Enabling Financial Inclusion through an Alternative Credit Assessment Tool

Insights from Rural India

Study Partners
Department for International Development, Government of UK
Dharma Life
London Business School
The London School of Economics and Political Science
Shell Foundation

Contents

List of initialisms and acronyms 3
Abstract 4
Executive Summary 5
Introduction 5
Project Objectives 1
Study methodology 2
Current Status and Achievements 2
Way Forward 2
1. Background 3
2. Introduction to the Concept 1
2.1 The Challenges of Microcredit in India 1
2.2 Study Objectives 2
2.3 Study Approach 2
2.4 Study partners 3
3. Methodology for testing the tool 5
3.1 Designing the credit assessment tool 5
3.1.1 Literature Review 5
3.1.2 Identifying Variables 5
3.1.3 Initial Field Testing of the Credit Assessment tool 5
3.1.4 Designing of Revised Credit Assessment Tool 5
3.1.5 Experiment Design for Implementation of the Credit Assessment Tool 5
3.2 Designing Business Processes for large-scale implementation of the tool 6
3.2.1 Design of Credit Product 6
3.2.2 Management of DLE data 6
3.2.3 Stakeholder Consultation 6
4. Designing the tool 7
4.1 Review of literature on existing credit assessment and entrepreneurial screening tools 7
4.1.1 Psychometric screening 7
4.1.2 Know-Your-Customer screening 8
4.1.3 Social referencing 9
4.2 Initial field testing of the credit assessment tool 9
4.2.1 Psychometric constructs 9

4.2.2 Alternative KYC Data 10
4.2.3 Learnings from the Field Trials 11
4.2.4 Other Learnings from the field trials 14
4.3 Post-trial Tool Refinement 15
4.4 Experiment Design for the Studies 18
4.5 Which stakeholders can benefit from this tool? 19
5. Business processes for the study 19
5.1 Designing the Deferred Payment Facility 19
5.2 Role of technology 21
5.3 Stakeholders to be engaged 22
5.4 Learnings from the Stakeholder Consultation 22
6. Way forward 22
6.1 Study initiation 22
6.2 Preparations for the second phase of the study 23
6.3 Reporting 23
7. Works Cited 24

List of initialisms and acronyms

HAP: Household Air Pollution

MFI: Microfinance Institutions

DLE: Dharma Life Entrepreneur

KYC: Know Your Customer

DfID: Department for International Development, Government of UK

UNICEF: The United Nations Children's Fund

EFL: Entrepreneurial Finance Lab

DPF: Deferred Payment Facility

INR: Indian National Rupee

Abstract

In the face of affordability challenges in the Indian market, the demand for important products and services remains low. Equally concerning is that small-scale entrepreneurs in these markets, who are in a position to facilitate last-mile access to socially-beneficial products for populations at the base of the pyramid, also lack the capital to maintain the necessary inventory of products for further selling. In this situation, the need for affordable credit among these entrepreneurs and consumers emerges strongly. However, even while financial institutions such as Microfinance Institutions have made an entry into rural and low-income markets, a large portion of the population remains underserved. One reason for this is the lack of reliable models to screen and assess the creditworthiness of individual borrowers. Given the limited financial footprint of individuals among rural and low-income groups, alternative models for credit assessment present a possible solution towards extending credit to previously underserved sections. Dharma Life, the Department for International Development of Government of UK (DfID), London Business School, The London School of Economics and Political Science, and Shell Foundation have come together to address this need by designing and testing a low-cost and easy-to-administer alternative credit assessment tool, especially developed for deployment in rural and developing markets. This report highlights the process of testing and developing this tool, and the learnings along the way. The plan for further testing and refinement of the tool through subsequent studies is also discussed here.

Executive Summary

Introduction

Access to important consumer goods has been a persistent challenge faced by developing economies and has produced inequalities in health, sanitation and other standards of living. For example, the global health hazards of Household Air Pollution are aggravated by the lack of access to clean cooking solutions: in India alone more than 1.25 million deaths (approximately 29 percent of the global HAP disease burden) result from the use of solid fuels for cooking and heating. Similarly, 77 million Indians lack access to safe water – the World Bank estimates that 21 percent of communicable diseases in India are linked to unsafe water and poor hygiene practices.

The challenges posed to product adoption in rural India are two: accessibility and affordability. Last-mile distribution remains a challenge. Due to the infrastructural and logistical challenges of setting last-mile retail networks in rural India, consumers lack access to and awareness about useful products such as clean cooking solutions, clean energy solutions and water purification systems. While operational and infrastructural challenges can be overcome by employing local resources to serve as quasi-retail points for important products and facilitate access, such local entrepreneurs require adequate capital to support their sales operations. Entrepreneurial financing can thus resolve the working capital needs of rural entrepreneurs. Additionally, affordability constraints affect product adoption. Household incomes in rural India are small and fluctuating: close to 35 percent of India's population lives on less than $1.25 a day. Moreover, liquidity constraints and high upfront costs for purchasing essential consumer goods pose further challenge to product adoption. Consumer financing therefore poses a potential solution to drive product adoption.

Underlying the above two challenges is a common impediment: access to credit. Poor access to credit is a major barrier for rural entrepreneurs and consumers to sell and access social impact products respectively. Rural entrepreneurs are unable to procure a sizeable inventory of products, in the absence of affordable credit. On the other hand, the absence of low-cost product loans constrains consumer adoption. The current financial ecosystem and solutions available for rural micro entrepreneurs and consumers are inadequate and not aligned to the needs of those seeking micro loans of less than INR 10,000-15,000. Microcredit, while a potential solution to the need for financing, is faced with its own problems.

Additionally, credit assessment of prospective borrowers in the rural context is difficult. Borrowers in rural markets characteristically possess limited formal recorded information about their financial histories, complicating the process of assessing creditworthiness. This problem of information asymmetry limits the outreach of micro-lending. Further, high transaction costs linked to small ticket size loans deter lenders from extending product loans to rural consumers. Product loans are mainly provided as top-up loans to existing members of MFIs with a credit history, therefore excluding non-MFI members. While credit assessment is a potential solution to these challenges, existing tools and methodologies to assess creditworthiness are riddled with their own challenges.

Many of the alternative frameworks cater to developed markets, where formal transaction histories are easy to procure owing to financial inclusion at even bottom of the pyramid sections. Moreover, within the alternative credit assessment universe, there are very few players who provide an assessment for

entrepreneurs. Most engagements focus on assessing consumer creditworthiness and have neglected entrepreneur assessment.

Project Objectives

The need for an easy-to-administer, scalable, cost-effective tool that is appropriate for use with diverse participants cannot be overstated. Responding to this need, Dharma Life has partnered with the UK Government's Department for International Development (DfID) and Shell Foundation to conduct a study that tests an alternative credit assessment framework among rural entrepreneurs and consumers, with the purpose of developing a credit assessment tool that is contextually relevant and scalable in rural and emerging markets.

This project will therefore have two arms: while the first arm will involve developing a credit assessment tool for rural entrepreneurs, the other arm of the project will develop a similar methodology of assessment among consumers. In accordance with research considerations, the entrepreneur credit assessment methodology will be developed before the consumer assessment methodology.[1] This report will therefore highlight our learnings through the process of developing the credit assessment tool for entrepreneurs.

To test credit behaviour, we will distribute a basket of products on credit among randomly selected village-level Dharma Life Entrepreneurs. This will serve as the inventory necessary for entrepreneurs to conduct their sales and marketing operations. Simultaneously, the credit assessment tool will be administered among the entrepreneurs as a means of capturing the *input variables* unique to each of the entrepreneurs participating in the study. Entrepreneurs shall conduct their sales and service operations through the study period, while managing their credit repayment commitments. At the end of study, entrepreneurial performance, credit repayment and other relevant outcomes will be captured for these entrepreneurs. An analysis of the associations between credit-relevant outcomes and the input variables captured through the credit assessment tool shall indicate what variables are most relevant to predict creditworthiness.

Our study has the objective of developing a low-cost and easy-to-administer credit assessment tool that can help serve the presently underserved market of rural microentrepreneurs. This will be done with the following steps:

1. Designing the credit assessment tool through review of existing methods
2. Multiple rounds of testing the credit assessment tool across DLE networks to assess the potential of variables to predict entrepreneurial potential and credit worthiness
3. Administration of tool in a large-scale study to gauge how key predictor variables combine with access to funding to predict a variety of entrepreneurial, family, and community outcomes

[1] Dharma Life's standard screening methodology – conducted during entrepreneur selection – allows to control for certain entrepreneur-specific parameters before administering the credit assessment tool. This affords us the ability to control the sample of entrepreneurs among whom the credit assessment tool will be tested, and ensure that the said sample is as homogeneous as possible. Upon assessing the scope to develop the credit assessment methodology for entrepreneurs and consumers, it was concluded that as a first step, an entrepreneur scoring methodology would be easier to develop. In light of these practical feasibilities, we decided to initiate the project with entrepreneur assessment, and proceed with consumer assessment in the second leg of the project.

