, and has not only illuminated their world as they have experienced it but also the tangible and intangible aspects of the GI phenomenon.

The grassroots innovators also discussed their intentions, expectations, social relations, challenges, motivations, beliefs and capabilities. While sharing their experiences they did not resist discussing the most uncomfortable or stressful phases of their innovation journeys. They had to constantly deal with pressures from family, friends and the community. They have had many responsibilities and have had to constantly juggle their roles as son, brother, husband, father, farmer, grandfather, income earner and innovator. Sometimes they had to stop pursuing their innovations to attend to their social responsibilities, such as the marriage of their children. AA told:

> "I had borrowed money from friends and had started working on my idea. I made half cart, and ran out of money...and meantime I had the responsibility of the marriage of my three children. I incurred debts for their marriage; amidst these social obligations my experimentation with the cart did not get enough time and resources."

MPP used the TK of pottery, and revived the profession by automating the making of earthenware. While discussing his decision to leave his job in order to make a tile-making machine for the potter community, MPP remembered his father's resentment of his decision. He recalled his father's words:

> "Insane boy, no one is ready to give their daughter for marriage to a potter rather they will give their daughter to a clerk as he has fixed income and easy life, pottery work is very arduous job and we have stopped doing because of the labour and time involved. Why are you doing this when you have a stable job?"

Grassroots innovators acknowledged and appreciated the support from and benefits of associating with institutions such as agricultural universities, the NIF, HBN, SRISTI, NID, IIMA and GIAN. A few grassroots innovators introduced me to their spouses, staff, children and grandchildren, and showed artefacts such as certificates, trophies, photos, media clippings and the innovations themselves. Most showed me their farm, house, factory, fabrication workshops and the places in which they experiment, manufacture and innovate. Many grassroots innovators showed photographs of award ceremonies. The most striking photo was of MJ being given a shawl by his fifth grade teacher. Such gestures and honesty helped me to explore, understand and relate to their world and worldviews.

Of the 13 grassroots innovators, nine were serial innovators with more than one innovation. In their case, their stories weaved together the experiences of all of their innovations. However, for the simplification of analysis, this thesis elaborates only on the experiences of the innovation for which they have been recognised and given awards. Of the innovations discussed by the grassroots innovators, nine were agricultural in nature and had been conceived in order to enhance the effectiveness of agricultural work and solve issues prevalent in agriculture. Ten innovations were frugal in nature, and seven were eco-friendly. Only three innovations related to social needs, having been produced to usher in social change. All but two innovations were inclusive innovations. All 13 were pro-poor innovations, with grassroots people both their producers and consumers, and all were beneficial to the community, bringing socio-economic transformations to the region. For instance, the bamboo strip and incense stick-making devices not only eased the work of tribal people but enhanced their socio-economic life and reduced rural-urban migration in Rajasthan. This particular innovation is frugal, social, green and inclusive in nature. The following table lists the

13 award-winning GIs and their associations with other closely associated innovations, such as agricultural, frugal, social, green and inclusive innovations.

Table 5.1: GI Explored

GI	Agri	Frugal	Social	Green	Inclusive
Tilting cart	✓	✓	-	✓	✓
Innovative windmill	✓	-	-	✓	-
Tractor without steering	✓	✓	-	-	✓
Motorcycle-operated sprayer	✓	✓	-	-	✓
Hand-driven sprayer	✓	✓	-	✓	✓
Motorcycle driven plough	✓	✓	-	-	✓
Cotton stripping machine	✓	-	✓	-	✓
Mobile groundnut thresher-cum-collector	✓	✓	-	-	✓
Clay fridge, filter and non-stick clay pan	-	✓	-	✓	✓
Bamboo strip and incense stick-making machine	-	✓	✓	✓	✓
Healthcare chair	-	✓	✓	✓	✓
Modified air curtain for air conditioner	-	✓	-	✓	-
Groundnut digger	✓	-	-	-	✓

Source: Self Compiled

Of the 13 grassroots innovators whose experiences were gathered, nine were serial innovators, and while discussing their innovation journeys they tended to share innovation experiences in general. They also highlighted at length their experiences with the innovations for which they were most recognised and awarded. Nine of the 13 are predominately farming related, and the other four are varied, contributing to different sectors such as health or the environment.

It was observed through the interviews with grassroots innovators that it is difficult to distinguish the innovation process from the innovator's own being. GI has been identified as a finely conceptualised novel artefact, not just a technical pursuit involving makeshift improvisations and fabrication. Rather, it is a socio-technical action involving the cognitive, social and commercial abilities of grassroots innovators. The source of GI—the intention to innovate—is in the socio-economic and personal fabric of the innovator.

All 13 grassroots innovators are male and between 31 and 68 years of age. Nine of them live in villages with populations of between 12,200 and 55,000, and the rest have migrated from their villages to Ahmedabad or Rajkot. Nine were school dropouts, one undertook informal education at night school, and three have formal, undergraduate-level qualifications. Here, the term school dropout is used instead of school leaver as the innovators used the term in colequial language which is more close to the 'dropping out of the school' than 'leaving the school'. While one grassroots innovator, quit highschool, others droped out due to various economic and social reasons. Seven grassroots innovators are farmers and have agriculture-related GIs. Two are non-farmers, although their innovations are related to agriculture. The rest are non-farmers, and their GIs are not related to agriculture (see Table 5.2). BT, GD and MJ are actively involved in farming as well as running innovation-led ventures, and their livelihood comes from both activities. As MJ stated: "My livelihood is based on the fabrication business and on farming".

Table 5.2: Socio-Demographic Data of Grassroots Innovators

Sr. No	ID	Innovation(s)	Age	Education/ qualification	Caste	Marital status	No. of children	Occupation	Serial innovator	IPR
1	AA	Tilting cart, modified pulley and many other farm implements	68	Fourth grade school dropout	Brahmin	Widower	3	Fabrication workshop, rural entrepreneur	Yes	Yes
2	BA	Innovative windmill and many other innovations	47	10th grade school dropout	Brahmin	Married	3	Fabrication workshop, rural second-generation entrepreneur	Yes	No
3	BT	Tractor without steering and many other innovations	62	10th grade school dropout	Patel	Married	2	Farmer and entrepreneur	Yes	Automobile operating and controlling system: Request for Enhancement filed
4	GD	Motorcycle-operated sprayer	67	Informal schooling until second grade	Rajput	Married	4	Farmer	No	Yes: Grassroots Technological Innovation Acquisition Fund
5	GS	Hand-driven sprayer and many other herbal product innovations	58	Ninth grade school dropout	Rajput	Married	2	Farmer and rural entrepreneur	Yes	Yes, 2003: Grassroots Technological Innovation Acquisition Fund
6	MJ	Motorcycle-driven plough; bicycle sprayer	44	Fifth grade school dropout	Patel	Married	3	Farmer, fabricator and rural entrepreneur	Yes	Patent: Adaptive Agricultural Machine 7(2005), Grassroots Technological Innovation Acquisition Fund
7	MP	Cotton stripper	63	Ninth grade school dropout	Patel	Married	2	Rural entrepreneur	No	Patent: cotton stripper (2003)
8	MSP	Mobile groundnut thresher-cum-collector	58	Fifth grade school dropout	Patel	Married	3	Farmer	No	No

Sr. No	ID	Innovation(s)	Age	Education/ qualification	Caste	Marital status	No. of children	Occupation	Serial innovator	IPR
9	M PP	Mitti Cool fridge Non-stick clay pan	49	Failed SSC	Potter	Married	2	Rural entrepreneur	Yes	Yes
10	PP	Automatic thread winder, bamboo strip and incense stick-making machine	42	Eight grade school dropout	Carpenter	Married	2	Entrepreneur	Yes	Yes: manual stick-making machine. Automatic thread winder: Grassroots Technological Innovation Acquisition Fund
11	ST	Tractor-operated groundnut digging machine	31	Bachelor of Commerce	Patel	Married	1	Entrepreneur	Yes	CS Filed: Tractor-operated groundnut digging machine
12	SP	Healthcare chair	68	Old SSC and Certificate in Physical Education	Potter	Married	2	Fabrication business, rural entrepreneur	No	Design registration applications
13	Y M	Modified air curtain for air conditioner	47	Bachelor of Commerce	Brahmin	Married	1	Entrepreneur	Yes	No

Source: Self Compiled

The aspects of grassroots innovators' lived experiences are outlined in Table 5.3, and are inclusive of social relations and innovation behaviour. The purpose and process of the GI and the support system also explicitly appeared to be an integral aspect of the lived experiences of grassroots innovators. Additionally, the background, capabilities and beliefs of grassroots innovators was noted to have affected innovation actions. Grassroots innovators discussed their innovation actions and shared their experiences of ideation, experimentation, opportunity exploration, prototype development and commercial scaling.

Table 5.3: Aspects of Lived Experiences

Aspects of Grassroots Innovators' Lived Experiences	
GI	Grassroots innovator
Purpose of GI	Background
Process of GI	Capabilities
Support system	Beliefs

Source: Self Compiled

5.3.1 Purpose, Process and Support System

The intention and necessity to innovate are two starting points of a GI journey. While reflecting on the purpose of innovation, some of the grassroots innovators suggested that they innovate in order to solve problems encountered by themselves or others. It is evident that the necessity to innovate is largely to enhance livelihood or to overcome a pressing problem that affects the community at large. GI usually stems from problem solving, but it was also observed that hobby, necessity and concern are other implicit drivers of grassroots innovators' search for innovative solutions. While discussing the purpose of innovation, YM revealed that 'the purposes of innovation can be innumerable, mainly driven by the concern for family, customers and innovation itself'. Thus, the purpose of innovation cannot be categorised rigidly because problem solving, necessity and concern are intertwined. For instance, some problem solving comes from necessity and concern.

The GI process involves the normal trajectory of making a product through sensing a problem, working on an idea through experimentation and then developing it diligently for personal use or commercial scaling. Opportunity recognition and exploration in GI is emergent and a deliberate act, usually performed through the grassroots innovators' informal personal networks. While serial grassroots innovators are driven by the ideation and creativity, the grassroots innovators with single innovation are driven by problem solving and developing their idea.

Grassroots innovators do not follow a strict timeline in their innovation actions. They follow basic steps, which involves ideation, experimentation, prototyping, opportunity recognition and exploration, and commercial scaling. However, the grassroots innovators revealed that these steps may not be carried out in sequential fashion. At the onset of ideation, profit is not the aim. Rather, most ideation is an urge to find solutions to situated problems, or to meet necessities caused by exogenous factors such as natural calamities, accidents or labour scarcity. It was observed that each GI is a project in itself, following its own processes based on experiences, resource availability, the capabilities of grassroots innovators and the support system. Some grassroots innovators brainstorm their initial ideas with users or expert friends and family members.

Experimentation in GI includes trials and testing, usually performed locally by grassroots innovators with available resources. The majority of innovators experiment frugally, using existing resources dumped as scrap. They avail resources for innovation from the market on the basis of goodwill and trust. Instances of reciprocation were encountered in the stories shared by the grassroots innovators. GS performed experiments secretly, as he was afraid of his family members, who were opposed to such activities. Other grassroots innovators experimented alone on their farm, in their house or at a friend's farm or shed. Once experimentation was over, the grassroots innovators used the products themselves or asked farmers or users for feedback. BA stated: 'Based on farmers' feedback and repairing work we modify existing agricultural equipment or develop novel agricultural equipment'. Subsequently, grassroots innovators—through observation, informal research and lateral thinking—improve the

product. The majority of experimentation and prototyping is done by grassroots innovators with the help of family, friends and villagers. Only three out of the 13 grassroots innovators had institutional help with prototyping and product design. In GI, experimentation and prototyping is performed simultaneously.

Grassroots innovators begin by using their innovations themselves, or demonstrate them to others for testing and to gather feedback for further development. When locals see the use of the innovation or come to know of its benefits, they place orders. The majority of grassroots innovators can sell their innovations at the local level, through word-of-mouth. Such initial sales help them further develop their innovation. In MPP's case—with the earthenware innovation—the payment for the first water filter enabled the development of the clay water filter innovation. The proceeds from piecemeal sales were re-invested in further innovations. Grassroots innovators have demonstrated a propensity to take risks with investment and to survive in unfavourable financial conditions.

Opportunity exploration and recognition in the context of GI is intriguing. The prospects of GI are guided largely by the social dynamics, purpose and benefits of GI, and the grassroots innovator's background, attitude, motivation and beliefs for furthering their innovation for market purposes. The opportunity to further the commercial scaling of GI is dependent not only on the market viability of the innovation but also on the innovator's age, attitude, background and financial resources. Some GI were not scaled by the grassroots innovators, and they sold their patents because of a lack of funds to manufacture them themselves, or because of conflicting priorities, social obligations or health issues. However, one innovator continued to scale his innovation and also worked on farms. He opted to keep his innovation-based business operations small so that he could also concentrate on farming. The community workshops, Sattvik Food Festival, agricultural fairs, Shodhyatra and NIF award ceremonies and GI exhibition in New Delhi open up avenues for GI and provide exposure and encouragement for grassroots innovators.

At the ideation stage, most grassroots innovators discuss their resource needs with their family, friends and village. At this stage, grassroots innovators use second-hand resources or those scrapped locally. When grassroots innovators had to buy from a market, their transactions were usually based on credit or goodwill (unless procured from the city, which was usually done on a cash basis). Resources availed on goodwill reflect the underpinning trust and character of social relations at local levels.

Personal networks, word-of-mouth, demonstration of technology at the local level and third-party or institutional support were instrumental in the commercial scaling and diffusion of GI. Grassroots innovators avail formal and informal, economic and non-economic support from heterogeneous actors in the GI eco-system. All 13 grassroots innovators received support from family, friends, strangers, community and, innovation network actors, such as agricultural universities, SRISTI, GIAN and NIF. At the commercial scaling stage, the role of these institutions increased as they provided larger market reach and assistance in filing patents, transferring technology or establishing the business. A few innovators received help from these institutions at a very early stage, in order to develop a prototype or design products. Support from these institutions and their members was not only beneficial for innovations but also provided the grassroots innovators with motivation, exposure and growth opportunities. They also admitted that connecting with people from these institutions opened up avenues for learning, collaboration over product development and design, and commercial scaling.

Discussing community workshops, BA stated: “We grassroots innovators don’t pull each other down but help each other with available resources for experiments and co-operate each other”. Such beliefs reflect the sense of solidarity and communal relationship between grassroots innovators. Grassroots innovator AA—who mentors and scouts for grassroots innovators—co-conceptualised Shodhyatra, and is currently on the board of advisors of SRISTI and HBN. He stated: “The way SRISTI supported and encouraged me, similarly other innovators should also get such help”.

Three grassroots innovators—MJ, MPP and MP—were sent to Kenya by the Government of India and NIF. They demonstrated their innovation to Kenyan farmers and local agricultural university personnel. This provided them with exposure, which further encouraged them in their innovation pursuits. They were happy to share their knowledge and train Kenyan farmers to assemble and use the motorcycle-driven plough, bicycle sprayer and tilting bullock cart. The trip to Kenya was rewarding for MJ, who will soon be exporting his motorcycle plough (Bullet Santi) to Kenya. As he said:

> "The innovation journey is still on... I learnt a lot through the experiences in this journey. I have understood that there is lot to learn from different parts of the world."

The types and extent of support differed, but overall, the role of family was remarkable. Of the 13 grassroots innovators, 11 acknowledged the support of their family members, especially their wife and children. Only two grassroots innovators did not receive support from their family members. GS stated:

> "I have a huge support in the form of encouragement from my village people. Except my own family members I had support from others. My family members never encouraged me, my wife used to shout at me and my father used to tell that this hero will only do such stupid things all his life."

MJ did not receive family or community support in the initial stages of innovation either, saying:

> "Family had nothing, so what help they can give? Family members will tell this won't work….entire community used to tell it won't work…They all used to shout at me, call me insane and discourage me."

Such responses from immediate family highlight the strength of the innovators, who did not succumb to such experiences but continued to follow their passion for innovation.

It is evident that relational exchanges with family and friends have helped grassroots innovators withstand setbacks during the ideation and opportunity-recognition stages. Family members—especially wives and children—play a pivotal role in facilitating GI. Their socio-emotional support was acknowledged by most grassroots innovators. A few confessed that their passion for innovation and problem-solving forced their parents, wives and children into hardship. In some cases, friends and villagers played an instrumental role in product development, opportunity recognition and scaling. A

few grassroots innovators shared their experiences of chance meetings with strangers who not only recognised the value of their innovations, but also motivated them and connected them to institutions that foster or promote innovation.

There were cases where ideation and opportunity-recognition occurred through the sole efforts of the grassroots innovator, but in which the GI was scaled and fostered through the efforts of the grassroots innovator's children. Grassroots innovators who established their businesses based on their GI are increasingly involving their children in the production and marketing of the innovation. It has been observed that such relationship dynamics and capabilities are central to fostering and sustaining GI. Although some innovators—such as MPP and MP—did not explicitly mention the involvement of their sons in their ventures, such involvement was evident upon visiting their factories, meeting their sons and during the Sattvik Food Festival. Overall, the contribution of family members was central to opportunity recognition, prototype development and the scaling of GI. Overall, the ideation and opportunity recognition emerges from the self, family members, friends and community members (see Figure 5.1)

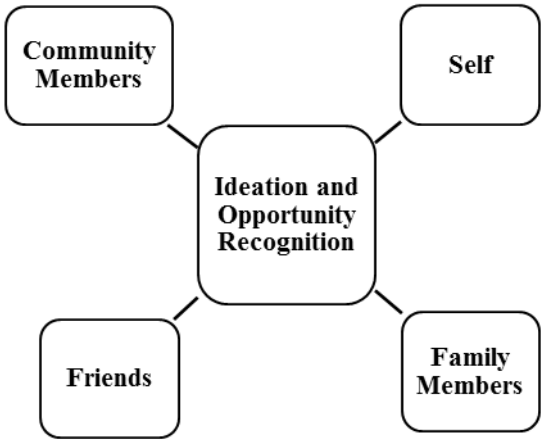

Figure 5.1: Sources of support in Ideation and Opportunity Recognition (Self Compiled)

Institutional support in the form of recognition and monetary rewards helped grassroots innovators forge stronger ties with their families. This was evident from BA, whose father is also a grassroots innovator, and who said: 'Another encouragement was when my father received a lifetime achievement award, we got respect, recognition and the house came into order'. Such recognition, rewards and support from institutions infused faith in the grassroots innovators. It also changed some relational dynamics. For instance, BT stated: "Family members and relatives were apprehensive about my innovations until the time I received an award. They all viewed my innovation as a waste of time and resources".

The majority of economic relationships with customers are driven by the idea of serving, rather than making profit. Those grassroots innovators who are farmers explicitly expressed that they wanted their innovation to be beneficial to others. They innovate for the farming community, to provide affordable solutions that not only make farming and other related work easy but also increase overall productivity. All grassroots innovators believed in sharing knowledge, and that their innovations should enhance others' livelihoods as well as encourage them to innovate. However, some grassroots innovators resent copying, and acknowledge the importance of patents. Each grassroots innovator recognised the role of relational, non-monetary exchanges in their innovation journeys. All 13 grassroots innovators reiterated that their personal traits and social relations were key elements driving their innovation pursuits.