Study methodology

The credit assessment tool will see refinements through increasing applications and iterations across diverse contexts. Our study will test the tool through prototyping and trials across diverse contexts. The preliminary phase of the study involved creating a prototype of the tool by incorporating dimensions currently in use by other entrepreneurial assessment frameworks. This prototype was then tested within a small entrepreneur population to detect associations between entrepreneur-specific parameters and credit and sales performance. The tool was then refined using the learnings of these initial field trials, and modified to include indicators that demonstrated highest predictive power over credit and sales performance. The revised tool was then prepared to undergo further testing across different geographies and entrepreneur contexts, mainly through two studies.

The first study will involve administering the tool among 400 Dharma Life Entrepreneurs. Shortly following the training and onboarding of DLEs, we will administer the credit assessment tool across the 400 DLEs, capturing relevant credit assessment indicators as well as a few data points regarding the baseline indicators of the DLEs prior to their induction as Dharma Life Entrepreneurs. Following this, the product baskets on credit will be disbursed to 200 randomly selected DLEs, while the remaining 200 DLEs remain the 'control group' i.e. are unfinanced. At the end of the study, entrepreneurial outcomes among the 400 DLEs will be observed and associations between these 'outcome' variables and the 'input' variables captured through the credit assessment tool will be observed. A credit scoring algorithm will be developed through this study, the power and validity of which will be tested in the subsequent study.

Current Status and Achievements

Presently, the following milestones indicate the status of completion of work in this project:

Finalisation of the credit assessment tool: Following two rounds of field testing, the credit assessment tool was designed to encompass dimensions covering three broad categories:

a) psychometric constructs,
b) alternative KYC screening, and
c) Social referencing

Finalisation of credit product design and business processes for deployment of the loan product: The loan product here is a deferred payment facility, where borrowers are given a product bundle comprising a variety of social impact goods, including solar lights, induction cooktops, water purifiers, sanitation napkins etc. From the revenue generated through the sale of these products, entrepreneurs can repay the credit in equal monthly instalments.

Preparation for field study to test the tool across DLE networks and test credit performance: The credit assessment tool will be administered to all 400 DLEs during their initial onboarding. Correlations between psychometric and KYC variables, and entrepreneurial and credit outcomes will be measured for all DLEs. The results from this study will guide the large-scale study to be implemented.

Capital support received from various organisations for DPF deployment: We were successful in forging partnerships with organisations such as Stichting DOEN, Tata Trusts and PSI-Unilever in gathering the necessary capital support for DPF lending.

Way Forward

The first study, which involves the administration of the credit assessment tool among Dharma Life Entrepreneurs and measuring entrepreneurial and credit outcome indicators against the input variables, is being conducted in Uttar Pradesh and Rajasthan, and will be extended to other states as well. We are also currently making efforts at gathering

resources and support to conduct the second study.

1. Background

Worldwide, inequality is both revealed and sustained through differential access to basic consumer goods. For example, approximately 2.7 billion people across the globe use biomass fuels (e.g., animal waste, wood, charcoal) for cooking (World Energy Outlook, 2014). Such fuels are not only relatively inefficient, they are a major source of outdoor and indoor air pollution, and cause millions of premature deaths each year as well as undesirable health consequences like respiratory disease and low birth weights (Bruce, Rehfuess, Mehta, Hutton, & Smith, 2006). Likewise, more than a billion people worldwide lack access to clean water—or to filtration systems that would make polluted water safely potable—and polluted water contributes to the death of 15 million children annually, with many millions more suffering ill health as a result (World Health Organisation and UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2000).

These negative health outcomes disproportionately impact the impoverished individuals who lack access to the products and services that improve health and standard of living (e.g., clean cook stoves, inexpensive water filtration systems). Why are these products not more widely used in rural areas? Certainly, the money it costs to acquire them is one barrier. In addition to barriers of affordability, the lack of access to information, as well as the lack of access to markets for purchasing products impedes consumer adoption.

In view of these barriers to adoption for socially-beneficial products, Dharma Life has built a business model to cater to the consumer at the bottom of the pyramid by establishing product and service networks at the last mile. It does so through the development of 'village-level entrepreneur' networks: entrepreneurs sell socially-beneficial products (e.g. clean cook stoves, water filtration systems) while providing education about why and how to use them, and themselves serve as a social model of their use to build comfort and wider acceptance for these products. This model has proven highly effective. Dharma Life, till today, has provided products to 2.5 million consumers across 12 states in India, and has reached out to more than 2 million beneficiaries through its awareness and behaviour change campaigns.

Extending these benefits more widely entails many interventions, one of which is addressing the affordability barrier among entrepreneurs and consumers. Access to credit helps entrepreneurs sustain and expand their businesses—credit support, for example, enables entrepreneurs to widen their product offerings and stock greater quantities of products, in order to fulfil demand in their villages. Alongside these methods to build capacity on the selling side, growth depends on financial assistance on the buying side. Rural consumers may recognize that they would reap health and well-being benefits from acquiring new products like a clean cook stove, but may be unable to make the relatively large financial commitment upfront. Responsibly-provided consumer financing would help overcome such barriers.

2. Introduction to the Concept

2.1 The Challenges of Microcredit in India

In the face of affordability challenges and the inadequacies of financing institutions in rural India, microcredit presents a potential solution to facilitating access to important products among lower income consumers. However, the current financial ecosystem and solutions available for rural micro entrepreneurs and consumers are inadequate and not aligned to the needs of those seeking micro loans of less than INR 10,000-20,000. While other models such as the group-lending model used by Micro Finance Institutions cater to this customer segment, the approach is initially focused on female group-lending models and only at a later stage targets individuals, which therefore only addresses a very small percentage of a village ecosystem. In such a situation where the bulk of rural entrepreneurs and consumers is left underserved, microfinance initiatives may improve access to consumer goods for only a small portion of individuals in a community, potentially increasing inequality (Banerjee, Karlan, & Zinman, 2015). Similar constraints apply to co-operatives and Self-Help Group lending models. While there have been significant efforts through business correspondent models and most recently through the Indian Government's Jan Dhan Yojna[2] , the major challenges highlighted above remain.

Consumer and entrepreneur financing for products like clean energy sources can be provided on a larger scale—in a way that might diminish, rather than increase, inequality— only when it is possible to assess creditworthiness. But doing so in a timely, affordable manner among unbanked individuals poses a clear challenge.

One of the key issues micro lending faces is that the credit assessment for this segment is a costly and tedious process. The existing credit assessment tools fail to aptly capture the credit worthiness of rural micro entrepreneurs and consumers. This results in a large number of creditworthy customers being denied credit, which restricts their participation in economic growth.

For one, in the absence of financial insitutions and bank coverage, consumers in rural markets leave limited financial footprints in the form of transaction and credit histories. Credit assessment in rural India is thus impeded by this lack of formal data in the form of bank and credit histories. This signals the need to develop an alternative credit worthiness tool by which creditworthiness and default risk of consumers can be assessed, using alternative data that is more accessible and relevant to rural consumers. The existing credit assessment frameworks have the following limitations:

- Limited suitability for and compatibility with the rural base of the pyramid customer segment (i.e. rural consumers and micro entrepreneurs)
- High cost of large-scale deployment
- High dependence on formal credit history and collateral availability
- High cost of credit assessment and collection for a relatively small loan size

[2] As of 2015, the Indian Government's Jan Dhan Yojana had opened more than 75 million 'zero-balance' bank accounts in rural India, while providing each bank account with an overdraft facility of INR 5,000. Rural households can access these low-volume lines of credit through local banking institutions such as Business Correspondents. More details regarding the scheme can be viewed here: https://www.pmjdy.gov.in/scheme.

In the context of the above-mentioned limitations and needs of the sector, there is a need to develop an alternative tool for domain specific assessment that is both reliable and cost-effective. This tool will aim to bring down the cost of credit assessment and incorporate the use of innovative methods to collect data from rural entrepreneurs and consumers.

2.2 Study Objectives

Responding to this need, Dharma Life has partnered with the UK Government's Department for International Development (DfID) and Shell Foundation to conduct a study that tested an alternative credit assessment framework among rural entrepreneurs and consumers, with the purpose of developing a credit assessment tool that is contextually relevant and scalable in rural and emerging markets.

This study is being conducted with the following objectives:

1. Designing the credit assessment tool through review of existing methods
2. Multiple rounds of testing the credit assessment tool across DLE networks to assess the potential of variables to predict entrepreneurial potential and credit worthiness
3. Administration of tool in a large-scale study to gauge how key predictor variables combine with access to funding to predict a variety of entrepreneurial, family, and community outcomes

This report details the learnings from the initial rounds of prototyping and testing the credit assessment tool for rural entrepreneurs.

2.3 Study Approach

The first phase of the study has been designed to test the prototyped credit assessment tool by disbursing a financing product among Dharma Life Entrepreneurs. To begin with, the credit assessment tool will be administered among the entrepreneurs as a means of capturing the *input variables* of the entrepreneurs participating in the study. Following tool administration, the financing product will be disbursed to entrepreneurs. The financing product with which entrepreneur credit performance will be tested in this study is a product basket that has been designed by Dharma Life, and comprises diverse social impact products including solar lights, induction cooktops, water purifiers etc. The product basket will be loaned to entrepreneurs as a *Deferred Payment Facility*. The *Deferred Payment Facility* entails that DLEs proceed to pay for those products after generating revenue on the sale of those products in their respective markets. More details of the role of the Deferred Payment Facility in our study will be discussed in the section on Experiment Design.

Following tool administration, the Deferred Payment Facility will be disbursed to entrepreneurs. Entrepreneurs shall conduct their sales and service operations through the study period while managing their credit repayment commitments. At the end of study, entrepreneurial performance, credit repayment and other relevant outcomes will be captured for these entrepreneurs. An analysis of the associations between credit-relevant outcomes and the input variables captured through the credit assessment tool shall indicate what variables are most relevant to predict creditworthiness. It is expected that through multiple rounds of testing, the tool will progressively evolve into a high-accuracy methodology for entrepreneur screening and assessment.

The prototyped credit assessment tool has been designed to integrate constructs and dimensions currently being used by existing entrepreneurial screening and assessment models, to result in a comprehensive and multidimensional tool.

While many organisations have created similar alternative credit assessment models, most of them do not cater to rural micro entrepreneurs and consumers in India. Moreover, many of the existing models look at specific behavioural or demographic dimensions in isolation while assessing credit worthiness. The goal is to develop a credit assessment model, which takes a multi-dimensional approach combining different inputs including psychometric, alternative KYC and social referencing data to predict relevant outcomes and to arrive at a more holistic and inclusive measure of credit worthiness. The input and outcome variables being identified in the tool are fully informed by formative research and the questionnaires developed to capture data on these variables are customized to the rural context.

The existing methods for assessing creditworthiness of rural entrepreneurs and consumers are not only limited, those that exist are proprietary; using them is therefore expensive. The costs make it prohibitive to roll out credit on a large scale. An additional challenge is that because these methods are proprietary, it is difficult or impossible to compare alternative methods. For example, the makers of one screening tool, the Entrepreneurial Finance Lab Research Initiative (EFL) (Klinger, Khwaja, & del Carpio 2013; discussed in more detail below) note that their measure includes two indicators of intelligence plus the "Big 5" personality dimensions. However, there are hundreds of different methods for assessing the Big 5; because they do not make their specific measures public, other researchers are unable to test them. Therefore, through this study, we hope to make our findings on credit assessment for rural and developing markets public and freely accessible, so that others can learn from, use, and improve on our efforts.

The alternative credit assessment tool we propose also offers the benefit of scalability and cost effectiveness. By contrast to the standardised credit assessment tool proposed here, it is true that traditional credit assessment models can incorporate a wider set of information for risk assessment, and are therefore likely to provide more comprehensive credit analyses of prospective borrowers. However, scaling these assessments over a larger population involve not only high operational costs, but also entails large-scale investment in human capital to develop the required team of credit and risk assessment experts. The high costs per evaluation would thus adversely affect the profitability of micro loans. However, the credit assessment being proposed here aims at eliminating these high-cost human resource requirements from the assessment process. It provides a cost-effective means of screening for creditworthiness, commensurate with both, the ticket size of the credit product on offer, as well as the wherewithal of the financing institution.

Thus, this tool will be developed for use in place of traditional credit screening methods to assess for credit provisioning. In turn, this financing will enable a large number of unbanked rural entrepreneurs to acquire socially impactful products.

2.4 Study partners

This study is being conducted as part of a multipartite engagement of Dharma Life with the UK Government's Department for International Development (DfID), Shell Foundation, The London School of Economics and Political Science (LSE) and London Business School (LBS). This study has also engaged Tata Trusts, Stichting DOEN and PSI-Unilever as funding partners for the lending capital to be provided to the Dharma Life Entrepreneurs (DLEs), and Johnson & Johnson for support in entrepreneur and community impact assessment. This study has also benefited from the inputs of consultants from Oliver Wyman and Bottom Up Advisors in the phases of designing the credit assessment tool and designing the deferred payment facility, respectively.

3. Methodology for testing the tool

3.1 Designing the credit assessment tool

The following steps describe the processes that guided the initial testing and designing of the credit assessment tool.

3.1.1 Literature Review

This study reviewed existing bodies of work on credit assessment and scoring to prospect for the dimensions and variables that offered potential to gauge creditworthiness and entrepreneurial performance.

3.1.2 Identifying Variables

Drawing from our findings from previous work conducted in credit and entrepreneurial assessment, we identified variables as under three broad categories: psychometric screening, *Know-Your-Customer* screening, and social referencing.

3.1.3 Initial Field Testing of the Credit Assessment tool

Reiteration of variables/questions and multiple rounds of field testing were critical to ensure that the resulting model was brief, accurate and fully contextualised to the rural environment. The credit assessment tool underwent multiple rounds of administering the questionnaire, which were followed by analysing the variables and their power to predict creditworthiness and entrepreneurial potential. This made the credit assessment questionnaire more relevant by removing or modifying questions whose responses presented a highly skewed distribution with very low variance, and by reconsidering questions whose responses are not correlated with the outcome variables or do not explain variance in outcome variables in a statistically significant manner.

The first round of field testing was done on 13 DLEs and 3 customers in UP, Bihar and Gujarat. This was done to capture preliminary feedback regarding the comprehensibility and relevance of questions in the rural context. Based on the feedback thus gathered, a revised questionnaire was formulated and administered on a larger scale, among 303 DLEs. Sales and credit default data of the DLEs were also collected and used as output variables in the model.

3.1.4 Designing of Revised Credit Assessment Tool

Upon administering the credit assessment questionnaire across the existing base of DLEs, data gathered for input variables (viz. psychometric and KYC data) was assessed for its power to predict the output variables (viz. sales performance and self-reported credit default data). Based on the findings, the variables found most relevant and powerful in their capacity to determine creditworthiness and entrepreneurial potential were retained, while those that posed relatively less potential to predict said outcomes were removed. Additionally, the credit assessment tool was revised to ensure minimal scope for inaccurate reporting and *'gaming'* the questionnaire.

3.1.5 Experiment Design for Implementation of the Credit Assessment Tool

The credit assessment tool, by its very nature, is iterative: by this, we mean that its content is refined and its accuracy improved the more widely it is administered across diverse geographic and demographic contexts. The design of our study recognises this need and is thus aimed at testing the tool

at multiple stages to increasingly enhance its accuracy and suitability. The experiment design was thus framed in response to this need to administer the tool across varying markets and time frames.

3.2 Designing Business Processes for large-scale implementation of the tool

3.2.1 Design of Credit Product

The Deferred Payment Facility was designed in consultation with domain experts with experience of micro-lending in rural markets. The different components of the DPF lifecycle, including designing the product basket, screening loan applications, defining deferred payment tenures, delivering products, monitoring collection of payments, and managing delinquency for late or non-payment – all were deliberated in collaboration with these experts.

3.2.2 Management of DLE data

The question of managing DLE specific data was crucial to two parts of the study: one, for the administration of the credit assessment tool in a low-cost yet accurate manner, and two, for monitoring DLE sales activity and aligning it with DPF payment collection timelines. In response to this need, appropriate systems and processes for the collection, storage and management of DLE data had to be set in place.

3.2.3 Stakeholder Consultation

Upon concluding the first round of tool and credit product design, Dharma Life, along with DfID and Shell Foundation conducted a workshop inviting stakeholders from diverse sectors and expertise, in order to validate the preliminary findings and collect feedback on the design and deployment of the credit assessment tool and the Deferred Payment Facility.