For an idea to evolve into an innovation and be successful in the marketplace, grassroots innovators sensed the need for stronger social relations and monetary resources, and stressed the ethical means of prospering through innovation. Timely institutional support and recognition motivated grassroots innovators to continue, despite initial failures or hardship. Additionally, the recognition, respect and reach provided by family, friends, community and institutions mattered more than rewards and other monetary benefits.

Recognition, appreciation, rewards, trust and exposure from institutions provided grassroots innovators a platform upon which to showcase their innovation skills and

pursue their dreams. Such support proved significant for these innovators, as it connected them with their innovative pursuits. There were instances of doubt in the minds of grassroots innovators, especially when institutions offered them both monetary and non-monetary gains without expecting anything in return but trust and the giving of something valuable to the community. Non-monetary resources included advice, awards, motivation, materials, space and access to resourceful people, institutions and the market.

Many grassroots innovators accrue resources for GI based on their goodwill. Three of the grassroots innovators accrued resources, demonstrating the benefits and usefulness of their innovations. Non-monetary resources or relational exchange played an integral role in all stages of GI. These resources not only allowed grassroots innovators to proceed further in their innovation journey, but also fostered GI at each stage.

At the onset of the innovation journey, grassroots innovators either used their personal savings or borrowed money from family, friends or money-lenders. All grassroots innovators acknowledged the significance of monetary resources, but stated they put more importance in trust, relationship continuity and the reciprocity embedded in the transaction and contract. Monetary resources relate to tangible financial resources and benefits, such as monetary rewards, loans, patents, royalties, profits and sales. These resources operationalise and provide transactional dimensions to the exchanges. Formal means of governing relationships—such as the signing of contracts—arise only when there is commercial scaling, patenting, sale of licences and the availing of design rights. At the initial stage of innovation, grassroots innovation source funds through varied channels (see Figure 5.2)

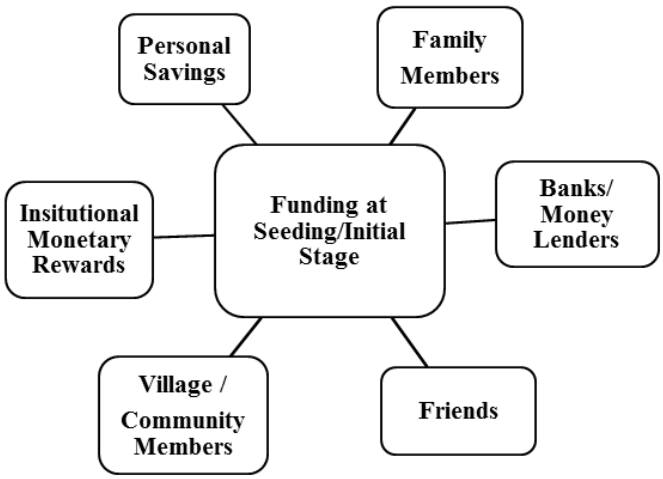

Figure 5.2: Sources of Funding at Seeding/Initial Stage (Self Compiled)

In a few cases, grassroots innovators experienced intensive help and the transfer of innovation and entrepreneurial skills. BA—a second-generation entrepreneur—is proud that he inherited innovation skills from his father, who is also grassroots innovator. As he stated: "I get such ideas because of the inherited knowledge and skills". His father, AA, is proud that his son is continuing the innovation tradition, and that his innovations are also being recognised and rewarded. Such transfer of knowledge and succession planning has helped foster GI. As AA stated: "I have imparted my knowledge to BA and his innovations have been recognised and he has received awards too."

Usually, GI exchanges entail transactions and contracts, the learning and sharing of non-monetary and monetary resources. The exchange dynamics embedded in the GI journey reflect an intricate mix of reciprocity, respect, self-interest and trust. At the ideation, opportunity-recognition and prototyping stages, most exchanges and interpersonal relationships are driven by socio-emotional relationships. It was also observed that belief systems affect exchanges and interpersonal relationships. The socio-economic exchanges underpinning GI were, in general, observed to be based on trust, a sense of reciprocity, mutual obligations and respect for each other.

The GI journey is not without challenges. Some arose from changes in the environment and personal circumstances. Grassroots innovators face various challenges (see Table 5.4), and their magnitude depends on the type of GI and available support systems. All but one of the innovators agreed that innovation is a challenging journey. MP expressed:

> "No innovation is without challenges or problems. One has to face these changes, solve these problems and make their innovation marketable. There are technical, financial, and mental and worker-related challenges in an innovation. An innovator has to face all these challenges and should be open to suggestions and advice. In addition to this there are some challenges from nature or the environment."

Table 5.4: Frequency of Themes Related to Challenges in GI

	Challenges			
Sub-themes	Financial	Moral	Technical	Social
Frequency	39	10	15	26

Source: Self Compiled

Conformity and livelihood pressures posed severe challenges for the grassroots innovators, in terms of time, experimentation and seeking help. However, these pressures eased as innovations were recognised as beneficial and useful. Grassroots innovators have multifaceted roles, and must constantly juggle their roles as son, brother, husband, father, farmer, income earner and innovator. While sharing their experiences and challenges, these innovators did not resist discussing the most uncomfortable or stressful phases of their innovation journeys.

For some innovators, balancing innovation aspirations with work and social life is challenging. The experience of MP reflects this. As he stated:

> "I used to work full time as a supervisor in a factory. For innovations, one needs to have some finance and spare time. I also required a place to innovate. Now the residence is at one place, working at another place and innovating at a third place. Co-ordinating all this and commuting was very hard."

Grassroots innovators had to constantly balance personal aspirations and obligations to the family, community and network partners. Grassroots innovators acknowledge their *naiveté* in terms of marketing their products for a larger market, and in protecting their business interests and IP.

Overall, grassroots innovators faced financial, moral, technical and social challenges. The social and technical challenges were experienced largely at the ideation and prototype development stages. Only one grassroots innovator, YM, struggled at the opportunity-recognition stage, while for others, opportunity was recognised by word-of-mouth and personal networks at an early stage. Despite of successful innovation, commercial scaling of GI for the GIr had been challenging. Through grassroots innovator's lived experiences, the key deficient elements in operationalising GI for commercial scaling were discerned. (see Figure 5.3)

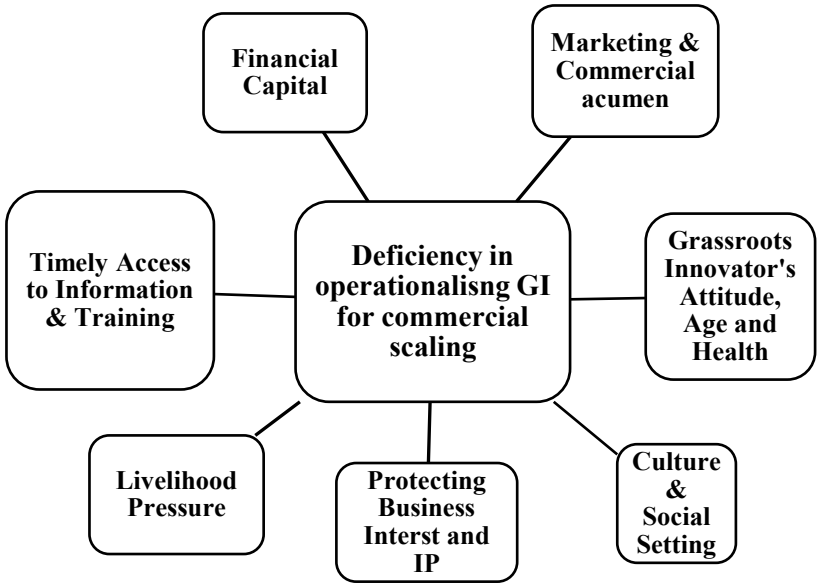

Figure: 5.3: Deficiency in operationalising GI for commercial Scaling (Self Compiled)

5.3.2 Background, Capabilities and Beliefs

The majority of grassroots innovators lack formal schooling; nevertheless, they have demonstrated awareness and knowledge of basic scientific principles through their innovations. They have also reflected domain knowledge, expertise and skills, in their conception of specific, novel and useful solutions. All but two are school dropouts and have even less formal education. However, their astuteness, practical knowledge, attitude and skills have helped them innovate and succeed. As GD stated:

> "Though I am illiterate, I am known for my intellect. I could go to the 18 states of India and meet people just because I have developed a useful, novel product using my acumen."

Their outlook not only helped them envisage the benefits of their innovations but also to explore, accumulate and connect with local people for resource accumulation and product development. Of the 13 grassroots innovators, only one was aided by his prior formal training and education, in the ideation and prototype-development stages. The grassroots innovators demonstrated problem-solving mind-sets and intelligence. Their innovations are the product of their capability to observe, learn and apply forethought, knowledge and experiences to situated problems. Their ability to relate to the community and social structure was also revealed through their narratives.

Grassroots innovators possess the ability to experiment and innovate. While talking about the purpose of innovation, a few of them—BT, MP and GS—remembered their childhood and told of their ability to observe, experiment and tinker with available resources to make objects that are useful at home or on farms. PP also acknowledges that innovation is his hobby and favourite pastime: "I am doing innovation for my own happiness. I get joy out of innovation". Aptitude and a mind-set for innovation and experimentation were visible in the serial innovators (BT, GS, PP, MJ, MP and YM). As MJ stated:

> "I have been interested in and it is my hobby to fabricate things […] I keep ideating every now and then, and whenever am free I keep experimenting. I don't note down any designs or patterns. I don't have anything in writing; everything is printed in my brain."

All of the grassroots innovators expressed that experience, observation and concern for other beings are vital in the generation of ideas and in exploring and developing products. They recognised and appreciated the value and importance of the capability to learn, research, inquire, network and experiment, and they expressed how these capabilities helped them evolve and pursue innovation. They were not apprehensive in taking help from their children or other experts, and they were willing to learn, enhance their knowledge and meet people. It was also observed that grassroots innovators were emotional about their solutions, and there were instances in which they became annoyed with the design and product-development support from

innovation network actors. The innovators were outspoken, and were not afraid to voice their opinions on innovation or other issues.

Discussion of capabilities emerged when the grassroots innovators began to explain how their ideas originated, how they recognised opportunities to make novel products and how they faced challenges in innovation. The majority indicated that the skills necessary for the generation of ideas were embedded deep within them. They attributed their innovation success to their ability to observe, gather resources, solve local economic problems and explore opportunities.

Grassroots innovators have to confront social, temporal, spatial and resource constraints when scaling their innovations or establishing an innovation-based start-up. The manner in which grassroots innovators face challenges reflects their adaptability and strategic thinking. For instance, when BT's sons asked him to relocate to the city and give up experimenting and innovating, he had to convince them of the value of his work. YM, a serial grassroots innovator and entrepreneur, tried to end his life after incurring huge debt through his pursuit of innovation, which led to failure. When under sever debt, a thought of ending his life did occur to MPP.

In a few cases, grassroots innovators experienced intensive help and the transfer of innovation and entrepreneurial skills. BA—a second-generation entrepreneur—is proud that he inherited innovation skills from his father, who is also grassroots innovator. As he stated: "I get such ideas because of the inherited knowledge and skills." His father, AA, is proud that his son is continuing the innovation tradition, and that his innovations are also being recognised and rewarded. Such transfer of knowledge and succession planning has helped foster GI. As AA stated: "I have imparted my knowledge to BA and his innovations have been recognised and he has received awards too."

There were two situations in which the grassroots innovators stopped innovating: when their families were concerned about their health, and when they decided to focus on their core occupation, farming. Two men expressed that these situations had

arisen for them. At present, they look after their farms sporadically and spend time with their grandchildren. Such instances are culturally specific: on the one hand, sons are duty-bound to take care of their parents, but on the other, parents must maintain family ties and social relations.

It was observed that despite several constraints and compromises, the general attitude of the grassroots innovators was positive. They all faced the challenges in their innovation endeavours with resilience and a positive outlook. For instance, PP stated that he looked for the positives in bad situations, saying:

> "I find that the set-back is also for something good. Any sort of sadness has not been able to discourage me or put me down in any situation. I am happy."

Further, MPP stated that he strongly believes that 'where there is a will there is a way and one can change his/her destiny through perseverance and hard work'. Such beliefs and attitudes towards life have helped the grassroots innovators succeed in their innovation journeys, despite structural or social impediments, resource constraints and other issues.

All of the grassroots innovators demonstrated their ability to translate learning into practice. They also stressed originality, the sharing of knowledge and innovating in ways that enhance community life. As MPP stated:

> "In the current age, copying is easy and we cannot stop that. More than the patent, what I believe is that the individual should have a belief in them for doing something on their own rather than copying. I think we should keep innovating; let the one copying keep copying but we should give something original to the world."

Grassroots innovators revealed their inclination towards experimenting and fabricating novel machines and tools, their capability to institutionalise GI at local levels, and that they are always thinking of ways to solve a problem—even sleeping with such thoughts on their mind, which the next day they work on, despite social, moral or other impediments. The grassroots innovators' attributes discerned from their lived experiences are depicted in the figure below.

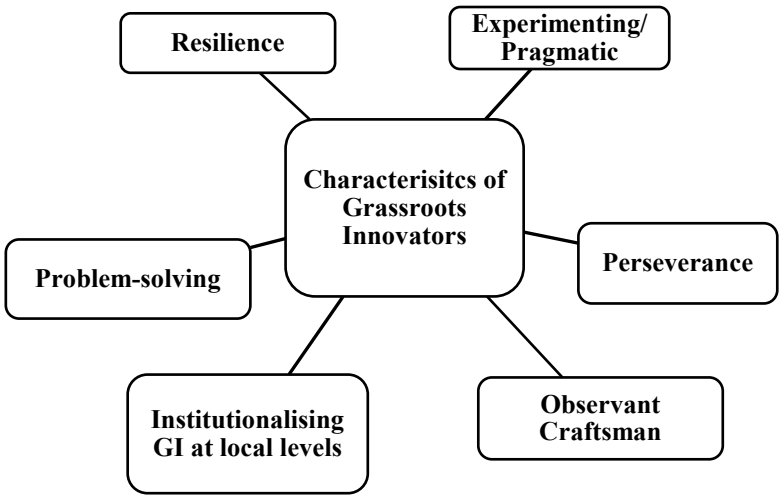

Figure: 5.4: Characteristics of Grassroots Innovators (Self Compiled)

The grassroots innovators proved themselves through their ingenuity and development of a beneficial novel product. They earned goodwill as entrepreneurs and innovators. GI, according to all of them, is an applied project that involves experience, practical knowledge, experimentation, resource allocation, testing and research. It is not just makeshift improvisation for short-term solutions to local problems. They also demonstrated strong moral grounding in terms of innovating and earning through righteous means, sharing knowledge and expertise for the greater good. Each of the innovators stressed doing good deeds and abiding by their worldly duties, in order to achieve transcendence. This belief is reflected in their innovation pursuits. For instance, YM suggested:

> "There is no end to the desire for money as such, but to earn money by doing something new and useful is what I desire…I am ready to earn less but will give my life for quality products and service."

Similarly, reflecting his moral mindfulness, BT stated:

> "I have to be vigilant that I don't bring in money through the wrong means. I don't like to snatch, steal and borrow from someone for my livelihood…I want to undertake more innovations that are useful to the farmers."

Further, MJ shared the belief system guiding his innovations when he said: "I firmly believe that whatever you innovate should be based on the path of truth (ethics)". Such belief systems also demonstrated that the grassroots innovators are content with their financial situations. They do not compete for profit or market share; nor do they

have a rent-seeking attitude. They are driven by an inner urge to be useful, good and fair in their deeds, including in their innovation. As SP said:

> "It is not that I am making a loss. I am able to run my house from the sale of the chairs, but my main mission is to maintain the health of the people and to seek their blessings."

There were instances when they turned down lucrative business offers that did not fit their belief system or personal life mission. For instance, BT recalled an interaction with business-people who approached him after he received an award for his innovation:

> "A few businessmen came to my house with a powersaver box and asked me to have a look at the configurations, circuit or to make a design for them. They convinced me of the value of this as the people are facing power problems, power saving is very important. I told them that this is true, but this particular device has nothing to offer to the farmer, therefore I will not waste my intellectual capacity and time on this thing. Moreover, this is already available on the market so I need not waste my time making something already out there. Rather, I want to invest my time on farm-centric innovations because my ancestors had to toil hard. I want to ease the life of the farmers and I have taken this mission in hand."

A belief in solidarity and knowledge sharing for the greater good was demonstrated when the grassroots innovators discussed their take on patents and the value of their innovations. Expressing the benefits of patent, GS—who received a patent for his hand-driven spraying cart—stated:

> "If anyone copies my design it is alright, let them earn too. The main thing is instead of innovation or knowledge getting extinct, let it further evolve or diffuse for use. Why keep secrets? One should share their know-how, information and knowledge and pass it on to next generation."

There were instances in which grassroots innovators recognised the benefits of patents in securing their livelihood and motivation. MPP stated:

> "Patenting is a very important thing because it provides some safety net to an innovator and it is recognition of the hard work of the innovator…Financial help through patents also motivate them to innovate."

Their belief in harmonious growth and knowledge-sharing supersedes the notion of individual growth and high economic returns. The innovator of the Bullet-Santi, MJ, expressed why he made his patent on open source: "I said I don't want a royalty, whatever I am destined to get I will get and let others' households run through the manufacturing of this machine."

Grassroots innovators do recognise the increasing problem of copying, and strongly oppose such acts, causing them to stall their progress at times. They also understand the importance of patents, but stress sharing, improvisation and originality. PP won a legal battle over patent infringement for his automatic thread winder, and the experience made him aware of the importance of patent protection. However, he still believes in sharing knowledge, and stated that sharing has a positive, flow-on effect on innovation capabilities overall. He revealed:

> "It hurts or saddens the most when someone makes and sells a similar machine. If they make or sell something better and an improvised version, then we are happy that someone has gone one step ahead and given a better product. I believe that it is not ok to make something similar. At least some improvised and better versions are always welcome, and then only there is progress…Patenting and time taken to market are very important. From the challenging times, I learnt that there is no point in hiding or keeping secrets. If someone is benefiting from an innovation, give it to them. The more you open your mind and be broad-minded and share, better and better thoughts come."

In addition, phenomenological exploration revealed what it means to be a grassroots innovator. Of the experiences that they shared about their social structure, work and innovation journeys, some are unique and others universal. On mining their experiences, it can be argued that the GI phenomenon is embodied in the being of grassroots innovators. The lived experiences and their descriptions offer holistic insights into the GI phenomenon and the social, economic, moral and personal elements of the innovators' lived experiences of GI (see Figure 5.5).