4. Designing the tool

4.1 Review of literature on existing credit assessment and entrepreneurial screening tools

In designing this tool, we drew on diverse bodies of literature to scope indicators that predict creditworthiness for entrepreneurs. Our review of existing models on entrepreneurial assessment revealed three broad areas for which screening and credit assessment are largely done. These include:

- ***Psychometric screening.*** This involves the use of questionnaires to measure knowledge, attitudes, abilities and personality traits. Constructs such as self-control, motivation, values, honesty, intelligence, aptitude, personality traits and beliefs etc. pose useful tools in understanding the trustworthiness and creditworthiness of prospective borrowers, and are likely to predict both ability and willingness to repay credit.

- ***"Know your customer" (KYC) data.*** A suitable credit assessment tool would be one that triangulates data across multiple sources and compares them with self-reported data. KYC checks are routinely conducted by institutions and organisations to verify the identity of the candidate being screened, through bank transaction histories, credit card statements and other documentation. However, given that rural consumers provide limited scope to furnish such documentation, alternatives to standard KYC data in the form of mobile usage data, social media and online behaviour can be assessed. This can be integrated with standard checks on legal history and criminal records, credit history, income, expenditure, savings, education, gender, age etc.

- ***Social Referencing.*** Assessment of overall personality and behaviour of the prospective entrepreneurs and customers through the village leaders and other relevant individuals also provides a useful means of assessing social reputation of prospective borrowers.

The below sections detail the scope of existing models for entrepreneurial assessment in the market in these three areas of assessment.

4.1.1 Psychometric screening

It has long been recognized that effective entrepreneurship demands a specific psychological orientation (e.g. Baum & Locke, 2004; Ahmetoglu, Leutner, & Chamorro-Premuzic, 2011). The search for an "entrepreneurial personality" takes two approaches. Most commonly, measures of psychological constructs like motivation, extroversion, conscientiousness, or orientation toward the future are correlated with measures of business success such as earnings. For instance, earnings in adult men ages 36-54 were predicted by measures of their motivation (i.e., orientation toward challenge and sense of personal control) 15-25 years earlier (Dunifon & Duncan, 1998), suggesting that those who were more highly motivated engaged in behaviours that disposed them to more success in business—though notably, in this sample work was not necessarily entrepreneurial. A limited body of work has extended these ideas to the rural Indian context. The sales volume of rural kiosk operators in Assam and Uttar Pradesh was predicted in part by their self-efficacy, achievement motivation, and other psychological attributes (Acharya, Rajan, & Schoar, 2007). We drew on this work, conducted in Indian as well as (more often) Western settings, for a broad initial list of constructs to consider.

A second approach is to train (change) one or more psychological dimensions and observe effects on a measure of business success. In contrast to much of the work above, which tends to be drawn from relatively high-income Western businesses, this approach has been used in low-income rural settings. David McClelland, who did some of the pioneering work on human motivation, developed a program in 1963 in Hyderabad, India to train small businessmen in achievement motivation in hopes of improving their entrepreneurial capacity (McClelland & Winter 1971). Similar work continues: for instance, Frese et al (2016) describe their "action-regulation training approach, focusing on self-regulation and active behaviour in entrepreneurship as a bottom-up solution for poverty reduction" (p. 196). We drew on this work as well in populating our list of constructs to consider.

Perhaps most relevant to the present context, work from the "Entrepreneurial Finance Lab" (EFL) has used personality (i.e., extroversion, agreeableness, conscientiousness), integrity, and intelligence (measured via digit span recall and Ravens Progressive Matrices) to predict credit risk with small business owners in Peru, Kenya, Colombia, and South Africa, most of whom had loans between $800-$3000 (Klinger, Khwaja, & del Caprio, 2013). Interestingly, several of the variables were related in different ways to business profit and loan repayment. For instance, integrity weakly predicted lower profits but higher likelihood of repayment. The combined measures provide useful credit scoring information for banks, which is further improved when models are customized to each country and financial institution. These considerations lead us to expect 1) that psychometric and related variables are a useful starting point, 2) that there is room to go beyond the set of variables Klinger and colleagues utilized in hopes of building an even better credit-scoring model, and 3) that the relatively homogenous business context in the present sample may be a benefit in building this model, although 4) it is worth considering that credit-scoring models may differ by region or gender.

However, as mentioned earlier, it is difficult to build on the work of measures like EFL is that these methods are generally proprietary and so items cannot be adopted directly from them.

To combat this challenge, in our work we have used best available measures. (A second challenge is time; some of these measures are extremely long and it would not be feasible to administer them in the field.) For example, to measure the Big 5 we started by translating the Ten-Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003) which has been widely used (more than 3500 citations) and which is designed specifically for situations where time is limited. The challenges and learnings that followed are discussed in more detail below.

Another relevant consideration that emerged from our validation workshop and initial testing (more details below) was that there is a need to adapt measures to prevent self-presentation biases. Accordingly, we returned to the literature to look for measures that would be less susceptible to such biases. Behavioural measures, in contrast to self-report, seem less prone to self-presentation biases. For instance, decisions in a simple experimental economic game predicted repayment of loans to a Peruvian group lending microfinance program (Karlan D. , 2005). Karlan noted: "I find that individuals identified as "trustworthy" by the Trust game are in fact less likely to default on their loans." We incorporated such measures as we continued developing the framework.

4.1.2 Know-Your-Customer screening

A review of 116 articles on the determinants of salespeople's performance (Churchill, Ford, Hartley, & Walker, 1985) found some variance in performance accounted for by "personal factors," or things that differ between individuals which are not part of their aptitude, skill level, motivation, or job role,

including “such factors as the salesperson’s age, height, sex, weight, race, appearance, education, marital status, number of dependents, club memberships, and other similar characteristics” (p. 109). Moreover, in a study investigating sales of rural kiosk operators in Uttar Pradesh (Acharya, Rajan, & Schoar, 2007), sales were related to age and borrowing experience over and above the relation to psychological characteristics.

4.1.3 Social referencing

One tool for reducing personal credit default is social enforcement, or incentivizing one or more individuals in one’s social network to pressure a borrower to repay. A randomized experimental test found that offering payments to clients whose friends repaid their loans reduced default by 10 percentage points (Gharad, Karlan, & Zinman, 2012). A variant of this approach forms the bedrock of the microfinance movement that has witnessed explosive growth over the last two decades. That model relies on group lending, with peer pressure from other members of the group, almost always from one’s social network, serving the role of enforcement.

While the three areas of assessment highlighted above have been shown in various lines of research to be separately useful for assessing creditworthiness (e.g. Gharad, Karlan, & Zinman, 2012; Klinger, Khwaja, & del Carpio 2013), they have not, till date, been combined in an easy-to-administer, scalable, cost-effective tool that is appropriate for use with diverse participants (e.g., illiterate respondents). Our tool was therefore prototyped drawing from the three core areas identified above: psychometric screening, alternative KYC screening, and social referencing.

It was decided that the best approach to develop a low-cost and high-accuracy tool would be to test the tool across different entrepreneur populations within the Dharma Life network and evolve the tool through the insights that emerge in these trials. In line with this objective, our first prototype of the credit assessment tool was tested in the existing Dharma Life Entrepreneur network. The learnings from these field trials are detailed below.

4.2 Initial field testing of the credit assessment tool

Drawing from the findings of our review of existing credit assessment models, the first prototype of the credit assessment tool was developed. The resulting tool was multidimensional, aimed at assessing entrepreneurial potential and creditworthiness through the indicators mentioned below:

4.2.1 Psychometric constructs

The following psychometric constructs were prospected for their ability to predict credit behaviour and entrepreneurial outcomes:

1. Self-control
2. Big 5 Trait - Extraversion
3. Big 5 Trait - Conscientiousness
4. Big 5 Trait - Openness to experience
5. Big 5 Trait - Agreeableness
6. Big 5 Trait - Neuroticism
7. Risk aversion
8. Consideration of future consequences
9. Implicit theories - ability mindset

10. Implicit theories - personality mindset
11. Materialism - Success
12. Materialism - Centrality
13. Materialism - Happiness
14. Passion for work
15. Resilience
16. Core self-evaluation - Self efficacy
17. Core self-evaluation - Self esteem
18. Core self-evaluation - Locus of control
19. Motivation (autonomy, control and impersonal)
20. Primary Motivator to become a village-level entrepreneur
21. Propensity to plan for money- Short Run
22. Propensity to plan for time- Short Run
23. Emotions regarding finance (guilt/shame)
24. Aspiration levels (Wealth)
25. Aspiration levels (Image)
26. Aspiration levels (Community)
27. Optimism
28. Social values orientation (prosocial, individualistic, competitive)
29. Intelligence/mental ability
30. META – Opportunism
31. META – Creativity
32. META – Vision
33. META – Proactivity
34. Time discounting
35. Tightwad/Spendthrift (Spending behaviour)

4.2.2 Alternative KYC Data

The following KYC variables were prospected for their ability to predict credit behaviour and entrepreneurial outcomes:

1. General information: Name, age, gender, education, family size, number of children etc.
2. Mobile usage: Call duration, average number of contacts, average number of outgoing calls, monthly mobile bill amount etc.
3. Banking and savings behaviour: Ownership of bank account, average balance in account, annual savings etc.
4. Litigation history and criminal record: Court cases against the respondent, court cases filed by the respondent etc.
5. Online behaviour: Access to internet, monthly internet bill, use of internet on phone versus mobile, use of social networks etc.
6. Aspirations: Job aspirations for son/brother and for daughter/sister
7. Reading behaviour: Inclination towards reading newspapers, magazines etc.
8. Availability of Identity and address proofs
9. Credit history/debt load: No. of loans availed, loan amount, repayment status, loan purpose etc.
10. Expenditure: Monthly household expenditure on food, health, energy
11. Income: Monthly household income, primary and secondary sources of income etc.