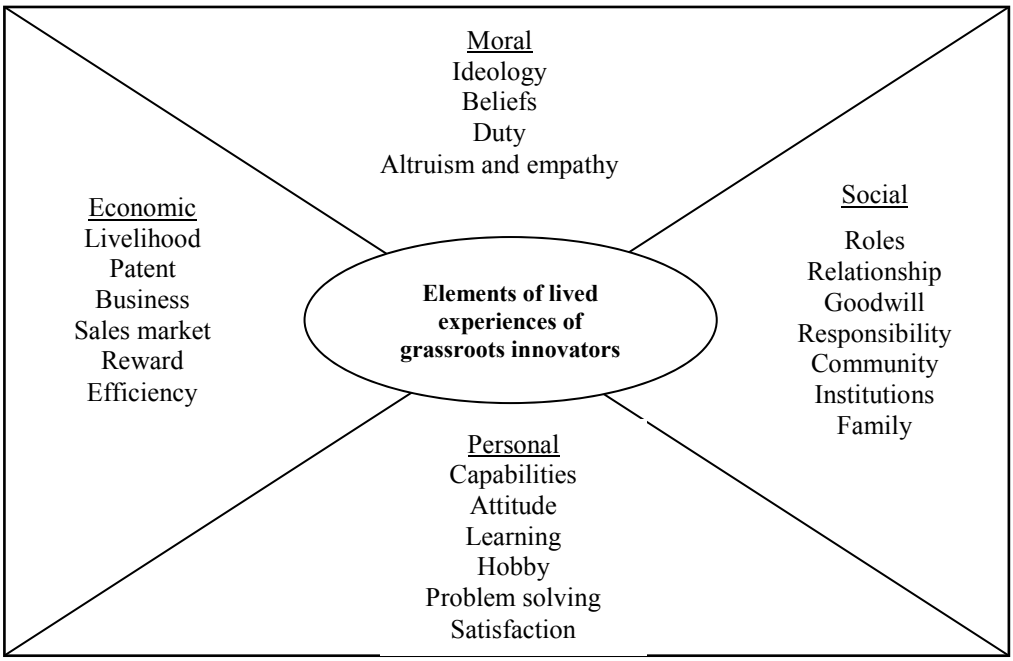

Figure: 5.5: Elements of Lived Experiences of Grassroots Innovators (Self Compiled)

5.4 Underpinning Themes

Phenomenological themes, according to van Manen (1997, p. 90):

> "are more like knots in the webs of our experiences, around which certain lived experiences are spun […they] are the stars that make up the universes of meaning we live through and by the light of these themes we can navigate and explore such universes."

The overarching theme that emerged from the data on the grassroots innovators' lived experiences of their innovation pursuits was that GI is not a technical pursuit for them. Rather, it is a human endeavour embodied in socio-technical emancipating and empowering action to find solutions to situated problems. For the innovators, GI is a way of life and a project orchestrated through intrapersonal and interpersonal engagements. Grassroots innovators revealed their sense of purpose, level of knowledge and philosophies of learning. They also shared their experiences of constraints and role responsibilities. All expressed how hard it is to separate innovation stories from life stories. There was simultaneity in creative thinking and being; purpose of innovation and life purpose; innovation and serving; innovation and livelihood earning.

The aspects of lived experiences (see table 5.3) and the elements of lived experiences (see figure 5.5) provides broader picture of the grassroots innovation as embedded in the life stories of the innovators. Furthermore, a detailed thematic analysis and Maxwell's (2012) categorising and connecting strategy allowed grouping the underpinning themes from the lived experiences. These themes led to understand the phenomenology of GI - the nature and a spirit of the GI (see table 5.5).

Table 5.5: General and Sub Themes

General Themes	Sub Themes
Intrapersonal	Capabilities Observation Formal Learning Acumen Purpose, Intention and Behaviour
Interpersonal – Exchange Relationship	Process of GI Exchange Relationship
Entrepreneurial and Emancipation	Micro-ventures Freedom Mindful of changing environment Purposive action Lateral thinking Entrepreneurial Creativity

Source: Self Compiled

5.4.1 Intrapersonal and Interpersonal Aspects of the GI Phenomenon

Intrapersonal aspects are the inherent, innate aspects of an individual, encompassing one's outlook, beliefs, personality, emotional state and skills. Essentially, they are things within a person. The grassroots innovators' innovation journeys suggest that the seeds of ideas germinate through grassroots innovators' own assertive, ingenuous demeanour. Grassroots innovators' personal beliefs, outlook and skills drive the intention to innovate and operationalise the GI process, despite impediments.

Grassroots innovators' shrewdness in assessing problems and fabricating a product from available resources allows them to excel at developing novel products and starting innovation-based start-ups or fabrication workshops. For instance, AA, BT and

GD state that they are skilled at generating ideas and experimenting, but innovation that involves usefulness and novelty comes from their practical experiences and observation skills. As AA indicated, “Ideas occur to me naturally but experience helps me to innovate.” Intrapersonal aspects of the GI phenomenon are endogenous elements of the personalities of grassroots innovators.

All grassroots innovators agreed that innovation journeys start with the inner self, and they emphasised self-motivation, positive outlook, passion and practical intelligence. Capabilities and a GI mind-set emerged as major themes in this thesis. Grassroots innovators also acknowledged that they ingeniously find solutions and assess socio-economic situations. Despite failures, they are keen learners, which have helped them evolve in the innovation journey (see Table 5.6).

Table 5.6: Frequency of Themes Related to Capabilities

Sub-themes	**Capabilities**			
	Observation	Formal training	Learning	Acumen (innovation and entrepreneurship)
Frequency	45	13	50	60

Source: Self Compiled

GI mirrors the skilled craftsmanship of grassroots innovators and it is manifested through the observation, learning, doing and researching capabilities of the grassroots innovators, and their lateral thinking. They stress envisioning, perseverance and strategic thinking in terms of marshalling resources. The outlook of innovators at the grassroots level shapes GI actions. From lived experiences it can be inferred that with open-mindedness, observation and learning skills, these innovators evolve in their innovation journeys.

Self-motivation and innate psychological needs such as joy, freedom, satisfaction, a sense of achievement and passion are instrumental in spearheading and sustaining GI innovation actions. PP stated: “I undertake innovation for my own happiness and I get joy out of innovation.” Of the 13 grassroots innovators, ST is the youngest, with an undergraduate qualification. He revealed:

> "I have seen on the internet that there are machines in foreign countries where the groundnut plants are picked up with a vacuum system. For the past two years I have been internet savvy. When I innovated I was not even aware of the internet and all."

This reflects the fact that young grassroots innovators have basic computer and web-based skills, which can help them in their innovation pursuits. The older innovators are not technologically savvy but are aware of the internet. All of the grassroots innovators have a web presence, as do the NIF, SRISTI, GIAN and HBN. Independent media stories have also increased the visibility of the innovators.

It is also evident from the grassroots innovators' life stories that their social relations are instrumental in fostering GI. Although grassroots innovators did not explicitly speak about their networking ability, this was clear from their stories of accumulating resources at the initial stages of GI. Overall, observation, experience, formal training, learning and acumen for innovation and establishing a venture surfaced as the capabilities of the grassroots innovators. As PP stated: "The experience of manufacturing an automatic thread winder helped me to innovate and make the incense stick machine."

Exchange and interpersonal relationships surfaced as the most prominent themes underpinning GI mobilisation (see Table 5.6). Grassroots innovators' exchange relationship experiences were intriguing, and it was inferred that reciprocal obligation and solidarity underpin GI development. Reciprocity for development and diffusion of GI was mainly affected by a sense of gratitude, mutual commitment and trust. Further, from the narrative accounts of the innovation experiences and the role of support systems, three forms of exchange relationship were discerned: socio-emotional, economic and ideological. Ideological exchanges derive from an altruistic frame of mind, belief in good karma and moral conduct.

Table 5.7: Frequency of Themes Related to Exchange Relationship

	Exchange Relationship		
Sub-themes	Socio-emotional	Economic	Ideological
Frequency	65	50	62

Source: Self Compiled

Grassroots innovators-turned-entrepreneurs also demonstrated that empathy and a service mind-set allowed them to evolve in the innovation-led businesses they established. For instance, MP—innovator of the cotton lint-stripping machine—expressed the importance of service, and how he considers customer complaints if there are problems with a machine's functioning. He stated:

> "Any ginner whose machine is not working is incurring loss and I can understand this. I see this as not their loss but my loss and make sure that this does not happen to them."

GIs are dynamic, relational phenomena that evolve with grassroots innovators' beliefs, expectations and obligatory relationships for varied resources, and the actualisation of their desire to make novel and beneficial products. The lived experiences also demonstrated that relational exchanges nurture GI and can enhance social capital. It was observed that reciprocal commitments in innovation actions make each party accountable, and such reciprocity serves as a governing mechanism in the contractual agreement. Further, it ushers long-term personal and socio-economic change into the lives of grassroots innovators.

On mining the subjective views and experiences of the grassroots innovators, the underpinning socio-economic and personal elements were revealed. The storied lives, as narrated by the grassroots innovators, reflected their worlds and their being. The distinctiveness of the GI phenomenon lies in the capability of innovators to use available resources frugally; their experience and practical knowledge in making a novel and beneficial product; and balancing the calling to innovate with their core occupations and social responsibilities.

Grassroots innovators valued their freedom to experiment and develop their ideas. It was observed that most grassroots innovators are averse to monotonous work and inertia. They challenge situated constraints, and face social and economic pressures. As MJ stated: “I cannot afford to do just repair job-work. If you want to progress then you need to be thinking ahead at least five years.” Collectively, their storied lives echoed perseverance, confidence, resilience and responsibility. All grassroots innovators discussed the roles of their family, friends and villagers in facilitating GI, and they saw themselves not just as innovators but as responsible, observant, duty-bound, emotional and creative individuals with multiple roles and abilities.

5.4.2 Entrepreneurial and Emancipatory Aspects of the Grassroots Innovation Phenomenon

Innovations led some of the grassroots innovators to start their own micro enterprises. Of the 13 grassroots innovators, only two (MSP and GD) had not started a venture.MSP wants to start a factory and manufacture his groundnut thresher but he is reluctant to do so because of the high capital investment required, plus his health. GD sold his patent to a third party, and does not want to start a venture because he and his son are happy farming.

All of the serial innovators run their own start-up businesses. During the interviews they called themselves businessmen or adventurous rural businessmen.BT a serial innovator and entrepreneur had to sell off one of the patent as he could not himself manufacture it due to lack of financial and other support. Later he set up his venture with the help of his sons to manufacture long-lasting lightbulb and shock box for farmers.

GI has changed the lives of a few grassroots innovators remarkably. Through their innovations they were able to liberate their community from inefficiency and arduous tasks. One innovator was able to lessen rural-to-urban migration, as his innovation enhanced economic and working conditions. For a few grassroots innovators,

especially farmers, GI has supplemented their earning and opened avenues for alternative earning.

Grassroots innovators offered affordable and accessible solutions, which helped the community a great deal. Further, the benefits of GI triggered socio-economic changes in rural areas. Recognition of innovations spread the benefits of innovations across India, and grassroots innovators were motivated to continue with their innovation pursuits. Overall, GI increases well-being by generating employment, creating opportunities for skill enhancement, developing local economies through enterprise building in rural areas and generating pathways for extra sources of income.

GIs have raised the standard of living for a few innovators. For instance, MP stated:

> "Innovation has ushered change into our lifestyle. We were farmer's sons, but now we are businessmen. I did not study, I had to stop my son's studies, but today my grandchildren are studying."

Moreover, grassroots innovators are establishing micro-ventures in rural areas. They are a source of regional economic development and sustainable transformation, evidenced through the storied lives of grassroots innovators and their real-life work. It is also apparent that these grassroots innovators are also rural entrepreneurs who employ and train people from the local community. These innovators are sowing the seeds for family businesses by training their heirs. They are also encouraging a culture of innovation at the grassroots by mentoring aspiring, skilled innovators within the community. AA, MPP, MJ, MP, PP and GS scout, network, share and link farmers, skilled villagers and unknown innovators with institutions such as the NIF, SRISTI and GIAN.

All grassroots innovators revealed that they innovate to liberate themselves, their family and community from livelihood and inefficiency issues. A few grassroots innovators wanted to liberate themselves from their own discomfort of a monotonous life, inefficiences and inertia, which prevailed in their existing environments. Overall, grassroots innovators consider their GI experiences emancipating and entrepreneurial. Grassroots innovators' perceptions of patenting reflect how emancipation can fuel GI. As PP stated:

> "In grassroots innovation there should be nothing like patents and it should be open. This will accelerate everyone's thought processes and something good will come out that it will help the community. This will be a source of livelihood for others and someone will be able to reach out to other people and places where I was unable to in India."

All of the grassroots innovators are mindful of the changes and issues in their regions. The ability to think ahead was evident in their lived experiences. For a few of them, situations such as drought, earthquakes and personal tragedies led them to formulate an idea, recognise an opportunity to solve a problem and develop novel and beneficial products. Their life stories demonstrated that they have the mind-sets to resist and challenge inertia, and to think laterally. To them, GI is a social action and solution-science, driven more by doing, using, interacting and learning than researching, strategising and planning for innovation in a linear, preordained manner.

The majority of the grassroots innovators referred to themselves as innovators with an innate desire to be useful to their family, community and nation at large. While a few considered themselves businessmen and innovators, others saw their activities as a way to do well and adhere to a higher calling in life. For instance, BT stated: "Apart from being a grassroots innovator, I am a servant of God, and service to mankind is my duty." GS related his identification with his passion and work, saying: "Innovator is my best identity…I am a farmer king in all manners, from farming and innovation to writing and singing devotional songs." Acknowledging his 27 years of active association with the HBN, AA strongly identifies his work with the institute, saying: "I am a SRISTI friend and innovator. People know Amrutbhai as SRISTI's friend and innovator. This is my identity." MPP, ST and YM are grassroots innovators-turned-entrepreneurs. MPP stated:

> "Apart from a grassroots worker, I am rural India's enterprising businessman as labelled by *Forbes* magazine, a scientist or as a good innovator I have a reputation in society."

The youngest innovator, ST, stated: "I identify myself as a businessman, apart from being known as an innovator". YM, an entrepreneur and one of the most resilient serial grassroots innovators of non-farming equipment, metaphorically identified himself with his role, saying: "I identify myself as a father: father of my son, my

product and my staff members." Innovation experiences offered the grassroots innovators a different way of being in the world.

5.5 Conclusion

In general, the findings suggest that the grassroots innovators are creative, self-motivated tinkerers with transformative capabilities. They provide solutions to problems and useful, beneficial, novel products that are context-specific and affordable. On exploring the GI phenomenon, the structure and underpinning elements of lived experiences surfaced. GIs are affected by social relations, norms and economic status. Nevertheless, they conscientiously make the decision to innovate, keeping in mind the urgency and necessity of solutions to the problems faced by themselves or others in the community. Prioritising their passion and innate need to innovate, grassroots innovators begin their innovation by balancing social relations, responsibilities, social norms and protocols. Moreover, their intrapersonal attributes and skills and community spirit have helped them prosper in their innovation journeys. The lived experience of innovation by grassroots people is not a just series of activities that reify innovation, but about profound changes in the existence of grassroots people as innovators.

Detailed discussion of the findings occurs in the following chapter. It is demonstrated in the storied lives that GI is not a provisional improvisation. It is a systemic creative pursuit that meets unmet demands at the local level. GI does not just exist as an object out there, but is part of grassroots innovators' being and their way of life. The GI phenomenon is an inside-out journey for them.

Chapter 6: **Discussion**

6.1 Introduction

On exploring the lived experiences of grassroots innovators, their daily routines, patterns of thinking, acting, decision making and marshalling of resources surfaced. The findings of the study (presented in the previous chapter) made it clear that the lived experiences of Indian grassroots innovators are dynamic, contextual and temporal in nature. GI enactment is complex bricolage which contours livelihood pathways for the grassroots innovators and community at large. GI is instrumental in extending, expanding and enriching livelihood. At the grassroots, people seek to put-together a living through varied activities (Chambers and Conway 1992).

Discussion of the findings relating to the essence of the GI phenomenon and what it means to be a grassroots innovator are presented in this chapter. Assimilating essence and being of the phenomenon this chapter begins with the discussion of the phenomenology of GI. Subsequently, it discusses what it means to be a grassroots innovator and then it proposes GI as relational commercial exchange and a mind-set driven practical solution science. Finally, the chapter deliberates on the grassroots innovation as a source of entrepreneurship and emancipation.

6.2 Phenomenology of GI

Although each of the 13 grassroots innovators' lived experiences were unique, there are some commonalities between their worldviews, actions, expectations and principles of innovation. The study also identified the intertwined nature of the GI phenomenon and the underlying intrapersonal and interpersonal attributes fostering GI. Further, it was discerned that GI potential is manifested not only through the usefulness of an innovation but also through the capability, outlook and capacity of grassroots innovators to spread the innovation and share knowledge for its development. It is also gathered from the data that GI is not only an intellectual

pursuit but also a social action that is practical, unconventional and co-operative, driven by human relations.

6.2.1 Being a Grassroots Innovator

The essence of human nature is in action. According to Heidegger (1962), to be human is to be practically involved with the world, to do things, make things and use things, rather than to sit around thinking about things. As van Manen (1997) states:

> "Being of something is to inquire in the nature or meaning of that phenomenon and being in the world refers to the way human beings exist, act or are involved in the world."

Reflecting Heideggerian existential philosophy, Steiner (1995) suggests that it is human nature to be co-operative, practically involved in a complex world, unconventional and uncommitted to one's paradigm at some point. Hence the understanding of the essence of a phenomenon is incomplete without considering what it means to be a grassroots innovator.

The phenomenological exploration provided insights on the grassroots innovators' intentionality; their existence directed towards innovation and their individual innovative behaviour and exchange behaviour. For grassroots innovators innovation is an innate part of their existence. Their innovation acts are also manifested through interpersonal skills and social roles, which are explicit and outside of the actor (Hellström 2004).

Being a grassroots innovator is not only about the manifestation of ideas into innovation but also an inside-out journey of being self-governed, responsible, ethical and committed people for the family, community and nation. The reflection of grassroots innovators explicates that innovation is embodied in thinking, intentionality, acting and being. As BT stated:

> "In my family, since childhood I have liked creating new things...I like innovation. I keep thinking how a machine can ease laborious work and according to my situation and ability I slowly accumulate some equipment and make things...Each person has some mind-set. Some people, after fulfilling their daily needs, when left with spare money buy investment property, vehicles or spend money on entertainment or on what they like. I spend such money on my innovations, my hobby is to innovate.

> Especially agriculture and farming-oriented innovation I like to do this and to make something useful for farmers and relieve them of arduous tasks...provide them affordable farm-related products…do some social work through my innovations."

It is also evident that being a grassroots innovator is to be conscious of existential purposes and duty, to transcend and adapt to evolving situations with mindfulness and practical consciousness. Grassroots innovators identify themselves as responsible individuals with multiple roles and social duties. While those in farming-related GI identify themselves as farmers first and innovators second, the others identify themselves as innovators and businessmen. All grassroots innovators acknowledged that their acumen and ingenuity are no less than those of well-educated, resourceful city people.

It is important to note the age of the grassroots innovators and their innovation and entrepreneurial pursuit. Majority of the grassroots innovators experiment their ideas at a very young age; however their pursuit for innovation and entrepreneurship starts at the later stage. The livelihood issues, social responsibilities and support can be major factor for such delays. Innovators such as BT, BA, GS, and PP had been experimenting since very young age and had the innovation propensity since childhood. For other innovators the innovation pursuit triggered at the later stage of their life through observation, experience and necessity. The innate capability, education level, occupation, socio-economic setting and responsibilities of the grassroots innovators influence the pursuit of innovation.

Grassroots innovators attach their innovations to the purpose of their life, and perceive it as a means of transcending life and serving God. Their self-interest is based on the moral values of usefulness to others and earning through right means, so personal economic gain comes second in their innovation actions. For grassroots innovators, the success of their innovation comes in the form of being useful to the community at large, enhancing others' livelihood and being recognised. As such, orientation towards innovation and innovation behaviour of grassroots innovators contradicts the assumption of economic man (*homo-economicus*). Rather, it befits the notion of reciprocal man (*homo-reciprocans*). The former is driven by utility-

maximising human nature, and innovates only for profit and economic gain. The latter is driven by reciprocity, and innovates to improve the environment.