12. Owned assets: Land and asset ownership

4.2.3 Learnings from the Field Trials

Based on the variables identified, the prospective Detailed Assessment question was formulated for field testing. This questionnaire was tested among 303 DLEs in Bihar, Gujarat, Madhya Pradesh, Maharashtra, Uttar Pradesh, and Rajasthan. Following data collection, Dharma Life partnered with Oliver Wyman, a management consulting firm with experience in financial services and risk management, to assess the predictive power of the variables being tested.

The core part of the analysis tested the predictive power of the variables vis-à-vis the desired outcomes. The desired outcomes that variables were tested against were linked to both sales performance data of the entrepreneurs (indicative of *entrepreneurial potential*), as well as self-reported data on incidences of credit default (indicative of *creditworthiness*).

Entrepreneurial Potential was measured using the following metrics:

1. *Sales Value:* Total sales value in the last 12 months
2. *Sales Volume:* Total sales volume in the last 12 months
3. *Activity Rate:* Number of quarters in which the Entrepreneur registered a sale in the last 18 months
4. *Product Mix:* Number of product categories that the Entrepreneur registered sales in, since the start of the Entrepreneur's relationship with Dharma Life
5. *Service Activity Revenue:* Whether the Entrepreneur earned any service related income

To test the predictive power of input variables in predicting default (as measured through self-reported data on incidences of default), Accuracy Ratio, a statistical measure of rank order performance, was used.[3] An accuracy ratio of 20-35 percent generally suggests that the individual variable in question is a good predictor of default, whereas one below 10 percent suggests that the individual variable in question is a poor predictor of default. Correlation was used to determine linkages between the variables and entrepreneurial potential. For this analysis, variables showing correlation coefficient greater than 0.6 and less than -0.6 indicated high correlation, whereas those showing correlation coefficient less than 0.6 and greater than -0.6 indicated low correlation.

The following insights emerged from the analysis of entrepreneur data collected for the psychometric and KYC variables.

Psychometric constructs appear to be good predictors of creditworthiness, with a total of 26 of the 35 constructs having an Accuracy Ratio greater than 20% across at least one of the questions within the construct. The following 26 psychometric variables demonstrated discernible relations with propensity to default:

[3] A metric commonly used to determine the discriminatory power of credit scoring models, the Accuracy Ratio measures the ratio of the performance improvement of the model being tested (in this case, the default probabilities predicted by the credit assessment tool) over the random model (i.e. a model that assigns default probabilities randomly) to the performance improvement of the perfect model (i.e. one that accurately predicts default) over the random model. Here, Accuracy Ratio is being measured as a percentage.

1. Aspiration levels (Community)
2. Aspiration levels (Image)
3. Aspiration levels (Wealth)
4. Big 5 Trait - Conscientiousness
5. Big 5 Trait - Openness to experience
6. Consideration of future consequences
7. Core self-evaluation- Self esteem
8. Emotions regarding finance (guilt/shame)
9. Intelligence
10. Implicit theories- ability mindset
11. Implicit theories- personality mindset
12. Materialism - Centrality
13. Materialism - Happiness
14. Materialism - Success
15. META- Creativity
16. META- Opportunism
17. META- Proactivity
18. META- Vision
19. Motivation (autonomy, control and impersonal)
20. Primary Motivator to become a village-level entrepreneur
21. Propensity to plan for money- Short Run
22. Propensity to plan for time- Short Run
23. Risk aversion
24. Resilience
25. Self-control
26. Time discounting

Psychometric constructs also appear to be correlated to sales performance, albeit not as strong as creditworthiness. The following nine psychometric variables demonstrated relations with sales performance data consolidated across all three sales channels (viz. Direct Trade Channel, MFI Partnership Channel and the Federation Partnership Channel):

1. Aspiration levels (Image)
2. Aspiration levels (Wealth)
3. Consideration of future consequences
4. Implicit theories- personality mindset
5. Materialism - Success
6. META - Proactivity
7. Propensity to plan for money- Short Run
8. Propensity to plan for time- Short Run
9. Self-control

Some variables which did not demonstrate high correlations on a consolidated basis (i.e. when considering all three channels Direct Trade Channel, MFI Partnership Channel and Federation Partnership Channel together) are correlated when looked in isolation for the Direct Trade model only. The following four variables demonstrated relations with sales performance while looking at data from the Direct Trade channel in isolation:

1. Intelligence
2. Materialism - Centrality
3. Resilience
4. Self-control

KYC Parameters appear to be good predictors of creditworthiness as well as sales performance, though the relationship is limited to a total of only 26 of the total 86 individual KYC Parameters. Thus, there is substantial scope for removing redundant and irrelevant parameters. The following 18 KYC parameters demonstrated relations with default rate:

1. Family Size
2. Children
3. School going children
4. Number of Mobile Phones
5. Time when phone is used more - Morning
6. Access to internet
7. Platform for using internet - Phone
8. Social Networking awareness - WhatsApp
9. Usage of social network - WhatsApp
10. Social Networking Site - Usage
11. Number of travels to neighbouring town/month
12. Amount to be spent on next mobile
13. Aspirational job for daughter/sister
14. Reading
15. Read newspaper
16. Read magazines
17. Frequency of loan application
18. Primary Source of income

Fewer KYC variables revealed correlations with sales performance outcomes, when this data was consolidated across the three sales channels. The following two KYC parameters demonstrated relations with sales performance outcomes consolidated across all three sales channels:

1. Average electricity bill
2. Average household food expenditure

Like psychometric indicators, KYC parameters display correlations when sales performance outcomes are filtered to assess the Direct Trade Channel in isolation. The following 10 KYC parameters demonstrated relations with sales performance while looking at data from the Direct Trade channel in isolation:

1. Education
2. Gender
3. Access to internet
4. Time spent on internet/month (hours)
5. Platform for using internet -Phone
6. Social Networking awareness - WhatsApp

7. Social Networking awareness - YouTube
8. Lack of awareness of social networks
9. Usage of social network – WhatsApp
10. Driving License

4.2.4 Other Learnings from the field trials

Additionally, the field testing of the credit assessment tool also produced the following takeaways:

There is a need to customise the assessment content to the rural context. The literature review suggested various psychometric measures which had been tested and administered in a relatively more urban context and often in developed countries. For instance, some of the scenario based scales such as the "Self-determination and motivation scales" include scenarios with references to concepts such as "parents' night at school", which is not a common practice in rural India or "evening parties with friends", which is not gender neutral from a rural standpoint.

Potential means through which psychometric variables can be *gamed* need to be addressed through the use of indirect measures, proxy variables, reverse-coded questions and bipolar scales. Social desirability biases in behavioural assessment surveys could be a more common occurrence in rural India owing to strong social structures and integrated community living practices resulting in higher image consciousness – leading surveyed individuals to '*game'* their responses to paint a favourable picture of themselves or misrepresent their character traits. A second challenge is that with low-literacy respondents, questions are asked face-to-face, perhaps in relatively public settings. Thus, the pressure to present oneself in a favorable light is very strong, and seems to further contribute to problematic distributions of responses. Many measures require rural respondents to rate their own behaviour through questions that invite 'socially desirable responses' such as questions in the Big 5 inventory which asks respondents to rate statements like "I see myself as dependable" or "I see myself as open to new experiences". High mean and low variance in responses to such questions reduce their ability to accurately predict behaviour. Such measures can be replaced with longer measures, which test consistency of response on a specific trait through multiple questions, or they can be replaced by bipolar scales which prompt respondents to balance two opposite attributes determining the relative proportion of these opposite attributes. Reverse coded questions should also be considered instead of more direct and/or 'positively phrased' questions.

The questionnaires should be tailored to suit the general educational background of the prospective rural consumers and entrepreneurs: Many of the existing measures to test cognitive biases and IQ require respondents to have more than basic literacy and numeracy skills. Alternatives such as non-verbal and/or pictorial tests would serve better in rural settings where average education levels are generally low.

Visual depiction of response scale is more effective in rural areas compared to text based scales. "Animated face scales" trigger more attention, increase response rate and are easier to understanding compared to text based self- report scales. They specially work well in rural settings where text based scales could add to survey time owing to lower educational levels and corresponding comprehension capabilities of respondents.

4.3 Post-trial Tool Refinement

Drawing from the findings from the initial field testing of the credit assessment questionnaire, the revised credit assessment tool incorporated the following changes:

The credit assessment tool was modified to include the most relevant and predictively powerful psychometric and KYC variables. The following psychometric variables were retained in the revised tool:

1. Self-control
2. Big 5 Trait - Extraversion
3. Big 5 Trait - Conscientiousness
4. Big 5 Trait - Openness to experience
5. Big 5 Trait - Agreeableness
6. Big 5 Trait - Neuroticism
7. Risk aversion
8. Materialism - Success
9. Materialism - Centrality
10. Materialism - Happiness
11. Aspiration levels (Wealth)
12. Aspiration levels (Community)
13. Aspiration levels (Image)
14. Consideration for future consequences
15. Implicit theories - ability mindset
16. Implicit theories - personality mindset
17. Tightwad/spendthrift
18. Resilience
19. Core self-evaluation - Self esteem
20. Core self-evaluation - Locus of control
21. Motivation (autonomy, control and impersonal)
22. Propensity to plan for money- Short Run
23. Emotions regarding finance (guilt/shame)
24. Optimism
25. Social values orientation (prosocial, individualistic, competitive)
26. Intelligence
27. Time discounting

The following KYC parameters were retained in the revised tool:

1. Basic details: Marital status, Age, Gender
2. Family size: Total Members in Family, Number of Earning Members, Number of Dependents etc.
3. Level of educational attainment
4. Ability to read and write
5. Years of work experience
6. Annual Income: Primary and Secondary Incomes, Income Source, Basic Income (i.e. Income from Primary Source), Income from Secondary Source, Annual Personal Income, Annual Household Income,
7. Monthly and annual household expenditure

8. Time spent on primary occupation (in a day)
9. Number of people known among family and friend circles who have their own business
10. Possession of electricity connection, hours of electricity
11. Possession of cable connection, Possession of smartphone, Possession of vehicles, Possession of television
12. Knowledge on operating computer/laptop
13. Access to water for irrigation
14. Possession of address proofs
15. Possession of bank account
16. Last transaction in the bank account
17. Service skills: Hours that can be devoted to Dharma Life work in a day, Ideas for awareness and marketing activities, Perception of importance of reliable after sales service, Perceived challenges due to absence of after sales service, Favourable self-perception of subject's personal networks in village, Reported number of people who can be gathered at a single marketing activity, Preferred targeted consumer segment, Reported key opinion leaders in the village who can be gathered for the awareness activity, Amount willing to invest to start business of selling products, Ideas for raising money needed for investment
18. Time needed to arrange for capital
19. People among family/friends who will be able to help financially
20. Reported capacity to attend trainings
21. Number of school going children
22. Frequency of travel to the nearest town in a month
23. Current employment status
24. Years spent in current employment
25. Average monthly electricity bill amount
26. Number of family members dependent on agriculture and allied activities
27. Number of family members employed as daily wage earners
28. Membership with MFI
29. Time elapsed since first loan (in months)
30. Number of loans taken till date
31. Number of loans outstanding as of today
32. Details of outstanding loan: Principle loan amount outstanding as of today, Period of loan tenure that is remaining (in months), Method of repayment, Purpose of taking loan, Total interest expenditure since loan was taken, Distance of bank/MFI branch from place of residence
33. Number of changes of mobile phone number in the past three years
34. Number of mobile phones within the family
35. Mobile Usage: Possession of post-paid or pre-paid mobile connection, Average duration of calls (in minutes), Number of outgoing calls made in a day, Number of calls received in a day, Time of day when phone is used the most, Average monthly mobile bill amount, Number of contacts in mobile phone
36. Possession of post office savings account
37. Average account balance in a year
38. Proportion of income that is deposited in a year
39. Incidence of subject filing a case against anyone
40. Incidence of someone else filing case against subject
41. Access to internet
42. Time spent on the internet on an average per month

43. Use of the internet on phone
44. Use of the internet on desktop
45. Use of the internet on laptop
46. Social media usage: Awareness of Facebook, Awareness of WhatsApp, Awareness of YouTube, Use of Facebook, Use of WhatsApp, Use of YouTube
47. Planned amount to be spent on the next mobile phone purchase
48. Job aspiration for son/brother (male members of employable age)
49. Job aspiration for daughter/sister (female members of employable age)
50. Reading habits: Presence of habit of reading the newspaper, Presence of habit of reading magazines, Presence of habit of reading novels
51. Ownership of land holdings
52. Size of owned land holdings
53. Change in owned land holdings over past three years
54. Ownership of the house of residence
55. Primary mode of conveyance
56. Type of dwelling

Sales scenarios were added as an additional measure of behavioural assessment. Part of the problem with gauging psychometric traits using the available measures was that they tended to present situations and scenarios that were alien to the context of rural individuals in India. Sales scenarios developed by organisations to assess sales orientation of individuals come from a corporate sector focus, and were accordingly found to have references to "complex service pitches" or "communication tools like power point presentations", which many potential rural entrepreneurs would be unfamiliar with. Given these challenges of context as well as that of socially-desirable responding (discussed earlier), we introduced scenario-based measures that were more apropos to the rural context and pertaining to the problems rural entrepreneurs would potentially face. For example, the following presents a sales scenario tailored for administration in this study:

> *Your customer is using a product similar to yours, but one bought from another entrepreneur from a different region of India. You are trying to change his mind and convince him to switch to your product, although he is happy with the one he uses now. What would be the worst response to this?*

1. *You try to analyse both products by listing their major pros and cons thus giving an accurate and honest picture to your customer, or*
2. *You focus on additional benefits of your product that competitor does not have and try to demonstrate how much better off he would be using yours, or*
3. *You play on his local sentiments/patriotism and sense of pride and tell him he should support only local merchants, or*
4. *You offer him a 10% discount on this purchase if he decides to buy your product right now*

Such scenario-based measures are not only more appropriate to the rural entrepreneurial context, because it is not clear what the "right" or "desirable" response, respondents are less able to engage in selective presentation. Thus, such measures may prove useful in better distinguishing between applicants. This method has been successfully used in recruitment contexts (e.g. Aspiring Minds).

Questions to measure 'Overclaiming' of knowledge were also incorporated. The 'Overclaiming' measure detects and quantifies respondents' inclinations towards faking knowledge of certain issues and topics (Paulhus & Harms, 2004). This method asks respondents to rate their familiarity with a list of items (i.e. places, books, politicians etc.) This list is composed of items that genuinely are representative of their category, but is also composed of *foils* – items that are made to seem like they represent their category, but, in fact, do not exist. Overclaiming can therefore be measured as a proportion of valid familiarity claims relative to invalid familiarity claims. In this study, we chose to present respondents a list of names that were supposedly names of Indian political parties, and they were asked to respond as to which political parties they knew of. Therefore, overclaiming on foils can be used as a suppressor variable that potentially impacts one's scoring of entrepreneurial potential and creditworthiness.

The Raven Test and Digit Span Test were added as measures of intelligence. Given the possibility of respondents possessing limited literacy and numeracy skills, the credit assessment tool incorporated the Raven Test and Digit Span test as measures of intelligence.

4.4 Experiment Design for the Studies

Our experiments with testing and implementing the tool will be carried out in a study carried out in two phases.

The first phase of the study will involve administering the tool among 400 Dharma Life Entrepreneurs. DLEs will be selected per the basic criteria typically applied by the field team at Dharma Life. Dharma Life's basic screening comprises checks set in place to verify basic details such as the address and income sources of candidates, while also testing for willingness to conduct sales operations.[4] Two groups shall emerge from this pool of 400 DLEs: 200 DLEs will be randomly selected to avail the DPF, whereas the remaining 200 DLEs will be randomly assigned as the 'control group', i.e. the group that does not receive the DPF. Following this, all 400 DLEs will be onboarded and shall receive the necessary Entrepreneur Development Training before embarking on their sales operations. Shortly following the entrepreneur trainings, we will administer the credit assessment tool across the 400 DLEs, capturing relevant credit assessment indicators as well as a few data points regarding the baseline indicators of the DLEs prior to their induction as Dharma Life Entrepreneurs.