Reflecting on his innovation and entrepreneurial pursuit SP stated:

> "It is not that I am making loss, I am able to run my house from the sale of the chairs, but my main mission is to maintain the health of the people and to seek their blessings."

It is apparent that SP is not selflessly altruistic but is cognisant of the interest, needs and expectations of his community. He is also not driven purely by economic gain. His innovation arose from a personal emergency. Recognising the dearth of affordable exercise equipment and amenities in small Indian towns, he decided to produce and sell such chairs. He used his savings and started a fabrication workshop. His main intention was to encourage a healthy lifestyle. His innate expectation is that of benediction from the community.

An altruistic, empathetic belief system drives the actions of grassroots innovators, who are the producers of beneficial, novel products. However, these innovators have also demonstrated their innate desire to enhance their livelihood and prosper ethically and collectively. The grassroots innovators not willing to continue at a larger scale have either sold the patent or placed it on an open source basis, so that the innovation is beneficial to the larger community and other innovators can prosper. Grassroots innovators have also revealed their potential for entrepreneurship, and mentoring. Health and social constraints have limited the exploration of innovation opportunities for few grassroots innovators.

All grassroots innovators associated themselves with their occupation, while some did so to their caste and occupation. Although their social identities have not prevented them from innovating or commercialising their innovations, it is interesting to see how notion of caste is embedded in the minds of grassroots Indian people. Though, there exists different views on caste from religious, communitarian system to social or economic, it is still the defining feature of Indian social organization (Dirks 2011)

Grassroots innovators are observant, proactive, practical, and mindful and morally grounded individuals who see innovation as an innate part of their existence. They work with Hellström's (2004) practical consciousness: a cognitive state in between matter-of-act application and conceptual ideation and vision. Grassroots innovators are not just utility-optimising economic actors but are also social actors with multiple roles and responsibilities, who demonstrate unconventional innovation behaviour and practical conscientiousness to solve problems and co-operate to enhance their situation. These innovators identify themselves variedly. Berdegué (2005) has emphasised on paying considerable attention on the identities with which the poor will represent themselves in the innovation system and to support the expression of such identities for the promotion of pro-poor innovation processes.

Table 6.1: Elements of Being Grassroots Innovator

Intention	Behaviour	Identity
• Service • Duty • Being useful & recognised • Co-operation • Well-being • Sustenance	• Ethical • Relational • Experimenting • Sharing • Self-Governed • Proactive • Problem Solving	• Responsible Individual • Social actor • Innovator • Businessman • Farmer

Source: Self Compiled

Grassroots innovators also demonstrated entrepreneurial potential and few of them identified themselves as entrepreneurs and businessman. These grassroots innovators have also demonstrated their risk propensity, ability to face uncertainty, resource mobilisation skills, persistence, creativity, interpersonal skills, strategic vision to mobilise their innovation and the passion for their innovation. Most of the serial grassroots innovators were entrepreneurs and they were driven by the passion and capability to provide novel and beneficial product. Their decision to be an entrepreneur is effectual in nature (Sarasvathy 2001) where they think more on affordable loss than return on investment. Moreover, innate expectations of these

innovators are to control unpredictable future, eliminate uncertainity and exploit opportunities with available frugal means.

The specific experiences of the grassroots innovators who are entrepreneurs provided insights on the nature of entrepreneurship at the grassroots (see table 6.2). The opportunity led entrepreneurs were those innovators who started their ventures recognising the value of their innovation; they were driven by service and providing value to the customers through their innovation. The nature of entrepreneurship at the grassroots is innovation and opportunity led. Broadly, change, service, wealth creation and collective growth is embedded in both the nature of entrepreneurship at the grassroots. Grassroots innovators; traits, their awareness of their existential purpose, capabilities and their resources influences the entrepreneurial decision making.

Table 6.2: Nature of Entrepreneurship at the Grassroots

Nature of Entrepreneurship	**Key Defining Elements**
Innovation led entrepreneurship	Creativity, Innovation and Value
Opportunity led entrepreneurship	Value, Customers and Novelty

Source: Self Compiled

6.2.2 Essence of GI

The evolution and development of GI is embedded in the socio-economic structure of living. Majority of the grassroots innovators are the producers, and also the consumers, of GI. Innovation is woven into grassroots innovators' existence, and is affected by their belief system. Innovation is based on the economic structure of the society because only when people have taken care of their sustenance that they can innovate and create (Hellström 2004). Life stories of the grassroots innovator states that they do innovate for their sustenance, especially that innovation which is conceived for the efficiency in work on farms. Unlike the conventional view of innovation as scientific discovery, GI is perceived to be a socio-technical system (Seyfang & Smith 2007) that involves a co-construction process (Torri 2010). There are

bi-directional and mutually influencing and evolving interactions between grassroots innovators, institutions, family, community, organisations and environments. GIs are not just a technical reified artefact; rather they are human endeavours that evolve through interpersonal and intrapersonal elements of the social system and individual, respectively.

The 'push factors' of pro-poor innovation system such as - drought; reducing agricultural productivity, personal tragedy, inaccessibility and non-affordability (Berdegué 2005) has reverberated through the GI phenomenon. However, the lived experiences of grassroots innovators demonstrated that there was growth and expansion of the capabilities of the people at the grassroots through GI. In GI, knowledge, practice, expertise and innovation are exchanged for the greater good of society, not just for profit or economic return. Grassroots innovators innovate purposefully to solve a problem, overcome occupation-related hardships and enhance their and others' livelihoods. Overall, the drive to change the situation, to face persisting problems and to challenge the constraining factors was very eminent in all the grassroots innovator's innovation experiences.

6.2.2.1 GI a social action

Innovation is social action entailing interaction of mental activity and physical work (Hellström 2004) embedded in socio-economic structure. Grassroots innovators perceive GI to be a social action. Here, social encompasses an intricate mix of social relations, economic structure and interaction for innovation. The empirical exploration of the lived experiences as depicted in the previous chapter, suggest that the interpersonal or relational dynamics are central to GI augmentation. GI process is mainly spearheaded by the grassroots innovator in an unaided manner initially. Later GI is facilitated by the friends, family, community and institutions.

Grassroots innovators are flexible and open to others' views and interpretation. Such flexibility has facilitated the diffusion of innovation at a wider scale and provided traction to the GI. Decision process in GI involves intrapersonal attributes and interpersonal skills. According to Rogers (2003, p. 172), the innovation-decision

process is an information- seeking and information-processing activity, whereby an individual is motivated to reduce uncertainty over the advantages and disadvantages of an innovation. The empirical findings suggest that grassroots innovators follow unconventional approaches and are open to alternative viewpoints. Their interactions are co-operative and not competitive in nature. These innovators are unconventional individuals who are central to GI, rather than to conventional science or engineering. They are self-motivated, not only by unresolved situated problems but also to look for non-existent, unaffordable and context-specific solutions (Srinivas & Sutz 2008).

Grassroots innovators are grateful to receive institutional help, and there is a commitment to reciprocate in any possible manner. Grassroots innovators consider this their moral duty, and repay the obligation in various ways, such as by scouting for grassroots innovators in their villages and connecting them to institutions; by serving on the board of HBN, SRISTI, NIF or GIAN and acting as ambassadors, promoting the institution's work through community workshops or other events; by mentoring aspiring innovators, farmers and fabricators; by helping researchers through sharing their life stories; and by showcasing their innovation and entrepreneurial setup.

Innovation requires cooperation, and cooperation is rooted in institutions that help build trust (Berdegué 2005). Institutions are integral for the social and commercial development and diffusion of GI and it is seen to influence the innovation process and decision making. In pro-poor innovation, the institutional set up has helped in creating mutually respectful social relationship and cultivating values of trust, identity and dignity (Berdegué 2005); thereby leading to cooperative, positive and beneficial outcome from the GI.

According to Berdegué (2005), institutions consist of the formal and informal rules (laws and regulations, norms, values, and morals), that shape human behaviour, and the mechanisms for their enforcement. These institutions are significant link in an innovation system. In GI it consist of the family, community, village, formal organisations such as SRISTI, NIF, HBN, GIAN and other education and financial organisations. In case of GI, such institutional set up has helped in the determination

of the participation of the grassroots people in the process of innovation diffusion for the commercial purpose, to share its potential benefits and build social and ethical capital.

6.2.2.2 A Relational Commercial Exchange

The study found that socio-economic exchange in GI is usually governed by trust, social relations and goodwill. Personal, moral, economic (market), institutional and social factors affect the exchange decisions for fostering GI. Reciprocal belief in harmonious living, ethical conduct and co-operation drives exchange behaviour. It was also observed that there were no explicit economic contract between the grassroots innovators and the community for the use of grassroots knowledge, practice and innovation (Kumar & Bhaduri 2014). Furthermore, the grassroots innovators' need for reciprocity was brought out under the proper circumstances (Bowles et al. 1997) which were led by trust, goodwill, status and relationship. .

Interpersonal or relational dynamics are central to GI augmentation. The GI process is mainly spearheaded by the grassroots innovator and facilitated by friends, family, community and institutions. The lived experiences also demonstrated that the mental frameworks of grassroots innovators are equipped to act upon social and psychological contracts. Implicit contracts based on mutual understanding and social roles affect the innovation decisions of grassroots innovators. Such implicit aspects of interpersonal relations are reciprocal in nature. The subjective perceptions, social norms and expectations of the grassroots innovators also affect the content and character of the exchange relationship for fostering innovation. Overall, exchange and interpersonal relationships are driven by grassroots innovators' beliefs and capability to appropriate scarce resources for innovation. Their exchange behaviour reflects Meeker's (1971) relational exchange rules: reciprocity, rationality, competition, altruism, group gain and status consistency.

It was also observed that GI is driven by economic, socio-emotional and ideological exchange, which pivots on reciprocal obligations, rewards, resources, roles,

responsibilities and ideologies. For developing GI, grassroots innovators value exchange relationship which entails ideological (Thompson and Bunderson 2003) and transpersonal (Burr and Thompson 2002) psychological contracts. While ideological contract arise from an individual's desire to further highly valued cause which is altruistic in nature (Thompson and Bunderson 2003), the transpersonal contract arise from the desire to collaborate for benefiting the rest of the society (Burr and Thompson 2002)

The exchange rules are affected by folk beliefs and expectations, such as that those who are unhelpful will be punished, those who are helpful will receive help in the future, that all exchanges reach a fair equilibrium, and that being helpful lessens the likelihood of destructive behaviours (Cropanzano & Mitchell 2005; Bowles et al. 1997). The reciprocal behaviour driven by such a system is 'altruistic' in nature, only as it fosters sustained co-operation strictly at positive cost to the individual who bears the traits of justice and reciprocal commitment (Bowles et al. 1997). The likelihood of such beliefs affecting innovation behaviour was evident in the lived experiences of the grassroots innovators.

Grassroots innovators' behaviours regarding innovation pursuits are found to be rational and altruistic. Although grassroots innovators do not innovate with the motive of economic gain, they do rationalise the means of innovation, because they innovate within a frugal environment. There are times when grassroots innovators have incurred huge financial costs while innovating a beneficial product for the community. These costs are inclusive of monetary and non-monetary components, such as time away from the family, household resources or social relations.

Status played an important role in exchange relationships for grassroots innovators. Once the benefits of innovations were widely known, respect for the grassroots innovators in their communities increased. As a result, some people who had previously only dealt with grassroots innovators via cash transactions started to offer credit. Social roles and status affect regional innovators, encouraging them to undertake challenges arising from their social and economic environments (Cécora

1999). Social status involves the designated rights and obligations of an individual (Cécora 1999, p. 69) and along with social roles have affected grassroots innovators' exchange behaviours.

MPP began his innovation journey by borrowing money from a small money-lender as well as taking a loan from a bank. He incurred a huge debt in the pursuit of innovation, and had to sell his parents' house to repay it. Due to the financial pressures from the bank and other money-lenders, he had thought about taking his own life, but family support helped him through the difficult period. Now he is one of the best-known grassroots innovators and rural entrepreneurs in the world. Reflecting on his experiences and the current situation, MPP stated:

> "Lots of changes have happened and trust is huge now. Today, I make a deal on the phone and even if I have not paid in six months they don't ask. Now they say to me that Mansukhbhai, we know the person and money is not important."

Similar instances were shared by other grassroots innovators, in which their goodwill and recognition helped them to avail resources. This illustrates how the exchange rules change over the lifetimes of the grassroots innovators.

Trust surfaced as a critical element in relational commercial exchange in GI. It not only facilitated exchanges but also played an important role in governing them. Further, relational commercial exchanges blend market and non-market aspects of socio-economic exchanges and relationships. Trust and reciprocal commitment to tangible and non-tangible benefits can foster enduring social relations (Blau 1964).

According to Meeker (1971), an individual driven by altruism assists others even when potentially hurting themselves. Although grassroots innovators are open to innovation and believe in sharing knowledge, a sense of competition and protecting one's innovation from imitation were noted in two cases. However, such competitive behaviour was beneficial to the community. Competition is harming others when they risk one's own earnings (Meeker 1971). Nevertheless, such attitudes and expectations were absent among grassroots innovators.

Evaluation of the success of such innovations, which foster democratic engagements and empowerment, goes beyond economic efficiency (Davies 2012), largely because grassroots innovators orient innovation differently to mainstream, formal-sector innovators. There are economic and socio-emotional outcomes of exchange. The former are those that address monetary needs and are tangible, and the latter are those that address one's social and esteem needs, which are often symbolic in nature (Cropanzano & Mitchell 2005). Despite frugal financial capital, grassroots innovators-turned-entrepreneurs employ social, natural and ethical capital, reinforcing values of moral, community and ecological conservation (Gupta 2013). Such externalities are hard to quantify but does contribute to the solidarity and well-being of the individual and the community.

A few grassroots innovators mobilised their prototypes through informal, personal networks. At this stage, sales were insignificant. The majority of GIs gained an initial market through referral. Although contextual aspects (economic, technical and social factors) set the scene for innovation diffusion (Agarwal 1983), personal networks and word-of-mouth are the primary means of innovation diffusion (Rogers 2003). However, the scaling of GI requires more formal support systems because the GI is no longer limited to the innovator and is made accessible for the market or common users (De Keersmaecker et al. 2013).

On exploring the lived experiences, it was observed that prior to the prototype and commercial scaling, GI goes through much experimentation. Although the social system is instrumental in the development and scaling of GI, grassroots innovators faced multiple social, emotional, economic and moral challenges at the ideation and prototype development stages. Grassroots innovators work under various social, economic and cultural constraints and these affect their innovative behaviour (Kumar & Bhaduri 2014), especially at the prototyping and commercial scaling stage of GI. These innovators emerged as responsible, resilient, enterprising and innovative individuals. Nevertheless, Krishnan (2010) stated that an effective social and collective process is required to scale-up grassroots creativity. Grassroots innovators agreed that their innovation got traction with greater market access, IPR protection and

recognition only after they were scouted or connected to the institutions in the innovation network.

The lived experiences have revealed that majority of the grassroots innovators have the innate expectation to capitalize on their innovation, improve their livelihood and share the benefits with the community. The grassroots innovators engage in commercial relational exchanges for enhancing socio-economic and emotional well-being. It is also observed that the exchange arrangements in GI phenomenon are hybrid in nature comprising of individual discrete transaction and relational exchange. Keeping in mind such innovation behaviour and lived experiences of the grassroots innovators, this thesis advances the relational commercial exchange for fostering GI.

The commercial relational exchange in GI entails economic, socio-emotional and ideological exchange relationships, not just social relationships. This exchange takes into consideration the moral fabric of the GI community, and the idea of reciprocal fairness. It relates to the tendency of an individual to co-operate and increase the level of co-operation in solving management issues (Bowles et al. 1997). Some GIs were developed with such arrangements among friends, family members, institutions and individual grassroots innovators. Personal, moral, economics (market), institutional and social factors influence the exchange decisions for fostering GI in commercial space. Social and economic exchanges embedded in grassroots innovators' lived experiences of innovation are largely trust based, reciprocal, co-operative and collaborative relational commercial exchanges.

The idea of a complementary or community currencies mechanism, suggested by Longhurst and Seyfang (2011), is useful as it considers the reciprocal relationships that empower individuals in the grassroots sector. Such exchange mechanisms are important, as they create alternative financial spaces of value, which do not fit into capitalist thinking. However, this currency complements only social exchanges and overlooks the ideological and socio-emotional exchanges that are more prominent at the grassroots. Moreover, this mechanism is suitable for community led GI and not individual led GI.

The lived experiences revealed that the majority of grassroots innovators expected to capitalise on their innovations improve their livelihood and share the benefits with the community. They engaged in commercial relational exchanges for enhancing socio-economic and emotional well-being. Table 6.3 depicts the attributes of three different types of socio-economic exchanges. The column titled 'relational commercial exchange' lists the attributes of socio-economic exchange dynamics discerned from the lived experiences of grassroots innovators. Relational commercial exchange entails economic, socio-emotional and ideological exchange relationships and not just transactional and relational relationships.

Table 6.3: Exchange fostering Grassroots Innovations

Transactional Exchange	Relational Exchange	Relational Commercial Exchange
Monetary	Social contract	Individual discrete transactions and relationships
Contractual	Reciprocal moral and social obligation	Personal and partnering
Rule governed	Relational focus	Role focus
Impersonal	Non-contractual	Relational contractual
Linear	Ideological, altruism, group gain	Ideological
Short-term	Role-governed	Social and Moral responsibility
	Long-term	Reciprocal economic, social and moral obligations
		Trust- based
		Socio-emotional
		Governed by reciprocal commitments
		Co-operative and collaborative
		Dynamic
		Driven by goodwill

Source: Self Compiled

Cropanzano and Mitchell (2005) posit that exchange relationships evolve over time into trusting, loyal and mutual commitments. A belief in reciprocity and an individual's belief in an obligation of reciprocity is central to social and psychological contracts (Rousseau 1989). Such psychological contracts are vital to exchange dynamics in GI, whereby individual grassroots innovators spearhead exchange decisions under a constrained socio-economic environment. The grassroots innovators constantly live and thrive in the world of divergent expectations and multiple roles and identities. For

them, the notion of benefits transcends all personal gains and self-interest. Incorporating the concept of ideology influenced exchange at the grassroots into the interpretive framework of exchange relationship allows understanding of the psychological contract embedded in the exchanges fostering grassroots innovation (see table 6.4). It also opens up possibilities to understand the ethics, innate expectations, governance, and benefit sharing aspects in developing and fostering grassroots innovation for commercial purposes.

Table 6.4: Interpretive framework for Exchange Relationship

	Transactional	**Relational**	**Ideology-infused**
Scope	Narrow	Comprehensive	All-encompassing
Resources	Economic	Socio-emotional	Ideological
Duration	Specific	Indefinite	Variable
Individual's Obligation	Formal, Specific Role requirement	Generalised, Role obligation	Participatory Mission/cause led
Ethical Principle	Self-Interest	Commitment Joint Interest	Community Interest
Beneficiary	Individual/Self (Me)	Self & Community (We)	Society or Nation at large (All)

Source: Adapted from Thompson and Bunderson (2002) & Source: Self Compiled

Along with these perceptions, obligations, motivations and expectations shape the exchange dynamics in GI. Exchange relationships, resources, rules and the innovation network constitute relational commercial exchange dynamics, shaped through motivations, expectations, perceptions and obligations (see Figure 6.1). As these dynamics are from the grassroots innovators' situated reality, they can serve as a guide for devising a scaling mechanism for the grassroots innovation.