Within a month of DLE onboarding, the processes for credit disbursement will be initiated and the 200 DLEs shall receive the product baskets to initiate sales operations. Borrowers will be given a product basket comprising a variety of social impact goods, including solar lights, induction cooktops, water purifiers, sanitation napkins etc. as a *Deferred Payment Facility* (DPF). The DPF enables entrepreneurs to pay the price of the product basket in equal monthly instalments using the revenue generated from the sale of the products. At the conclusion of the first study, DLE outcomes across both the credit-receiving and control groups will be measured and mapped against the input variables captured in the credit assessment tool, to probe associations and determine a methodology for credit scoring of entrepreneurs. The results of this study will guide the hypothesis development of the subsequent study: based on the findings on associations between input variables and credit and entrepreneurial

[4] It bears repeating that the criteria for selection of DLEs to participate in our study will be only composed of the *basic* minimum qualifications. Care will be taken to not incorporate selection across any variables that are directly or indirectly being mapped in our credit assessment tool, lest we end up with a sample of study participants who over-represent a certain demographic or psychographic category and affect the results of our study.

performance, we will generate a minimum credit 'score' that distinguishes good borrowers from bad borrowers. Whether this score determines credit performance of DLEs will be the hypothesis to test in the second study. It should be noted that when we discuss DLE *outcomes* to map in the credit assessment tool, we not only refer to credit-relevant outcomes such as instalment repayments and incidences of late payment/default, but also entrepreneurial outcomes such as sales volumes and profits, and measures of human and community development such as perceived status of women, expenditures on health, education and others.

The second phase of the study will involve a larger-scale trial where the credit assessment tool will be tested by disbursing the financing product to a much larger pool of applicants. The proposed design for this study is to take a sufficiently large sample of entrepreneur candidates, to the rank of 2,500 individuals. After screening these candidates using Dharma Life's routine screening criteria, 825 candidates are selected to be fit to work as Dharma Life Entrepreneurs. Among the 825 candidates, 750 candidates are randomly selected to receive the routine trainings and be onboarded as entrepreneurs, while the remaining 75 are maintained as a small control group that are randomly assigned to not be taken on as DLEs at this time. Out of the 750 entrepreneurs, 375 will be randomly selected to avail the financing product, while the remaining 375 will engage with Dharma Life as unfinanced entrepreneurs. After 18 months, business outcomes, credit outcomes, and psychometric and social outcomes will be captured for all three groups. It is expected that the associations between the input variables captured in the tool and the output variables at the end of the 18 months will identify the most powerful metrics that can guide entrepreneur selection and credit screening, whether entrepreneurship can change psychology, and how access to credit drives outcomes.

4.5 Which stakeholders can benefit from this tool?

Given the public nature of our work, we invite diverse stakeholders to utilise this tool in effectively deploying micro-lending in rural markets. Financial institutions such as Microfinance Institutions and Non-governmental organisations would benefit from this alternative methodology for credit assessment, for its demonstrated relevance and predictive potential to determine creditworthiness and resolve common information asymmetries. Additionally, we are hopeful that the findings from this study can help organisations that support and incubate microenterprises, and can facilitate lending to microentrepreneurs.

5. Business processes for the study

5.1 Designing the Deferred Payment Facility

Product. The financing product in the first phase of the study will comprise products worth up to INR 10,000, and the second cycle onwards, will comprise products worth up to INR 20,000. The payment tenure for the INR 10,000-worth basket is 5 months and that for the INR 20,000-worth basket is 6 months. If a DLE is able to place a cash order for stock between INR 5,000 and INR 10,000 once in 5 months, s/he will be eligible to apply for another INR 10,000 DPF, conditional on timely repayment of DPF instalments. If a DLE is able to place a cash order of stock of above INR 10,000 in 5 months, s/he will be eligible to apply for INR 20,000 DPF, conditional on timely repayment of DPF instalments.

Population. The population eligible for the DPF should be residents of the village they cater to, and should possess KYC documents that provide proof of identity and proof of address. They should have bank account – or alternatively, will be made to open a bank account for tracking sales, income and

repayment. Eligible participants should have an existing source of regular income in the family, whether salaried or self-employed, and should exhibit capacity to repay as per the agreed deferred payment schedule, while having no past record of credit default. The monthly instalment should not exceed 50% of disposable income (income after accounting for expenses including existing financial/loan liabilities). The total indebtedness of the DLE should not exceed INR 60,000 in the first loan cycle and INR 1,00,000 in the second loan cycle. There will be three reference checks (from the neighbour, local shopkeeper and village *sarpanch*[5]) on the residential status, socio-economic status/reputation of the DPF applicant and her/his family.

Price. A 5 percent service fee to cover operational costs, internal costs and default costs will be levied on the DLEs who are issued products through the DPF facility. This service fee will be integrated into the prices at which products are sold to the DLEs under the DPF. DLEs who purchase products without the DPF will not be charged this service fee. Additionally, the service fee is only applicable as a one-time charge to be paid on the initial bundle of products purchased through the DPF: if a DLE repays her/his DPF instalment within the month and reorders products, then s/he will not be required to pay the service fee on the repayments.

Positioning. The benefits of the DPF will be explicated as follows:

- **Longer term:** That Dharma Life is the first company to offer a DPF over a longer term will be emphasised.
- **Prospects for higher credit limit:** That there is scope to upgrade one's credit limit to INR 20,000 in the future will also be highlighted.
- **Focus on social impact products:** That this product basket is in line with the larger goal of Dharma Life to promote social impact goods that would improve health through access to water purification units, clean energy products like solar lights and clean cooking solutions, and sanitary products like sanitary napkins, in the rural areas will be highlighted. The role of the DLE in fulfilling this goal will also be emphasised.
- **Scope for income growth:** That this offers good prospects for income growth of the entrepreneurs will also be promoted.

Promotion. The DPF will be promoted through one-on-one communication with DLEs. Additional textual material highlighting the DPF terms and conditions and its benefits to the entrepreneur will also be circulated.

Place. The DPF will be deployed in villages with DLE network, across Rajasthan and Uttar Pradesh.

Process. The following steps describe the process of DPF deployment:

1. Randomised selection of entrepreneurs
2. Market assessment and baseline in villages where DLEs are selected
3. Sensitization of entrepreneurs towards Dharma Life and social impact products (solar light, induction cookstove, water purifier)
4. Application for procuring social impact products on deferred payment facilities
5. Collection of e-KYC documents

[5] The *sarpanch* is the elected head of the statutory village government body known as the Panchayat.

6. Appraisal
7. Approval
8. Execution of agreements for getting products on deferred payment condition
9. Delivery of social impact products
10. Collection of deferred payment instalment
11. Monitoring of collection
12. Pre-closure of credit facility
13. Delinquency management for late or no/overdue deferred payment instalments