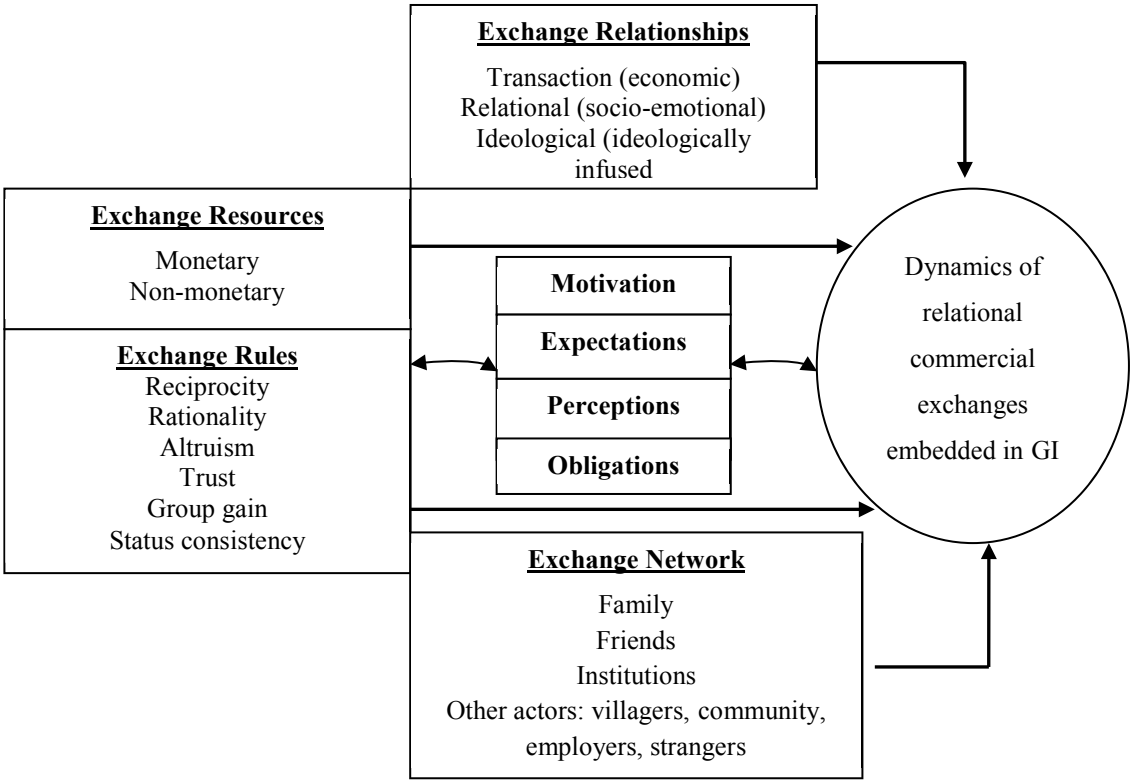

Figure 6.1: Dynamics of Relational Commercial Exchange (Self-Compiled)

6.2.2.3 A Mind-Set Driven Practical Solution Science

The majority of grassroots innovators demonstrated an ability to translate observation into innovation. Grassroots innovators showcased the drive, concern and will to solve problems situated in the local context. They provide creative, technological solutions to local communities' problems (Rajan 2013). Motivation to innovate is influenced by the innovator's nature of work, the work environment, evaluation of social and economic expectations, expected rewards, feedback on actual performance and autonomy. Of the 13 grassroots innovators interviewed, nine are serial innovators, and this reflects the innate ability of grassroots people to solve problems through innovation.

GI is driven by their usefulness and social dimensions and therefore it can forge a link for development. It was also recognized through lived experiences that the grassroots innovator is an epicenter creating positive ripple effect at the individual, family, community and national level. Their innovation and creative act has the potential for

socio-economic wellbeing of family, community and nation. GI, can therefore be, stated as solution science that ushers in social-economic change and personal evolution of the grassroots innovators.

The lived experiences of grassroots innovators also reveal that GI begins in a decentralised and isolated manner in remote villages. Grassroots innovators have demonstrated mindfulness, enriched awareness and entrepreneurial orientation in recognising and exploring opportunities and creating solutions and ventures fostering these solutions (Capel 2014; Amabile 1997). They revealed their innate desire to explore more innovation opportunities and enjoy the freedom to explore the world of innovation and business.

Grassroots innovators are authentic as they interpret experiences individually, or empathise with problems and take responsibility for their interpretations of the real world. Gupta (2010) posits that GI is based on the capacity of such individuals to create value from scarcity and to meet basic needs, which in turn are useful to the community at large. This capability is core to grassroots innovators' innovative behaviour, especially in ideating or recognising opportunity.

GI is a mind-set-driven practical solution science because it blends the practical consciousness, capability, attitude and passion for solving situated problems and confronting the uncertainties and hardships through experimentation in a frugal environment. Through such a human science approach, grassroots innovators evolve in their innovation journeys and demonstrate their ability to find solutions, learn and connect with support systems inclusive of family, friends, community and institutions.

Citing Marxian notion of practical consciousness, Hellström (2004), argues that in the sphere of human action the ideation first emerges from the thinking related to immediate work tasks. It is very important to understand the intention or rationale of a human action such as innovation. Innovation is a conceptual and physical goal-oriented activity, entailing something new and capturing a problem and its solutions (Hellström 2004). Capability and acumen backed by an innate sense of socio-economic

responsibility propelled the innovation decisions of grassroots innovators. Their practical orientation, curiosity and ability to observe, and the ability to think laterally are central to ideation and opportunity recognition.

Grassroots innovators' ideas go through much iteration. In one case it took seven years for an innovator to create a well-designed product. Trial and experimentation are integral aspect of GI (Bhaduri & Kumar 2011). When a prototype is ready, some grassroots innovators seek feedback from users, and others test the product themselves, developing their innovation through constant experimentation. Grassroots innovators are flexible and open to others' views and interpretation, in order to diffuse the innovation widely. On receiving indifferent treatment from the NID for the bicycle sprayer, MJ's decided to get going on his own. He revealed that he was able to provide a beneficial useful product within sixty days. Such, mind-set for problem solving and continuing without giving up is core to the GI phenomenon.

Grassroots innovators respect individuality and have demonstrated a belief in harmonious living. Individuality relates to the self-governance of autonomy; here, self-serving competition, control and power are absent (Steiner 1995). Individuality is also being authentic, with the willingness to co-operate and take responsibility for one's own experiences and interpretations (Steiner 1995). Their intention to innovate and their outlook on patenting testifies to the grassroots innovators' authenticity. While they have asserted their individuality and pursued their innovation, they have also been constrained by social relations, the economic system and their belief systems.

A lack of formal education among the grassroots innovators did not limit their ability to ideate or create opportunities. Personal experience, ingenuity, on-the-job training, learning and practical knowledge helped them develop a new product or make incremental changes to existing products and create affordable and useful solutions. Primarily, innovation behaviour is driven by the joy of creating a novel product to overcome difficulties, realising the vision or opportunity to exercise autonomy and responsibility (Schumpeter 1934). Innate psychological needs such as a feeling of competence, joy from work, autonomy and a sense of duty (Bhaduri & Kumar 2011)

provide sustainable thrust to grassroots innovators innovation pursuits. Curiosity, experimentation or an inquisitive mind are the driving force behind idea generation (Bhaduri & Kumar 2011). Grassroots innovators may not be knowledgeable but they innovate with the deep seated understanding of logic.

GIs are highly functional, useful and context specific, because they are generated from grassroots innovators' practical and inductive approach and lateral thinking. Grassroots innovators synthesise varied viewpoints where they see fit, and maintain the uniqueness of their innovations. GIs are conceived from practical problems experienced by the grassroots innovators at work or otherwise.

Ideation and opportunity recognition bear personal and social influences. The capability of grassroots innovators to sense and seize opportunities, to experiment prudently and reconfigure and marshal their existing resource base is akin to an entrepreneurial mind-set. Such furthering of innovation in a commercial space essentially reflects entrepreneurial creativity and entrepreneurial potential. These innovators also demonstrated the Schumpeterian innovation logic of envisioning, evaluating and engaging.

Grassroots innovators-turned-entrepreneurs are testament to how innovating entrepreneurs create disequilibrium in the social fabric and produce something qualitatively different to that previously present in the social system (Schumpeter 1934). Grassroots innovators lived experiences revealed their traits and identity. These innovators are adventurous and willing to experiment, cope with uncertainty, failure or lack of profit (Rogers 2003). Furthermore, these innovating individuals at the grassroots have demonstrated key innovation attributes, such as intelligence, motivation, creative problem-solving skills and entrepreneurial creativity (Amabile 1997). They create positive effects at individual, family, community and national levels. Their innovation and creative acts have the potential for socio-economic change. GI can therefore be considered a solution science that ushers in socio-economic change and the personal evolution of the grassroots innovator.

The benefits of GI is also determined by the degree to which an innovation is compatible with existing values, past experiences and the need for potential users or adopters (Rogers 2003). The economic advantages of GIs come in the form of usability, affordability, patents, technology transfer, design rights, investment in R&D, support setting-up micro-ventures, and reward and recognition for making innovation open source. It was observed that the HBN's contractually created commons enables material and non-material benefit sharing and recognition (Scaria & Dedeurwaerdere 2012), which fosters GI and entrepreneurship. However, these gains are availed only when grassroots innovators are connected to formal innovation network members, such as the NIF, HBN, SRISTI and GIAN.

As grassroots innovators are driven by the core purpose of creating value for the society, their innovation are also transforming socio-economic life and reducing inequities by providing affordable, quality products that enhances work efficiency and provides employment opportunities. These innovators' act of choosing to face the problem situation through innovation leads to individual and societal well-being. Individual wellbeing or welfare is derived from the choice, and possibility to perform the act of choice themselves (Sen 1999). Use value of the GI is substantial (Kumar & Bhaduri 2014), however the exchange value can be derived by fostering relational commercial exchange, creating network of grassroots innovators at local levels and connecting them to the institutions and formal sector. This is evident in the development and commercial scaling of tilting cart, tractor without steering, motorcycle operated sprayer, mobile groundnut thresher-cum-collector, cotton stripping machine and health chair.

Encapsulating the essence of GI from a phenomenological exploration, it can be argued that GI is a solution science with a locus of concern for sustaining and enhancing livelihoods and serving the community. It is a mind-set driven practical solution science phenomenon in which the acumen, capability and belief systems of the individual innovators play an important role. GI is intertwined with intrapersonal and interpersonal aspects of the social system. Therefore, it is a socio action in which opportunity recognition, ideation and scaling up are complex and uncertain. Further,

grassroots innovators battle with different belief systems, motivations, resource scarcity and conflicting interests, and require *in-situ* explanations for exchanges that are long term, contextual and fair. The relational commercial exchange is the spirit of GI and therefore the attributes and dynamics of the exchanges suggested in this chapter can help foster GI. Understanding the micro-macro essence of the GI phenomenon can help create the pathway for policy making for inclusive development.

Overall, the grassroots innovators view problems as challenges and attempt to transcend these problems through solutions that are practical, useful and beneficial. It takes time for the grassroots innovators to traverse from ideation to commercial scaling due to varied factors embedded in social and economic setting. However, grassroots innovators acknowledge that the payoffs for their innovation pursuit are phenomenal in terms of personal satisfaction and livelihood sustenance. The lived experiences have also revealed five secrets for innovation and entrepreneurial behaviour at the grassroots. (see Table 6.5)

Table 6.5: Innovation and entrepreneurial behaviour at the grassroots

1. **Creativity:** Through lateral thinking and ingenuity grassroots innovators conceive creative ideas.
2. **Mindfulness:** Creative ideas are implemented through mindful observation, learning orientation and practical intelligence of the grassroots innovators.
3. **Normative Action:** Through practical engagement and purposive actions, grassroots innovators pursue innovation and entrepreneurship. These actions are guided by the domain-relevant and creativity-relevant skills of the grassroots innovators.
4. **Collaboration:** Ideation, development and diffusion of innovation is a social act, where a varied support system fosters innovation and entrepreneurial pursuit at different stages. Exchange and interpersonal relationship fosters innovation.
5. **Entrepreneurial Creativity:** Through the ability to marshal resources to generate, develop and diffuse novel and beneficial ideas the grassroots innovators have demonstrated entrepreneurial creativity and potential.
6. **Effectuation:** Decision making is contingent in nature depending on the characteristics of the innovators (who they are, what they know and whom they know). Here the effect or goal is not preselected but rather constructed from the unspecified means.

Source: Self Compiled

6.3 Grassroots Innovation as a Source of Entrepreneurship and Emancipation

The majority of grassroots innovators set an example as rural entrepreneurs and build family businesses. MPP, who came from a potter community, started 'Mitti Cool' after many trials. He invented a mechanism for making clay kitchenware that is durable and performs similarly to non-clay kitchenware. He created a clay refrigerator, water filter, non-stick pan and pressure cooker. His products are in high demand as they are eco-friendly, affordable and maintain nutrition standards. He was recognised and awarded for his innovations—especially for their quality and inclusivity—and for transforming the pottery profession. At present his two sons help with his business, and he has trained 500 members of his potter community. His innovation has not only provided a means of livelihood to these people but has also saved the TK of pottery and taken away the caste-based stigma of the potter community, providing stability to the pottery profession. MPP's innovation changed the pottery profession and ushered socio-economic change into the region.

The incense stick-making machine is an interesting case as its invention not only eased the task of tribal people involved in incense stick making, but also enhanced their socio-economic life and reduced rural-urban migration in Rajasthan. PP, with his experience with the automatic thread winding machine innovation, made the incense stick machine. With the help of the DFO of Udaipur, PP spent time with tribal people in order to understand the existing incense stick-making process and the requirements of tribal wage earners who manually make the sticks. Now, tribal people can spend more time with their families, and overall there has been a reduction in migration to cities in the region. The cottage industry of incense stick making was boosted as a result of this machine, as it spread through self-help groups in remote Indian villages. To date, more than 200 sets have been sold, and PP receives regular orders from all over India. The first 50 machines were sold to the VFPMC in tribal areas of Rajasthan. The machine is easy and safe to operate, reduces drudgery, gives good and uniform-quality output and is suitable for livelihood generation purposes. PP's machine has eased the work of

the tribal community and increased efficiency, leading to better earnings, more orders and better living standards.

MP's cotton-stripping machine not only introduced a new process into the ginning industry but has also ushered in socio-economic change. This machine had been instrumental in mechanising the lint-stripping process from cotton balls. This innovation has increased revenue for farmers and ginners, and relieved village women from arduous tasks, giving them time for other work. Further, children are no longer required for the task, allowing village children to pursue their education. MP received a patent for the innovation, and established his rural enterprise to manufacture the machine, employing local people and mentoring aspiring innovators.

It is evident in all three cases that innovation and the capability of the grassroots innovators have transformed rural lives. Such, innovation from grassroots people not only empower them through local development, design ownership and control of technology but may also help challenge mainstream innovation agendas and development pathways (Fressoli et al. 2014). The role of family is very significant to entrepreneurship and can be summarised as 'credible role model' and 'financial supporter for ventures' (Cécora (1999, p.66). On the broader commercial field, these innovations succeeded because of a confluence of grassroots innovator capabilities, ingenuity and institutional support. This is apparent in the cases of entrepreneurship spawned from the grassroots innovation.

Entrepreneurial potential of the grassroots innovators is reflected through the perceived desirability and feasibility with the propensity to act and precipitating event influencing credibility, potential and intentions (Krueger & Brazeal 1994). Moreover, these innovators are effectual entrepreneurs (Sarasvathy 2001) who not only seizes contingent opportunities but also fulfil plurality of current aspirations by exploiting all means available to them. The micro ventures set-up by the grassroots innovators, are seen to be governed through the effectuation business process. Effectuation business process focus on affordable loss rather than expected returns, reduce or eliminate uncertainty, exploit contingencies and control unpredictable future (Sarasvathy 2001).

The visibility, legal and business advice, financial support, monetary reward and patenting provided by these institutions have not only motivated grassroots innovators but have also opened up more opportunities for them. However, entrepreneurship option is still difficult for the fraction of grassroots innovators because they lack the social and financial capital to exploit opportunities in the current capitalised economy. In the Indian culture, starting one's own business is more challenging because there is a common and strong perception that entreprneurship is the pergative of the business (baniya) caste. Moreover, it is also believed that entrepreneurial capabilities are hereditary and only for those who have abundant financial resources. Such bottlenecks can be overcome by linking innovation, capability, livelihoods, entrepreneurship and empowerment to innovation and development policies.

People's welfare can be assessed only through individuals' actual and potential activities and states of being (Sen 2003). It is only when an innnovative individual at the grassroots have freedom to explore and choose particular aspects of life, that nation can have development. Such aspects can further be seedbed for evaluating the policies for the grassroots innovators and also for overall evaluation of innovation diffusion, well-being and regional development programs.

Capability, according to Sen (1999; 2003), is being able to perform certain functioning; to what a person is capable of doing and being. Here capability entails the ability to recognise and make use of livelihood opportunities withstanding the adverse conditions in proactive and dynamic manner (Chambers & Conway 1992). Sen's capability approach stresses the subjective value of human choice, and innovation is one such choice of grassroots innovators. It allows reasoning of the meta-economic factors shaping human action, the collaborative social relations and the association of human freedom with cultural traditions. It also allows the juxtaposition of the essence of GI at a macro level, and provides broader insights into fostering GI for inclusive development, and for considering bottom-up policies that enhance the GI eco-system in an empowering and emancipating manner for poor and marginalised grassroots innovators.

As the interplay of innovation, learning and inequality in underdeveloped nations is complex, it is important to emphasise capability building (Srinivas & Sutz 2008) and to expand innovative capabilities (Cozzens & Kaplinsky 2009; Lundvall et al. 2011).The grassroots innovators value their ability to innovate, to enhance their living and being useful to the community and nation at large. The future of GI is promising, and institutional efforts to foster GI have paid off. However, government policy rigour is required, in terms of involving grassroots innovators and increasing their participation in building the Indian GI eco-system. Such rigour can be attained if the policies aim at enhancing the ability of the entrepreneurs to participate in transnational production and marketing syndicates (Cécora 1999). Furthermore, efforts are also required to synchronise them with the essence of the GI phenomenon.

Grassroots innovators are increasingly referred to as rural or indigenous entrepreneurs (Gupta et al. 2003; Pathak 2008; Onwuegbuzie 2010; Srinivas & Sutz 2008). The lived experiences demonstrate the ability of grassroots innovators to provide new solutions to problems and enterprise in a frugal environment. Therefore, the blending of Schumpeterian innovation economics with Sen's capabilities approach can shape the path for bottom-up approaches to fostering GI. While the former emphasises innovation-driven qualitative change, the latter stresses capability and freedom as a means and an end to development. This combination can also guide the empowering of grassroots innovators through entrepreneurship and capability building.

The embedded social-psychological value in GI is a means for social change and social empowerment (Kumar & Bhaduri 2014). There are instances in which grassroots innovators have been able to mobilise their innovations and reap monetary and non-monetary benefits at the local level prior to institutional scouting and support. In such instances, support from family, friends, villagers and users were central in mobilising GI. However, the missing link in the existing GI eco-system discussed in the literature review chapter is community. It is observed that the psychological and emotional support from the community has enhanced grassroots innovators' perceived ability to innovate.

Pansera (2013) states that grassroots innovators innovate with very limited capital, with the help of local communities. They are assisted by wide networks with shared interests (Church 2005). It has been observed in the storied life of the grassroots innovators that the GI community (family, friends, villagers and users), institutions (public, private and NGOs) and innovation infrastructure (policy, training, ICT and transportation) are important in mobilising GI. Such eco-systems not only facilitate the mobilisation of GI but also enhance the social and ethical capital of the nation (Gupta et al. 2003). The segmented, polycentric, loosely integrated and co-ordinated entities of the innovation network not only foster GI but have the potential to enhance social and ethical capital (Gupta et al. 2003). Social capital relies on obligations and expectations, the information-flow capability of the social structure and the norms accompanied by sanctions (Coleman 1988).

Although grassroots innovators are proud of their achievements and the recognition they have received, they still feel the need to learn business dynamics and the nuances of the market. Potential entrepreneurs in the community settings tend to operate with scant or no information about the possible impediments (Krueger & Brazeal 1994). However, the grassroots innovators do not suffer from the deficits of self-efficacy but they require guidance to actualise their entrepreneurial potential. Rural ventures started by grassroots innovators should be nurtured in terms of marketing and succession planning. Supportive culture along with formal programs (Krueger & Braseal 1994) that spreads the message that innovations and entrepreneurship are imperative for inclusive development.

Grassroots innovators should be made aware of commercialisation options in a manner that fits their belief system. These innovators have been accepting the technology commons, technology transfer and benefit sharing, however imputes should be given on allowing grassroots innovators to explore or promote the scaling and commercialising model. It is obvious from the life stories of the grassroots innovators that they expect freedom to explore opportunities, basic fabrication machinery and business capability enhancement. Additionally, innovation incubation centres should be opened in rural areas, in which serial grassroots innovators can

experiment and mentor aspiring innovators. Loans from bank and money lenders have proven detrimental for the grassroots innovators. However, monetary help from family, friends and institutions such as HBN, SRISTI, GIAN and NIF has encouraged the grassroots innovator and enhanced commercial prospects of the GI.

Inter-dependency, survival instinct and adaptation are the core of any evolving beings. Grassroots innovators revealed that institutional help at times of crisis helped reinstall their faith in innovating. Their innovation pursuits were looked down upon or considered something for local consumption only. However, these perceptions changed when institutions like HBN, SRISTI and NIF scouted them and offered them monetary and non-monetary help. These, along with GIAN and IIT-B, also help with the commercial diffusion of GI on a larger scale and when setting up an enterprise. Thus, grassroots innovators should be encouraged to collaborate and form co-operatives to improve their bargaining power with the formal sector and development agencies (Abrol 2014).

The innovator, innovation, and entrepreneur are increasingly considered a vital link in the development process. Convergence of innovation and development was believed to be possible only through a nation's S&T development. Nevertheless, for developing countries, innovation capacity development is more significant than just S&T development (Hall 2005). Lundvall et al (2002) state that the NIS should focus on enhancing the learning capabilities of innovators, the relationships contributing to innovation and competence-building. Such a focus will further empower grassroots innovators to contribute to the wellbeing and regional development.

If innovation system of a nation is socially constructed, then, it can accommodate differentiated policies (Berdegué 2005), furthering facilitation and support of pro-poor innovation (Berdegué 2005) including GI. For competitive use of pro-poor innovation, Abrol (2014) emphasize on the need of context specific paradigm for agriculture and agro-industrial production in the local or regional economies. If collectives and cooperatives are promoted for pro-poor innovation, it can enhance the competitiveness and bargaining power of the landless laborers, workers and peasant

and also provide resilience against the external economic shocks and uncertainties (Abrol 2014). It was observed that people at the grassroots are progressing in terms of their outlook. Currently, in India many areas of life are becoming caste free and the landownership, occupation and education are not dependent upon caste (Subedi 2013). This reflected in the empirical findings where a few grassroots innovators such as BT are moving away from farming to farm centric product manufacturing and service.

Individuals are the cornerstone of development and the progress of the nation at large. The role of grassroots innovators is considered very important, as their GI brings new energy and solutions that are inclusive in nature. Their micro ventures are increasingly looked for employment and innovations. Family run micro-enterprises can be considered a promising means of sustainable, emancipatory and empowering futures. The cohort of grassroots innovators can evolve and bring boundary-spanning changes.

The innovation action at the grassroots is tightly aligned with the livelihood. It is also driven by the belief of emancipating the self and the community from the inefficiency, deprivation and inaccessibility. Such factors cause the ideation and opportunity recognition for the grassroots innovators. These innovators do not follow a linear process of innovation of recognising an opportunity to innovate to earn profit or serve the market. Rather they recognise an opportunity to solve the pertinent issues faced by themselves or the community, solve the contextual problem occurring due to drought, scarcity of labour supply or affordable access or out of concern for others.

The well-being, livelihood and relational elements is at the core of the GI phenomenon and GI is operationalised through the belief system, practical consciousness, capabilities, social action and entrepreneurial potential together drives the GI. (see Figure 6.2). The desirability and feasibility of the innovation at the grassroots is facilitated through relational commercial exchanges and grassroots innovators' practical consciousness and mind-set for problem solving. There is a need to focus on this essence of GI phenomenon and nurture the grassroots innovator's capabilities to

innovate, allowing them to choose and amalgamate their livelihood options and freedom to unleash their capability with their own norms and socio-economic structure.

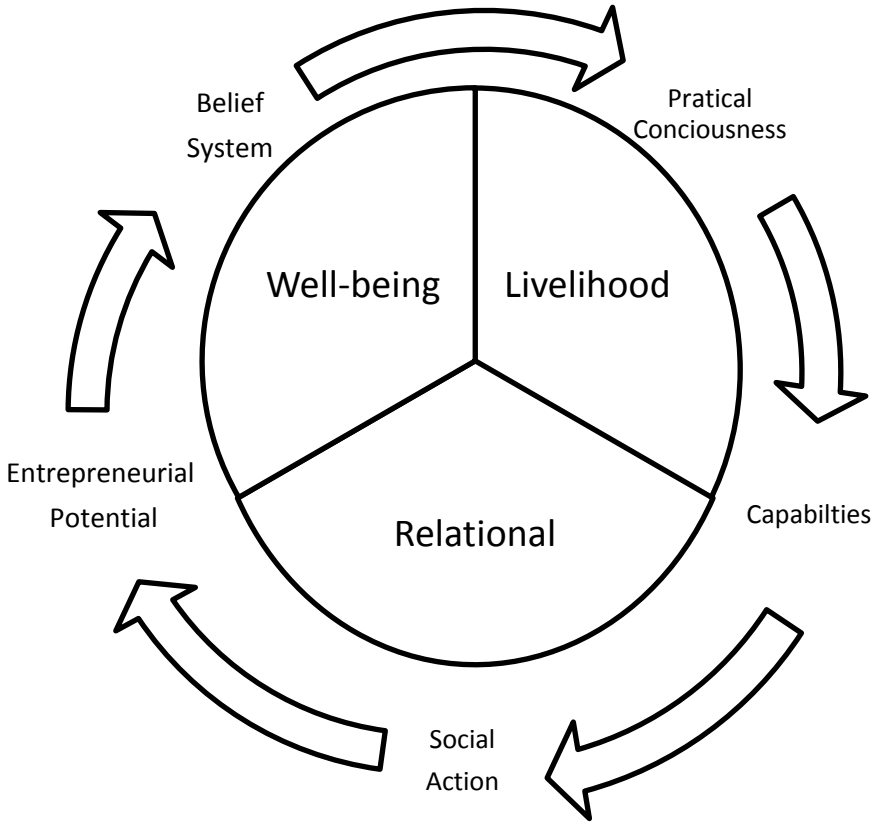

Figure: 6.2: Essence of Grassroots Innovation (Self Compiled)

6.4 Conclusion

The purpose of this inquiry has been to comprehend the lived experiences of Indian grassroots innovators, and thereby discern the essence of the GI phenomenon. It advanced with the understanding that GI is a socially embedded phenomenon, and engaged with grassroots innovators who innovated in varied categories in an informal manner, thereby ensuring the quintessential aspects of GI in the informal sector. It further revealed the logical idea of GI entailing the being, the essence and the notion of the innovation phenomenon at the grassroots. Such *in situ* revelation of the essence of GI phenomena serves as a useful guide for development agencies, policymakers, activists and researchers.

Chapter 7: **Conclusion**

Mr Saidullah's statement "If my innovations are good, why did I not progress enough?", led the researcher to explore the essence of the GI phenomenon and give voice to grassroots innovators through their lived experiences. The objective was to understand their experiences of opportunity recognition, ideation, prototyping and scaling GI, and to discover their views on the phenomenon in developing innovations for socio-economic exchange. Assimilating the research questions and findings, it can be argued that grassroots innovators' lived experiences constitute an intricate mix of innovation, livelihood, capability, co-operation, concern and passion.

The literature on this subject, specifically in the context of India, is inconclusive over the spirit of GI and the grassroots innovators' views on being grassroots innovators in the current market economy. The micro-macro link between individual innovation actions and the socio-economic system is missing in the literature. The study sought to answer: "What is the essence of the lived experiences of grassroots innovators in India?"

On examining the literature on fostering GI it was also demonstrated that GI is a complex phenomenon, and that there are structural impediments to developing GI for commercial purposes. Additionally, in the innovation and management literature, theories and operational indicators for individual-level GI processes and innovative behaviour of people at the grassroots innovators are scant. Exchange and social relationships are central to the functioning and sustainability of socio-economic activities, including innovation. In this thesis, along with diffusion theory, socio-economic exchange relationship experiences are investigated, using the lenses of exchange theory, including psychological contract. While exchange theory explains the dyadic socio-economic reciprocal interdependency, the psychological contract provides a view on the perceptions and expectations embedded in exchange and innovation activities. Diffusion theory facilitates understandings of innovators'

experiences in manifesting exchanges and innovation benefits through social systems of innovation.

7.1 Research Questions and Findings

This research addresses the overriding research questions, thereby drawing out the essence of the phenomenon from lived experiences of the grassroots innovators. The research attempted to fulfil this objective through exploring the research questions through a hermeneutic phenomenological approach. Understanding the themes of grassroots innovators' narrative accounts of their lived experiences provided insights into the essence of the phenomenon (van Manen 1997). It would be naive to claim that the human science phenomenon can be made theoretically transparent, but precision and exactness can be aimed for through interpretive description, as deliberated in the findings chapter (van Manen 1997). The purpose of the research questions was to explore broadly each grassroots innovator's lived experience, and how their background, consisting of their identity and capabilities, correspond to ideation, opportunity recognition and the scaling of GI.

1) How do Indian grassroots innovators understand their lived experiences of innovation?
    - How do grassroots innovators' identities and capabilities shape their innovation experience, especially at the opportunity recognition, ideation and scaling-up stages of GI?

The findings suggest that grassroots innovators are aware of their potential and value of their innovations at the local community level. However, value of their innovations at the state and national levels was recognised only after they were awarded for their innovations. For them, GI is a means to solve their livelihood and other issues, and to serve others. This question revealed their desires and their purpose for innovation. Reflecting on their innovation experiences, grassroots innovators unanimously agreed that innovation is challenging but rewarding. They also acknowledged their capabilities and the support they received from various actors and institutions.

The emotional aspects embedded in lived experiences were revealed as the grassroots innovators shared a few childhood experiences, inner conflict and hardships, which led them to think of solutions in the future and had an effect on their way of looking at the problem or situation. In some instances, the innovators' education, caste, family responsibilities, role, past experiences, health or geographical location affected the ideation, opportunity recognition and scaling of GI.

The above questions also revealed the belief systems of the innovators. The cultural aspects in terms of the caste and social setting were reflected through their belief system; however, these aspects did not have detrimental effects on their innovation pursuit. Their reflective responses—in the form of analogies or anecdotes—revealed their true selves, who believed in sharing knowledge, being useful to the family, community and nation, and living life on ethical terms. Grassroots innovators demonstrated that after their capabilities were recognised at the national level, they got more exposure and opportunities to serve their community. Their identity as grassroots innovators opened up new worlds to them, and made them value their potential. Grassroots innovators identified themselves as innovators, farmers, businessmen, father and God's servants.

2) What are their lived experiences in the ideation, opportunity recognition and scaling of GI?
    - How do grassroots innovators recognise opportunities, develop and scale-up GI?
    - What sorts of exchanges and interpersonal relationships facilitate ideation, opportunity recognition and scaling of GI?

Grassroots innovators faced many challenges in ideation, opportunity recognition and the scaling of GI. A few recognised opportunities prior to ideation, and others first conceived idea through problems or situations they observed, and then recognised the opportunity. Learning through trial and error, observation and personal networks helped grassroots innovators develop prototypes. Unlike mainstream innovation, GI involves non-linear informal processes of ideation and opportunity recognition. Scaling

of GI is usually conducted with the help of an innovation network member which also includes personal network. While 10 grassroots innovators started their own micro-ventures (fabrication and repairs workshops), two sold their patents to concentrate on farming and one is waiting for a patent while farming and working in villages, using his innovated machine. 10 of the 13 grassroots innovators are entrepreneurs, and 5 of these 10 are helped by their sons, with their ventures run as family businesses.

3) In what circumstances are socio-economic exchanges experienced positively, as inhibitory or constraining by grassroots innovators?
    - How do these episodes affect perceptions, expectations and obligations?
    - How are communitarian values or commercial imperatives balanced in innovation behaviour and actions?

Socio-economic exchange experiences varied depending on the type of innovation, level of family support, background and grassroots innovators' own attitudes and capabilities. Four grassroots innovators accumulated huge debts developing their innovations. Lack of financial or technical help at the prototype development or ideation stages were the major constraining factors. Lack of government subsidies in farm-related equipment, transportation costs, imitation, changing trends in farming and altering market conditions were inhibiting factors, but a few grassroots innovators recognised opportunities within these situations. Grassroots innovators were driven by altruism and believed in co-operation and co-habitation, not competition. They struck a balance between commercial and communal essentials through reciprocal behaviour, mentoring, knowledge sharing and providing jobs and training to their villages and communities. Making their innovations open source demonstrated that grassroots innovators are not driven by self-interest or profit. Although all are empathetic and strong believers in ethical conduct, they did share views on profits, patents, consumers and imitation. A few strongly believed in protecting their innovations, earning their fair share and sharing with their communities.

The lived experiences of the 13 grassroots innovators revealed that ideation, opportunity recognition, prototype development and scaling are challenging and rewarding. They also illustrated that grassroots innovators can succeed by utilising

their TK/ TK practices, own experience, practical consciousness and available resources, even if they did not have access to formal education. All exchanges and interpersonal relationships are based on trust, goodwill and reciprocity. Additionally, relationship continuity, roles, a sense of duty and concern drive exchanges at the ideation, opportunity recognition and scaling stages of GI. GI usually stems from experience and the informal knowledge system embedded in communitarian values and driven by social need and ideology, superseding economic motives (Seyfang & Smith 2007).

Researching the GI world also enabled insights into what it takes to be a grassroots innovator, and provided an understanding of the underlying individual and interpersonal dynamics shaping GI. Grassroots innovators go through varied social, moral, financial and emotional and market related trials and tribulations in their innovation journey. The entrepreneurial potential of the grassroots innovators was discerned and the aspiration for freedom to pursue their dreams, sustainable livelihood and wellbeing was shared.

7.2 Theoretical Implications

Building against the backdrop of the sociology, the innovation economics, the psychology of innovation and, the development studies, this thesis explores the essence of the GI phenomenon. This study confirms that no single theory can fully explain the lived experiences of grassroots innovators at the ideation, opportunity recognition, prototyping and scaling stage of GI. Rather, integrated theoretical perspectives are needed. The anchoring theories—diffusion and exchange (inclusive of psychological contract) —have been used, as they are relevant to all aspects of lived experiences of the grassroots innovator. These theories provided a lens for understanding the challenges at the four stages of GI. First, the diffusion lens was useful for understanding contextual factors, such as the role of grassroots innovators and other actors, and the communication of GI outcomes at each stage. Second, the social exchange lens allowed a consideration of the explicit socio-economic reciprocal obligation dynamics encompassing exchange objectives, and which facilitates GI at

various stages. Finally, the psychological contract sheds light on the innate aspects of implicit exchange relationships and expectations embedded in such relationships. To further explain and relate the findings of this research to an inclusive innovation and development policy context, neo-Schumpeterian innovation economics and Sen's development ideology were taken as the overarching theories.

This thesis adopted a phenomenological approach to search for the truths of the innovation/experiences through the consciousness of the innovator/experiencer. The subjective reality of the GI phenomenon, what the innovators really think and behave was revealed. This study proposes a constructivist episteme and interpretive stance, in order to explore the GI phenomenon. It can serve as a useful guide for understanding the innovation behaviour and entrepreneurship at the grassroots.

7.3 Discussion of the Empirical Findings

Encapsulating the essence of GI through phenomenological exploration, it is suggested that GI is a solution science, with concern for sustaining and enhancing livelihoods and serving the community. It is a mind-set driven phenomenon in which the acumen, capability and belief systems of individual innovators play an important role (Joshi et al. 2015). Additionally, the innovations are a socio-technical system in which ideation, opportunity recognition, prototyping and scaling up are complex, because grassroots innovators battle with differing belief systems, motivations, resource scarcity and conflicting interests. Although the GI phenomenon is fraught with challenges, it does bring positive changes to the lives of grassroots innovators, and opens up an avenue for rural entrepreneurship and socio-economic change. This thesis provided an *in situ* understanding of the GI phenomenon.

The innovation action at the grassroots is tightly aligned with the livelihood. It is also driven by the belief of emancipating the self and the community from the inefficiency, deprivation and inaccessibility. GI is a social phenomenon conceptualized and operationalized through the capabilities of the unconventional and authentic individual innovator at the grassroots. The age group of the thirteen grassroots

innovators 31 to 68 does indicate the subtle aspect of being an innovator at the grassroots and the trade-offs involved in the innovation journey. This can further help to theorise the age and innovation at the grassroots and how it differs from the formal sector innovations.

Grassroots innovators are utility-optimising economic actors as well as social actors with multiple roles and responsibilities. Exchange and interpersonal relationships are driven by grassroots innovators' beliefs and ability to appropriate frugal resources for innovation. These innovators are cognisant of the profit potential of their innovations, and recognise the opportunities for their innovations in their community. Nevertheless, for the majority of the grassroots innovators it is still difficult to be entrepreneur because they lack human, social and financial capital to exploit opportunities in the current capitalised economy. Such problems can be overcome by linking innovation, capability, livelihood and entrepreneurship to innovation and development policies. GI should be considered an empowering tool for fostering inclusive growth. Future studies relating to the resilience of enterprising grassroots innovators can further the study of policy narrative for rural development through innovations and entrepreneurship.

Hermeneutic phenomenology has not been a widely used research method in innovation and development studies. Its application to pro-poor innovation research and practice is suitable for future studies. Investigating GI from a human science research perspective and using hermeneutic phenomenology, this thesis argues that GI is more of a humanist pursuit than a technological pursuit. It opens up the subjective reality embedded in the GI phenomenon, and provides a rich understanding of underlying individual and interpersonal dynamics shaping GI. This may serve as an aid for future research on scaling, managing GI and developing the entrepreneurial capabilities of grassroots innovators.