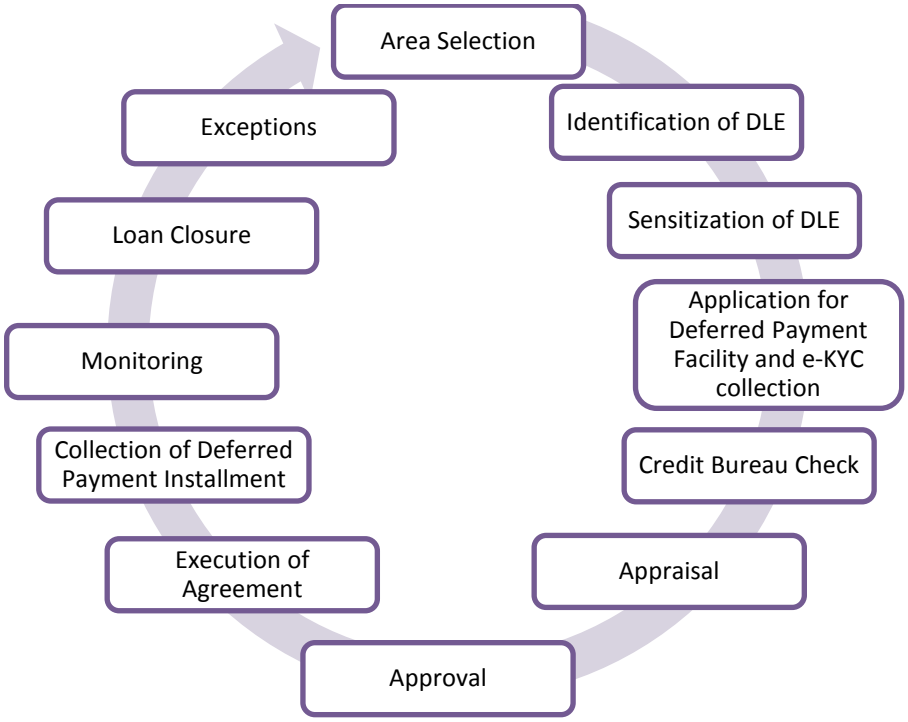

Figure 1: Life Cycle of DPF

5.2 Role of technology

This study will employ technology for administering the credit assessment tool as well as for real-time data collection on sales and marketing activities. This will be aided by the *dltrac* platform. dltrac is a social marketing platform developed by Dharma Life to enable real-time planning and implementation of field-level campaigns and sales in rural areas. Through the use of this platform, DLE data regarding sales values, sales volumes, marketing outreach, lead generation etc. will be collected on a real-time basis. This will aid the process of collection of deferred payment instalments and ensure effective planning and utilisation of DPF funds. f

DLE-specific data captured from the credit assessment tool will also be stored in this platform, from which we will produce the analytics important to testing our hypotheses. Interactive material, simulations and audio-visual content can be administered effectively through digital surveys. Many psychometric tests such as implicit association tests, trust games, risk games etc. can be uploaded on

digital applications. Digitalisation of the tool also considerably reduces data collection time and reduces dependence on manpower for data collation, making it easier to test the tool at scale.

This study will also explore the potential for collection of deferred payment instalments using e-commerce platforms. Data on DLE repayments can be integrated into the dltrac platform to store information on sales and credit repayments in a centralised manner.

5.3 Stakeholders to be engaged

Product partners have been engaged to provide the necessary lending capital to be provided to DLEs as part of the DPF.

Tata Trusts has been leading efforts in the clean cooking sector in India, with initiatives such as The Clean Cooking Initiative, which focused on promoting clean cooking technologies by building financial options for their purchase in Gujarat and Rajasthan. They will be providing the necessary lending capital for providing induction cooktops as part of the DPF product basket.

The DOEN Foundation (Stichting DOEN) through its Sustainable Energy Programme, has promoted low-threshold access to solar energy across countries in East Africa and South-East Asia, through the provision of low-cost solar lighting and microgrid solutions. As part of the same programme, they will be providing the necessary lending capital for providing solar lights as part of the DPF product basket.

Unilever Foundation, in partnership with Population Services International (PSI) has been working towards making safe drinking water available through its low-cost home water purifying solutions. They will be extending lending capital in the form of water purifiers as part of the DPF product basket.

5.4 Learnings from the Stakeholder Consultation

Our tool and research design received significant affirmation in the validation workshop conducted to elicit inputs from different stakeholders and industry players. The validation workshop provided inputs most useful for DPF deployment.

On the matter of defining the payment term for the DPF, Mr. Chandan Bhavnani, Vice President of YES Bank suggested that the five-month tenure proposed by us was excessive, for it posed the risk of the product depreciation in the five-month period. In the event of a DLE not being able to sell a certain product, the products that were collected back may not be fit for further reselling owing to the products undergoing substantial wear and tear and even damages due to mishandling on the part of the entrepreneurs and customers. The practical implications of a five-month DPF tenure will be tested in the first study which will be undertaken in Uttar Pradesh and Rajasthan.

6. Way forward

6.1 Study initiation

The first phase of the study will be initiated in the state of Uttar Pradesh and Rajasthan. Candidates will be selected to participate in the study as per the routine guidelines and criteria applied by Dharma Life's DLE recruitment team. Following this, credit assessment and DPF deployment shall be initiated simultaneously. Entrepreneur outcomes shall be tracked through the course of the study to ensure

effective utilisation of DPF resources as well as to monitor changes in markets and resulting business viabilities.

6.2 Preparations for the second phase of the study

In parallel to the execution of the first study, fundraising shall be initiated in order to generate capital support for the second phase of the study.

6.3 Reporting

Following the completion of the study, the data on the credit assessment variables will be analysed to determine which variables display strongest associations with entrepreneurial and credit performance. Our findings will enable us to model a credit assessment tool that incorporates the most relevant indicators. A plan for scale-up and commercialisation of the credit screening methodology so developed will be formulated.

7. Works Cited

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman

Banerjee, A., Karlan, D., & Zinman, J. (2015). Six randomized evaluations of microcredit: Introduction and further steps. *American Economic Journal: Applied Economics*, *7*(1), 1-21.

Bruce, N.L., Rehfuess, E., Mehta, S., Hutton, G., Smith, K., 2006. Indoor air pollution. In: D.T. Jamison et al. (Eds.), *Disease Control Priorities in Developing Countries*, 2nd ed., Washington, DC, World Bank, New York, Oxford University Press.

Dupas, P. 2009. What matters (and what does not) in households' decision to invest in malaria prevention? *American Economic Review, 99(2),* 224-230.

Ray, D. 2006. Aspirations, poverty and economic change. In Abhijit V. Banerjee, Roland Bénabou, and Dilip Mookherjee, eds.: *Understanding Poverty* 409–421. New York: Oxford University Press.

World Energy Outlook. 2014. International Energy Agency/Organisation for Economic Co-operation and Development. Worldenergyoutlook.org.

Yardley, J. (March 18, 2010). For India's newly rich farmers, limos won't do. *The New York Times.* Retrieved from http://www.nytimes.com/2010/03/19/world/asia/19india.html?_r=1 on January 1, 2016.

Acharya, V., Rajan, A., & Schoar, A. (2007, November). Retrieved from IFMR Lead: http://www.ifmrlead.org/wp-content/uploads/2015/OWC/determines-entrepreneurial-success-A-psychometric-study-of-rural-entrepreneurs.pdf

Ahmetoglu, G., Leutner, F., & Chamorro-Premuzic, T. (2011). EQ-nomics: Understanding the relationship between individual differences in Trait Emotional Intelligence and Entrepreneurship. *Personality and Individual Differences, 51*, 1028-2033.

Baum, R. J., & Locke, E. A. (2004). The Relationship of Entrepreneurial Traits, Skill, and Motivation to Subsequent Venture Growth. *Journal of Applied Psychology, 89*(4), 587-598.

Churchill, G. A., Ford, N. M., Hartley, S. W., & Walker, O. C. (1985). The Determinants of Salesperson Performance: A Meta-Analysis. *Journal of Marketing Research, 22*(2), 103-118.

Dunifon, R., & Duncan, G. J. (1998). Long-Run Effects of Motivation on Labor-Market Success. *Social Psychology Quarterly, 61*(1), 33-48.

Frese, M., Gielnik, M. M., & Mensmann, M. (2016). Psychological Training for Entrepreneurs to Take Action: Contributing to Poverty Reduction in Developing Countries. *Current Directions in Psychological Science, 25*(3), 196-202.

Gharad, B., Karlan, D., & Zinman, J. (2012). *You can pick your friends, but you need to watch them: Loan screening and enforcement in a referrals field experiment, Discussion Paper, No. 1009.* Yale University, Department of Economics. Economic Growth Centre.

Gosling, S. D., Rentfrow, P. J., & Swann, W. B. (2003). A Very Brief Measure of the Big Five Personality Domains. *Journal of Research in Personality, 37*, 504-528.

Karlan, D. (2005). *Using Experimental Economics to Measure Social Capital and Predict Financial Decisions, Centre Discussion Paper, No. 909.* Yale University and Princeton University, Economic Growth Centre (EGC). Yale University.

Karlan, D. S., Zinman, J., & Bryan, G. (2012, January 29). You Can Pick Your Friends, But You Need to Watch Them: Loan Screening And Enforcement in a Referrals Field Experiment. *BREAD Working Paper*. (B. f. Development, Compiler) Durham, North Carolina, USA.

Klinger, B., Khwaja, A. I., & del Caprio, C. (2013). *Enterprising Pyschometrics and Poverty Reduction.* Springer.

Paulhus, D. L., & Harms, P. D. (2004). Measuring cognitive ability with the overclaiming technique. *Intelligence, 32*, 297-314.

World Health Organisation and UNICEF Joint Monitoring Programme for Water Supply and Sanitation. (2000). *Global Water Supply and Sanitation Assessment 2000 Report.* New York: World Health Organization and the United Nations Children's Fund.