7.4 Policy Implications

A pro-poor innovation strategies and policies need to have a contextual fitness. It cannot be one size fits all but need to fit the particular conditions of different social settings (Berdegué 2005; Gupta 2007). Combining Schumpeterian innovation economics with Sen's capabilities approach can create a path for a bottom-up approach to fostering GI. While the former emphasises innovation-driven qualitative change, the latter stresses capability and freedom as a means and end to development. It is important to create an opportunity for the grassroots innovators to cooperate for scaling their innovation and to help these innovators to empower themselves. For the potential entrepreneurs from the grassroots, Krueger and Brazeal (1994) state there is a need to identify and establish policies that increase their perceived feasibility and their perceived desirability. The lived experiences have demonstrated the ability of grassroots innovators to provide new solutions to problems and enterprise in a frugal environment. Thus, policies should relate to:

1) creating opportunities for grassroots innovator to learn;
2) providing business training to grassroots innovators;
3) creating a platform for the development and distribution of GIs;
4) encouraging relational commercial exchange dynamics as they drive the GI;
5) including grassroots innovators in policy making, and for the diffusion, scaling and commercialisation of innovation;
6) allowing inherited knowledge to prosper for the livelihood and encouraging family business;
7) linking GI and poverty reduction policies;
8) innovation incubation centres should be opened in rural areas, where serial grassroots innovators could experiment and mentor aspiring innovators;
9) nurturing existing GI led micro-ventures in terms of marketing and succession planning;
10) promoting innovations in the other emerging markets and fostering linkages between grassroots innovators in these markets.
11) Providing grassroots innovators exposure to similar problems faced by other countries.

To realise the importance of the people's social and political power in the process of development, the constitution of India propagates political decentralisation through the 73rd and 74th constitutional amendments (Kumar & Bhaduri 2014). Such amendments will not only nurture local governance but can also prove to be a empowering, consensual and cooperative development model for the grassroots community who are in informal sector. Keeping this in mind, the nature and spirit of grassroots innovation phenomenon can further aid the developmental model. GI ecosystem can leverage and benefit from the decentralisation process professed by the 73rd and 74th constitutional amendments. The grassroots creativity inclusive of traditional knowledge, practices and GI should be the focus for the government's program such as 'Make in India' and 'national skills development'. Nation can benefit from the empowering, entrepreneurial and social change potentials of GI phenomenon only when it is ready to learn from the grassroots communities and encourage them through bottom-up policy and skills development.

7.5 Limitations and Agenda for Future Study

This qualitative study is not without its limitations, several of which future research can address. The current study recognises and discusses the lived experiences of grassroots innovators in only one Indian state. Such as an exploratory sampling is a major limitation as it raises the question of whether the findings can be generalised to a wider context. This limitation is acknowledged. However, the purpose of this study was not to generalise the findings but provide a contextual understanding of the lived experiences of GI.

The study used purposive sampling; therefore alternate or differing insights into the GI phenomenon were limited. For instance, all research participants were males, a major limitation of the research as it failed to provide a holistic understanding of the phenomenon. A future study looking at both male and female grassroots innovators across India could be undertaken to better appreciate the phenomenon. Grassroots innovators and GI scouted and recognised by the HBN and NIF were the focus of the

study. Therefore, the findings and discussion largely reflect network embeddedness and overlook grassroots innovators outside of this particular network. Moreover, a proper category-wise spread of innovations can further help to identify the parallels of the phenomenon. Only grassroots innovators were interviewed, so the findings reflect only their views (the aim of the study). Nonetheless, a community perspective, if incorporated, would have provided a more comprehensive view of the phenomenon, and would have helped further validate and triangulate the findings.

Overall, this thesis serves as a prologue to future research on innovation and entrepreneurship for economically deprived and marginalised grassroots people. It also opens up avenues for the study of Phelps' (2013) notion of innovation in a dynamic modern economy. The findings identified a plethora of potential areas to address in future studies. There is the need to extend the findings of this research in the context of sustainability and transformation, to explore the GI phenomenon in other South Asian countries and examine role expectations, livelihood and rural development in the GI movement. The mainstream and formal sector innovators, designers and scientists can benefit from these research findings on the essence of the GI phenomenon. This will further foster the synergy between GI and mainstream innovations for inclusive development. While this study begins to add value to pre-existing economic and sociological aspects of innovation and development theories, further examination of the community perceptions and identity could add valuable information to the essence of the phenomenon.

7.6 Final Comments

This thesis has argued that the undermining of the lived experiences of grassroots innovators in innovation and development studies and the current, top-down, imperialist, technocratic approach to GI is more restrictive than empowering. Endowments in the form of rewards, aid and compensation do not bring positive, long-term socio-economic benefits. The development of GI is, still dependent on a number of factors, including:

- overall outlook, motivation of grassroots innovators and their participation in the innovation network;
- whether GI contribute to an overall sense of well-being and provide sustainable livelihood opportunities, such as employment and business opportunities;
- whether GI helps innovators and communities maintain their identity and sense of pride in their culture and traditions, despite substantial changes in ways of life.

Taking an exploratory, multi-disciplinary approach grounded in economic and social theory, this thesis endeavoured to recognise the thoughts of grassroots innovators, in conjunction with GI experiences in the current settings. The subjective reality of the grassroots innovators' innovation experiences was explored, in an attempt to fill an existing void in the literature. This subjective reality of the GI phenomenon was inquired through the non-reductionist, inductive logic and a phenomenological approach. Such an approach provided a rich, contextually situated and inside-out understanding of underlying individual and interpersonal dynamics shaping GI in the commercial space.

7.7 Personal Reflection

Exploring the world of grassroots innovators was indeed an enriching experience. Personally, I was moved by the demeanour of the grassroots innovators and their life settings. Their enthusiasm was infectious, and their frame of mind was positive. What struck me the most was their concern to make me feel comfortable. Such attitude of care allowed me to connect to their world. They were willing to participate and also allowed me to audio record their stories. Despite, being from the same ethnic background of the respondents, this research brought me closer to my culture . It also made me aware of many underlying nuances of language, and rural, urban lifestyle and political ideologies.

The villages of the grassroots innovators were far off from the major towns and not well connected through public transport. Therefore, few grassroots innovators came to

pick me up at the bus stop or highway; few guided me how to reach their village and also followed-up whether I have reached safely after the interview. A few offered me lunch and tea while a few arrange a small trip to the village. Three grassroots innovators, whom I interviewed during sattvik food festival, invited me to their workshop at their village. Interestingly two grassroots innovators asked me to write down my local contact details and a line or two about my visit to their workshop. This made me think about their awareness on documenting and skills of networking. A few grassroots innovators gave their visiting card and broacher of their innovation and enterprise. Overall, grassroots innovators were not shy about their living conditions, background or education level. Their enthusiasm, assertive tone and passion for their innovation and their occupation were encouraging. All this not only facilitated the exploration of their lived experiences but also enriched my experiences as a researcher.

A lot can be written about the grassroots innovation phenomenon before meeting them, but actually meeting grassroots innovators in their local setting made it much more real and contextual. It was intriguing to see how practical these innovators are and how they maintain work and life balance. Grassroots innovators were thorough with their fundamentals and did not forget what they learnt informally at work or in their childhood. It was interesting to see how they assimilated this learning with their innovation. Excessive generalisation cannot be made because each of the thirteen grassroots innovators was different from each other, and their innovation journey was unique.

Though all the grassroots innovations discussed the difficulties and problems, they did not want to be defined by such problems, and that revealed that it is just part of their life. A few grassroots innovators seemed to feel more confident of being able to deal with the challenging situations. The anecdotes cited by few grassroots innovators relating to ethical life, earning through right means and helping others were symbolic of their belief system and their actions. Many referred to the teachings of Bhagwad Gita or folklore.

The revelation of traumatic experience of attempting or deciding to end one's life or going bankrupt, saving face from the debtors and society as a whole were soul stirring. Even the manner in which these innovators endured the criticisms and discouraging environment discloses their frame of mind and conviction. Some of these innovators expressed that such experiences have helped them to grow and that they learned more about the reality of pursuing innovation in frugal conditions. A few grassroots innovators seemed to feel more confident of being able to deal with the difficult situations. It was impossible not to be humbled by the positive outlook and insights given by a number of grassroots innovators.

Today, some of the grassroots innovators are national and international figures with many awards and recognition. These innovators are continuously contributing through their innovations, mentoring and connecting other grassroots innovators with the network of institutes. They participate in various fairs, attend shodhyatra demonstrate their innovation capabilities and experiences, connect with these innovators, establish friendship and learn more about themselves through the experience. They showed all the photographs, media coverage and shared their experiences of flying the first time and how they demonstrated their innovation in a foreign country.

Grassroots innovators do not see innovation as an object or a technical artefact they fabricate out there but rather a matter that has a meaning and value, which is developed as a novel beneficial product through their individual effort and social support. Such revelations led me to ask some basic questions about innovation and whether it is always reified and what is the structure and essence of their innovation experience.

While discussing ideation, opportunity recognition, prototyping and commercial scaling, grassroots innovators shared that they did not follow any linear process. They either recognised an opportunity to innovate first and then gone for ideation or they ideate first and then recognise an opportunity for diffusion. Some did not develop a prototype as they just developed one model using available resources and started using them on their farms or for themselves. A few grassroots innovators did develop a

prototype and explored opportunities for selling. These innovators demonstrated a deep understanding of the underlying concepts of the task at hand. All of them are a master craftsman and demonstrated that observation and understanding are more important than formal education.

Accumulation of financial resources for innovation had been varied. Grassroots innovators do find it challenging to avail finance from the bank. I saw a community funding in case of one grassroots innovation, and it was interesting to listen how he convinced his village people to help him financially. Solidarity, social support and trust had been driving force in accumulating financial resources for developing innovation. Few grassroots innovators leveraged on their goodwill and got credit. It was also interesting to hear that the exchange relationship in the village was more facilitating than in the city. Such experience reveals a lot about socio-economic dynamics. It was interesting also to observe how the relationship between the organisation members and grassroots innovators evolves. The timely financial help without collateral from the organisations such as NIF, SRISTI, and HBN instils faith and trust in the grassroots innovators. One grassroots innovator repaid the loan given by NIF and on top paid extra thousands Rupees as gratitutde for their support. Such gestures lay a ground for stronger social ties. The exploration of the GI phenomenon through lived experiences did challenge my preconceptions about the innovations and exchange relationships in general.

Overall, interaction with the respondents during interview, member checking, Shodhyatra and meeting in Rajkot helped me not only to collect data, validate the narrative accounts and findings but also to understand their view, relational dynamics and their attitude towards research and researcher like me. A majority of the innovators have been working on farms and have grown up in villages. I observed that this background was influencing them as an individual. They were vocal about environmental issues and importance of reusability, simple living, collective growth and change.

As the lived experiences of these innovators started unfolding, I could relate to the words of Swami Vivekananda (1963):

"Let her [India] arise out of the peasant's cottage, grasping the plough; out of the huts of the fisherman, the cobbler, and the sweeper. Let her spring from the grocer's shop, from beside the oven of the fritter-seller. Let her emanate from the factory, from marts, and from markets. Let her emerge from groves and forests, from hills and mountains. These common people have suffered oppression for thousands of years—suffered it without a murmur, and, as a result, have got a wonderful fortitude. They have suffered eternal misery, which has given them unflinching vitality. Living on a handful of grain, they can convulse the world; give them only half a piece of bread, and the whole world will not be big enough to contain their energy; they are endowed with … inexhaustible vitality. … And, besides, they have got the wonderful strength that comes from a pure and moral life, which is not to be found anywhere else in the world. Such peacefulness and contentment, such love, such power of silent and incessant work, and such manifestation of lion's strength in times of action—where else will you find these!"

Overall, the phenomenological exploration of grassroots innovations through engaging with the community, reflecting, sense-making, analysing, presenting, writing on the essence of lived experiences was indeed a learning, unlearning and relearning enriching experience for me as a researcher.

Appendix 1: Ethics Approval Letter

HREC Approval Granted
Research.Ethics@uts.edu.au

Thu 17/10/2013 05:58
To: John.Chelliah@uts.edu.au <John.Chelliah@uts.edu.au>; Rajul Gajendra Joshi <Rajul.G.Joshi@student.uts.edu.au>; Research.Ethics@uts.edu.au <Research.Ethics@uts.edu.au>; iec.rio@uts.edu.au <iec.rio@uts.edu.au>; postaward.grants@uts.edu.au <postaward.grants@uts.edu.au>;

Dear Applicant
Thank you for your response to the Committee's comments for your project titled, "Exploring the lived experiences of grassroots innovators of India.". Your response satisfactorily addresses the concerns and questions raised by the Committee who agreed that the application now meets the requirements of the NHMRC National Statement on Ethical Conduct in Human Research (2007). I am pleased to inform you that ethics approval is now granted.

Your approval number is UTS HREC REF NO. 2013000563
Your approval is valid five years from the date of this email.

Please note that the ethical conduct of research is an on-going process. The National Statement on Ethical Conduct in Research Involving Humans requires us to obtain a report about the progress of the research, and in particular about any changes to the research which may have ethical implications. This report form must be completed at least annually, and at the end of the project (if it takes more than a year). The Ethics Secretariat will contact you when it is time to complete your first report.

I also refer you to the AVCC guidelines relating to the storage of data, which require that data be kept for a minimum of 5 years after publication of research. However, in NSW, longer retention requirements are required for research on human subjects with potential long-term effects, research with long-term environmental effects, or research considered of national or international significance, importance, or controversy. If the data from this research project falls into one of these categories, contact University Records for advice on long-term retention.

You should consider this your official letter of approval. If you require a hardcopy please contact Research.Ethics@uts.edu.au.
To access this application, please follow the URLs below:
* if accessing within the UTS network: http://rmprod.itd.uts.edu.au/RMENet/HOM001N.aspx
* if accessing outside of UTS network: https://remote.uts.edu.au , and click on "RMENet - ResearchMaster Enterprise" after logging in.

We value your feedback on the online ethics process. If you would like to provide feedback please go to: http://surveys.uts.edu.au/surveys/onlineethics/index.cfm

If you have any queries about your ethics approval, or require any amendments to your research in the future, please do not hesitate to contact Research.Ethics@uts.edu.au.

Yours sincerely,

Professor Marion Haas
Chairperson
UTS Human Research Ethics Committee
C/- Research & Innovation Office
University of Technology, Sydney
E: Research.Ethics@uts.edu.au I: http://www.research.uts.edu.au/policies/restricted/ethics.html

Appendix 2: Questionnaire

English and Local language

Interview Questionnaire: (Open-ended)

Main Question: what is the meaning and essence of the lived experiences of grassroots innovators in India?

Three Sub Questions:

1. *How do Indian grassroots innovators understand their lived experiences of opportunity recognition, ideation and scaling-up?*
2. *What do grassroots innovators and traditional knowledge holders perceive at the opportunity recognition, ideation and scaling up stages of GI?*
3. *In what circumstances are commercial exchanges experienced positively, as inhibitory or constraining by grassroots innovators?*

Part 1: The goal is to develop rapport with the interviewee while gathering each person's life history regarding how he/she became a grassroots innovator

Let us start by discussing the life experiences that most influenced the grassroots innovators and how they begin their innovation journey.

1. Tell me something about your life.
    a. About you, your family and adults who influenced your life?
    b. About your community
    c. About your education and profession
    d. Please share your daily routine
    e. Why it is important to innovate and does innovation supplement your livelihood?
2. Can you briefly tell me the highlights of how you got to be known as innovator?
    a. Describe your first innovation or contribution of traditional knowledge for innovation.
    b. How do you think this innovation/s shaped you as a person?
    c. What are some things that you learned as a grassroots innovator?
    d. Why your innovation is important?

e. What are the benefits from your traditional knowledge/ practices/ innovations?

f. Did anyone outside your community approach you to provide incentives, resources rewards or other recognition for your innovation?

g. What are your views on being grassroots innovator?

3. What are some important events that stand out for you in the innovation journey?

   a. Why are these episodes important for you?

   b. How were you inspired for innovation?

   c. What sort of beliefs do you have about your livelihood/community support/ innovation?

   d. What does it take to be successful?

   e. Describe briefly the journey after innovation?

   f. Are you getting any rewards for your innovation? How important are they for you?

Part 2: The goal is to allow the individual to reconstruct the details of his/her life as a grassroots innovator by focusing on what he/she does at opportunity recognition, 1 2 **ideation and scaling stage of innovation… in exploring what it is like to be a grassroots innovator**

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1. Describe your journey from ideation to scaling innovation (product /process)?

   a. Describe how you identified opportunity to innovate?

   b. Were your prior knowledge and learning useful in recognizing opportunity and ideation?

   c. What sort of community and family support you envisage for innovation journey?

   d. What is market and customer in general and in specific to your innovation?

   e. What is the cost of production and how do you manage your resources?

   f. Do you think that your innovation needs larger market, resource, improvisation or protection?

   g. What if someone copies your innovation and monetizes it?

   h. Did you seek legal advice relating to innovation, is it important?

2. What sorts of exchange relationship exists for ideation and scaling up GI?

   a. How did you approach your customer?

   b. Why the customer / client did approach you?

c. How do you procure resources to develop your innovation?

d. Did you/ your community think of starting a company or selling the know-how?

e. Where do you see your innovation after 5 years?

f. What hurdles you faced in sourcing finance for product development?

3. Did you seek assistance or sort an alliance from people or institution outside your community?

    a. Describe the exchange relationship/ alliance journey and the evolution over the time. Are you happy with the current exchange relationships?

    b. How did the exchange relationship begin?

    c. Where did you hear about the alliance partner and/or assisting agency?

    d. What led you to alliance and what sort of assistance they provide?

    e. How would you describe the benefits you get from the exchange relationship?

    f. Case-specific situational question (multiple- ties/ level of engagement , etc)

4. What else do I need to know to understand more about your journey as a grassroots innovator?

Part 3: The goal is to encourage each grassroots innovator to reflect on the meaning his/her experiences holds for him/her.

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1. I innovated because _____ (complete the sentence)

2. Think of a time when you had a particularly when you had a particularly satisfying or rewarding time as an innovator? (include feeling and thought that you had)

    a. What made the experience so satisfying?

    b. What did you expect would happen?

    c. What lesson did you take away from the experience?

3. Tell us about a particularly challenging or difficult time in your role as a grassroots innovator

    a. What made the situation challenging?

    b. What were your expectations?

    c. What did you learn from this experience about innovator or key stake holder in the innovation process.

4. Tell me about some of the key people you rely for your innovation?

    a. Are they internal or external networks?

b. Why did you choose to rely on these people?

c. Why are they important to you?

d. What are your expectations from them?

e. How would you describe their help (in one sentence)?

5. What do you think is required or expected of you a grassroots innovator?

6. Complete this sentence, besides being a grassroots innovator, I am also _____, _____, and _____.

    a. Why did you choose these descriptors?

    b. How do they influence your innovation behaviour?

    c. At this point, how else would you describe yourself? Who is (participant name) _____?

7. If someone from your community dreamt of becoming a grassroot innovator like you, what advice would you give him/her?

    a. How should they go about?

    b. What are the important things he/she needs to do?

    c. Why do you think they should also innovate?

8. What else would someone need to know in order to fully understand about what it means to be a grassroots innovator like you?

.મુલાકાત પ્રશ્નાવલિ: (વર્ણનાત્મક)

મુખ્ય પ્રશ્ન: ભારતમાં ગ્રામ વિસ્તાર સર્જકો ના જીવંત અનુભવો ના અર્થ અને સાર શું છે?

ત્રણ પેટા પ્રશ્નો :

1. કેવી રીતે ભારતીય ગ્રામ વિસ્તાર સર્જકો તક માન્યતા, ચિંતનશક્તિ અને માપન ના તેમના નીવડી અનુભવો સમજી રહ્યાં છો?
2. ગ્રામ વિસ્તાર સર્જકો અને પરંપરાગત જ્ઞાન ધારકો, ગ્રામ વિસ્તાર નવીનીકરણ ના તક માન્યતા, ચિંતનશક્તિ અને માપન તબક્કે શું આવતા હોવાનું માને છે.
3. કયા સંજોગોમાં ગ્રામ વિસ્તાર સર્જકો ને વ્યવસાયિક વિનિમય ના હકારાત્મક અને અવરોધક અનુભવ થાય છે.

ભાગ ૧: અહીં ધ્યેય તે / તેણી એક ગ્રામ વિસ્તાર સર્જકો બન્યા કેવી રીતે સંબંધિત દરેક વ્યક્તિ જીવન ઇતિહાસ ભેગો કરી અને ઈન્ટરવ્યુ આપનાર સાથે એકરાગ વિકાસ સાધવાનો છે

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1. મને તમારા જીવન વિશે કંઈક કહો.
    a. તમારા વિશે , તમારા કુટુંબ વિશે અને કોઈ પણ વયસ્ક જે તમારા જીવન પર પ્રભાવ ધરાવતા હોય
    b. તમારા સમુદાય વિશે
    c. તમારા શિક્ષણ અને વ્યવસાય વિશે
    d. તમારી દિનચર્યા વિશે મને જણાવો
    e. શા માટે નવીનીકરણ લાવવુ ખબજ મહત્વપૂણ છે અને શું આ નવીનીકરણ તમારી આજીવિકા મા પુરવણી કરે છે?

2. શું તમે શનક્શિપ્ત મા કહિ શકો કે એક ગ્રામ વિસ્તાર સર્જકો તરિકે તમે કઇરિતે ખ્યાતિ કે નામના મેળવી?
    a. તમારા પ્રથમ નવિનકરણ અથવા નવીનીકરણ માટે પરમ્પરગત ગ્રાન ના સહાય વિશે વર્ણન કરો?
    b. આ નવીનીકરણ નુ તમારા ઘડતર મા શું યોગદાન છે ?
    c. તમે ગ્રામ વિસ્તાર સર્જકો તરીકે (આ નવિનકરણ દ્વારા) શું શીખ્યા?
    d. શા માટે તમે કરેલ નવીનીકરણ મહત્વપૂર્ણ છે?
    e. તમારા પરમપરગત ગ્રાન / વ્યવ્હાર / નવીનીકરણ ના શું ફાયદા છે?
    f. શું તમારા નવીનીકરણ માટે,તમારા સમુદાય ની બહાર તમને કોઇ એ પ્રોત્સાહનો , સ્રોતો પારિતોષિકો અથવા અન્ય માન્યતા આપવા માટે તમારો સંપર્ક કર્યો હતો?
    g. ગ્રામ વિસ્તાર સર્જકો હોવા પર તમારા અભિપ્રાયો શું છે?

3. આ નવીનીકરણ યાત્રામાં તમારા માટે મહત્વપૂર્ણ ઘટનાઓ કઇ છે?
    a. શા માટે આવી ઘટનાઓ તમારે માટે મહત્વની છે?
    b. તમે કેવી રીતે નવીનીકરણ માટે પ્રેરીત થયા?
    c. તમારી આજીવિકા/ સમુદાય આધાર / નવીનીકરણ વિશે તમારી માન્યતા શું છે?

d. સફળતા પ્રાપ્ત કર્વા માટે શું જરુરી છે?
e. સંક્ષિપ્તમાં નવીનીકરણ પછી ની યાત્રાનુ વર્ણન કરો ?
f. તમે ને તમારા નવીનીકરણ માટે કોઇ પારિતોષિકો / વળતર આપવામા આવિયા છે ? આ તમારા માટે કેટલુ મહત્વપૂર્ણ છે?

ભાગ 2: અહીં ધ્યેય વ્યક્તિગત તે । તેણી નવીનીકરણ ની તક માન્યતા, ચિંતનશક્તિ અને માપન તબક્કે શેના પર ધ્યાન કેન્દ્રીત કરે છે અને ગ્રામ વિસ્તાર સર્જક તરીકે તેમની વિગતો । તેણીના જીવન પુનર્ગઠન માટે દાખલ કરવું...ગ્રામ વિસ્તાર સર્જક તરિકે કેવુ લગે છે તેનુ અન્વેષણ.

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1. ચિંતનશક્તિ થી નવીનીકરણ ના સ્કેલિંગ (ઉત્પાદન । પ્રક્રિયા) સુધિની યાત્રાનુ વર્ણન કરો ?
    a. તમે નવીનીકરણ માટે ની તક કેવી રીતે ઓળખી કાઢી તેનુ વર્ણન કરો.
    b. શું તમરુ પુર્વ ઞાન અને શિખ નવીનીકરણ ની તક ઓળખવામા અને ચિંતનશક્તિ મા ઉપયોગી નિવડિયા?
    c. નવીનીકરણ પ્રવાસ મા સમુદાય અને કુટુંબ નો કયા પ્રકારનો આધાર તમે ધ્યાનમાં લો છો ?
    d. તમારા નવીનીકરણ માટે ચોક્કસ બજાર અને ગ્રાહક શું છે?
    e. તમારા નવીનીકરણ મા ઉત્પાદન ખર્ચ શું છે અને તમે કેવી રીતે તમારા સ્રોતો પ્રબંધ કરો છો?
    f. તમને તમારા નવીનીકરણ માટે મોટા બજાર , સાધન , સુધારણા કે રક્ષણ કરવાની જરૂર લાગે છે?
    g. કોઈ તમારી નવીનીકરણ ની નકલો અને તેનુ મુદ્રીકરણ કરે તો?
    h. તમે નવીનીકરણ ને લગતી કાનૂની સલાહ લીધી? શું તે અગત્યનું છે?

2. ચિંતનશક્તિ થી નવીનીકરણ ના સ્કેલિંગ મા કેવા પ્રકાર ના વિનિમય (આદાન- પ્રદાન) ના સંબંધો અસ્તિતિત્વ મા છે?
    a. તમે કેવી રીતે તમારા ગ્રાહક સુધિ પહોંચિયા?
    b. શા માટે તમારા ગ્રાહક અસીલ તમારી પાસે આવિયા?
    c. કેવી રીતે તમે તમારા નવીનીકરણ ને વિકસાવવા સ્રોતો પ્રાપ્ત કરો છો?
    d. ઉત્પાદન વિકાસ માટે નાણા મેળવા કેવા મુશ્કેલીઓ સૂચિત અવરોધ જોયા?
    e. તમે કે તમારા સમુદાયે એક ધંધો શરૂ કરવા કે વિશેષજ્ઞતા ના વિક્રય નુ વિચાર્યું છે?
    f. ૫ વર્ષ પછી તમારા તમારા નવીનીકરણ ને ક્યાં જુવો છો?

3. તમે તમારા સમુદાય બહાર ના લોકો પાસેથી સહાય અથવા કોઇ સંસ્થા સાથે જોડાણ કરિયુ છે?
    a. વિનિમય (આદાન- પ્રદાન) ના સંબંધો જોડાણ પ્રવાસ અને સમય જતાં ઉત્ક્રાંતિ વર્ણવો. શું તમે વર્તમાન વિનિમય સંબંધો સાથે ખુશ છો?
    b. વિનિમય (આદાન- પ્રદાન) ના સંબંધો કેવિ રિતે શરૂ થયા?
    c. તમે જોડાણના ભાગીદાર અને / અથવા સહાય સંસ્થા વિશે ક્યાં થિ સાંભળ્યું?
    d. ક્યા કરણ સર જોડાણ કરિયું અને ક્યા પ્રકારની સહાય થઇ ?
    e. કેવિ રીતે તમે વિનિમય (આદાન- પ્રદાન) ના સંબંધો માંથી મળતા લાભ ને વર્ણાવશો?
    f. ચોક્કસ કિસ્સામાં ની પરિસ્થિતિઓ ના પ્રશ્ન (બહુવિધ સંબંધો / સ્તર જોડાણ -, વગેરે)

4. એક ગ્રામ વિસ્તાર સર્જક તરીકે તમારી યાત્રા વિશે મારે વધુ શું સમજ્વુ જરુરિ છે?

ભાગ 3: અહીં ધ્યેય દરેક ગ્રામ વિસ્તાર સર્જક ને તેના / તેણીના અનુભવો તેને / તેણીને માટે ધરાવે અર્થ ઉપર પ્રતિબિંબિત કરવા પ્રોત્સાહિત કરવાનો છે.

1. હું નવા સંશોધન/ નવીનીકરણ કરું કારણ કે _____ (આ વાક્ય પૂર્ણ કરો)

2. એક ગ્રામ વિસ્તાર સર્જક તરીકે ચોક્કસ લાભદાયી । સંતોષ સમય યાદ કરો ? (લાગણી અને વિચારો નો સમાવેશ કરો)
    a. આ સંતોષ નો અનુભવ કેમ થયો?
    b. તમારિ અપેક્ષા મા શું થાત?
    c. તમે અનુભવ પરથી શું પાઠ લઇ શક્યા ?

3. એક ગ્રામ વિસ્તાર સંશોધનકાર તરીકે તમારી ભૂમિકા ખાસ કરીને પડકારરૂપ અથવા મુશ્કેલ સમય વિશે કહો
    a. શેના થી પરિસ્થિતિ પડકારરૂપ બનિ ?
    b. તમારી અપેક્ષાઓ શું હતી?
    c. તમે સર્જક તરિકે આ અનુભવ પરથી શું શિખિયાં

4. તમે તમારા નવીનીકરણ માટે જે લોકો પર આધાર રાખે છો તેમના વિશે જણાવો?
    a. તેઓ આંતરિક અથવા બાહ્ય તંત્ર ના છે ?
    b. શા માટે તમે આ લોકો પર આધાર રાખવા પસંદ કર્યું ?
    c. તમારા માટે તેઓ મહત્વપૂર્ણ શા માટે છે?
    d. તેમનિ પાસેથિ તમે શુ અપેક્ષાઓ રાખો છો?
    e. તમે કેવી રીતે (એક વાક્યમાં) તેમની મદદ નુ વર્ણન કરશે ?

5. ગ્રામ વિસ્તાર સર્જક તરિકે તમારિ પસેય થિ શુ અપેક્શિત હોઇ છે?

6. આ વાક્ય પૂર્ણ કરો -- એક ગ્રામ વિસ્તાર સર્જક હોવા ઉપરાંત , હું પણ છું _____ , _____ , અને _____ .
    a. શા માટે તમે આ વર્ણન પસંદ કર્યું?
    b. કેવી રીતે આ ભૂમિકા તમારા નવીનીકરણ વર્તન પર અસર કરે છે?
    c. બિજિ કેવિ રિતે તમેય તામરુ વર્ણન કર્શો ? કોણ (સહભાગી નામ) _____ છે?

7. તમારા સમુદાયના કોઈને તમારા જેવા એક ગ્રામ વિસ્તાર સર્જક થવુ હોઇ તો તમે તેને શુ સલાહ આપ્શો?
    a. ગ્રામ વિસ્તાર નવીનીકરણ જરૂર મહત્વની બાબતો શું છે?
    b. તેઓ શુ કરવુ પડે?
    c. શા માટે તેઓ પણ નવીનીકરણ લાવે તેવુ તમે માનો છો?

8. બિજુ શુ પૂર્ણપણે જરુરિ છે ત્સમજ્વા મા કે - તમારા જેવા એક ગ્રામ વિસ્તાર સર્જક હોવા નો અર્થ શું છે?

Appendix 3: List of key words used by the respondents

(Translated using Gujarati to English Dictionary Hardcover)

Sr.No	Respondent's Key Word	English Translation
1	Kotha Suj/Suz	Acumen/know-how/ability
2	Maansiktta	Attitude
3	Vichar	Thought/idea
4	Shanshodhan	Innovation
5	Shanshodhankar	Innovator
6	Dhandho	Business
7	Sanmaan/maan	Felicitation/ Respect
8	Madad/Sahai	Help
9	Protsahan	Encouragement
10	Saath-shakar	Support
11	Patent	Patent
12	Shodh	Research/ discovery of new tool (in this context)
13	Saanti/Hati	Plough
14	Kudrati	Naturally
15	Khedut	Farmers
16	Yantra	Machine
17	Sadhano, Ojaar	Tools
18	Paropkaar	Benevolent , Aultrism, selfless service for other
19	Vechaan	Sales
20	Nakal	Copy
21	Faydo/Fayda	Benefit/profit/advantages
22	Sanstha	Institution
23	Gnati	Caste
24	Prayatna	Experiment (in this context), try
25	Gyaan	Knowledge
26	Jaroor	Need
27	Mitra	Friend
28	Samasya/mushkeli	Problem/issue/hurdles
29	Majoor	Labourer
30	Samadhan/Hal/Upay	Solution
31	Takleef	Uncomfort/Problem/Pain
32	Sarkar	Government
33	Upyog	Use
34	Vadtar	Return
35	Nafo	Profit
36	Bhangaar	Garbage/scrap
37	Margdarshan	Guidance
38	Anubhav	Experience
39	Abhiprai	Testimonial/view
40	Vruti	Attitude
41	Kutumb	Family
42	Shokh	Hobby
43	Saral	Easy
44	Paristhiti	Situation
45	Vastu	Object, things

46	Aajivika/ghar-kharch	Livelihood/household expense
47	Akhatra /Prayogo	Experiment
48	Hetu	Aim/Purpose
49	Sanjog	Circumstrance/situation
Sr.No	Respondent's Key Word	English Translation
50	Karma	Acts
51	Magaj	Brain/intellect/mind
52	Krushi Mela	Agriculture fair
53	Samaaj	Society/community
54	Manobad	Willpower
55	Karkhanu	Factory
56	Upyog/upyogi	Use/useful
57	Utpadan	Production
58	Sudharo	Improvement
59	Bhagwan/Praghu	God/Almighty
60	Lupt	Extent
61	Majuri	Labour
62	Naksha	Design (in this context)
63	Banaviyaan	Made
64	Bhaadey	Rent
65	Padkaar	Trials/challenges
66	Namna	Goodwill/recognition/fame
67	Dukh	Sad/Pain/trouble
68	Ghatna	Event
69	Sagaa	Relative
70	Sambandh	Relation
71	Moko/tak	Opportunity
72	Gujaran	Earn living
73	Jatey	Own their own / by them selves
74	Navin	New/novel
75	Denu/devadaar	Debt/debtor
76	Gaanda/gaando	Mad/Insane
77	Abhigam	Perspective/view
78	Sakaratmak	Optimistic/ positive
79	Bhakti	Devotion
80	Anubhav	Experience
81	Odakh	Identity

Appendix 6 : Plates

Plate 1 : AA's innovation and sales list

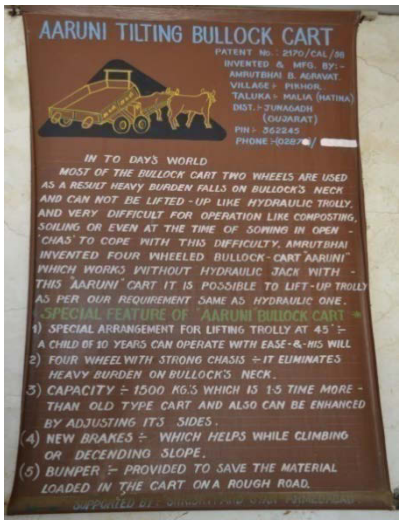

Plate 2 : Details of AA's Aruni Tiliting Cart at his workshop

Plate 3 : BA at the community workshop

Plate 4 : AA and BA at the community workshop

Plate 5 : BT demonstrating his innovations wheat sowing box

Plate 6 : BT demonstrating his innovations shock box.

Plate 7 : BT's innovation - Tractor without steering


કાલાવડના બચુભાઇ વૈજ્ઞાનિક ખેતી માટે રીમોટ
કંટ્રોલ વાળુ ટ્રેકટર વિકસાવવામાં વ્યસ્ત છે !!

Plate 8 : Media coverage of BT's tTractor without steering and sale of the design rights of this innovation

Plate 9: GD showing article in HoneyBee Network Magazine

Plate 10: GD's Motorcycle-operated sprayer

Plate 11: GS during interview at Sattvik Food Festival 2013

Plate 12 : GD's Hand-driven sprayer.
Photo : Source : NIF Award Book 2013

Plate 13 : MJ's Bullet Santi first model

Plate 14 : MJ's Bullet Santi latest model

Plate 15: MJ's bicycle sprayer

Plate 16: MJ's wall of fame at his workshop

Plate 17: **MP's Cotton Stripping Machine**

Plate 18 : MP and his son at their factory in Viramgam

Plate 19 : MPP's MittiCool boards in his village Vakaner

Plate 20: MPP and his son in his office

Plate 21: MPP's machine innovation to make earthenware

Plate 22: MPP's machine innovation to make earthenware

Plate 23: MPP's wall of fame in his office at Vankaner

Plate 24: A design student from Russia at MPP's factory for learning the art of earthenware

Plate 25 : PP demonstrating his bamboo strip and incense stick-making machine at Sattvik food festival 2013 after interview

Plate 26 : PP's Bamboo strip and incense stick-making machine

Plate 27 : SP with his Health Chair 'Maruti Jhula' at the sattvik food festival 2013 after interview

Plate 28 : SP with his Health Chair 'Maruti Jhula' at the sattvik food festival 2013 after interview

Plate 29 : YM with his latest innovation, microprocessor-based instrument that records temperature, pressure and dust particles in a pharmaceutical laboratory

Plate 30 : YM's wall of fame at his office

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Note: All INR to US $ conversion was done using currency covertor calculator viewed 19 August 2015, <http://www.xe.com/>

Personal Communications

Interviews were conducted with thirteen grassroots innovators of Gujarat, India whose views are quoted directly in this thesis. Details of these personal communications are as follows:

- Amrut Agrawat (2013), Personal Communication (8 December)
- Bharat Agrawat (2013), Personal Communication (8 December)
- Bachu Thesia (2013), Personal Communication (20 November)
- Ganesh Dodiya (2013), Personal Communication (20 December)
- Gopal Suartiya (2013), Personal Communication (22 December)
- Mansukh Jagani (2013), Personal Communication (7 December)
- Mansukh Patel (2013), Personal Communication (17 December)
- Mansukh Prajapati (2013), Personal Communication (18 December)
- Mohan Patel (2014), Personal Communication (20 January)
- Paresh Panchal (2013), Personal Communication (22 December)
- Sanjay Tilawa (2013), Personal Communication (25 December)
- Sakrabhai Prajapati (2013), Personal Communication (22 December)
- Yagnesh Mehta (2013), Personal Communication (16 December)