Stakeholder Analysis of IT Applications for Microfinance

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ABSTRACT

Microfinance Institutions (MFI) currently service over 130 million clients worldwide (World Bank, 2009), while potentially 3 billion people could benefit from the services offered by this sector. This huge base of clients, and the corresponding transactions which they generate, offer a significant potential for MFI operators to utilize Information Technology (IT) based applications in order to reduce costs and expand services. At the same time, a host of factors including inadequate infrastructure, such as the low penetration of computers and limited availability of data communication services in many geographies, and illiteracy and lack of skills, present significant challenges in being able to realize such potential. The present discussion uses a framework of stakeholder analysis, in order to identify specific problems and possible solutions impacting the future of IT applications in the MFI sector.

Stakeholder analysis is a well known technique which is used to design and construct large and complex systems. The present discussion looks at the MFI context which is characterized by multiple stakeholders, with a variety of often divergent goals / requirements at a systems level. Such requirements need to be identified, prioritized and quantified, in order to ensure that they are effectively addressed in the several downstream phases, such as design, development, implementation and ongoing support.

The present discussion examines the key stakeholders in the MFI context and their high level requirements. These requirements, which are typically complex and abstract, are then decomposed into elementary attributes, which are amenable to quantification and measurement. While the discussion addresses multiple stakeholders, the detailed analysis is restricted to MFIs and their clients (borrowers of micro credit). Clients are the most important category of stakeholders in any proposed system and the detailed discussion looks at some of the unique characteristics of this group, challenges they pose to designers of IT applications, and some possible ideas which have the potential to make significant impact in future systems. Specific attributes discussed include accessibility, availability and unique identity.

The usage of computers and Management Information Systems (MIS) in the MFI sector has been growing rapidly, with an estimated 82 % of all MFIs using some form of automation (CGAP, 2009 a) as per recent surveys. However, most of the currently deployed MIS solutions address back office functions and do not engage their clients directly or through intermediaries, using technology based solutions. The present discussion examines a few specific technologies and design ideas which have the potential to improve availability and accessibility of technology based solutions to the client base of MFIs, thereby enhancing the scope of automation in this sector.

INTRODUCTION

One of the major challenges facing the Microfinance sector is to engage its huge client base, now numbering over 130 million worldwide, effectively, using IT applications. Looking at the Indian context, with a user base exceeding 50 million, the challenge is to address the specific problems of poor, illiterate populations, dispersed across geographic areas with poor access to infrastructural services such as electricity, computing platforms and connectivity. Given that transactional frequencies are high, with daily collections in some cases, it is clear that automating certain identified aspects of the transaction processing system, using suitable IT based solutions could deliver significant benefits in terms of cost efficiencies, timeliness of data, and services to clients.

Recent statistics for 2007 (Srinivasan, 2008) indicate that Self Help Group (SHG) clients number around 40 million and MFI clients account for around 14 million in India. At a global level, the latest report of the Consultative Group to Assist the Poor (CGAP, 2009 b), provides estimates for 2004, 2005 and 2007, arrived at by different methods, with 133 million users for 2007. These estimates are not strictly comparable, due to differences in estimation methodology, as also differences in definition. However, it is sufficient for this discussion to note that the number of MFI users globally is already over one hundred million, and growing rapidly.

It has also been reported that as per recent surveys that only 13% of the population with annual income levels of Rs 50,000 or less (US $ 1,000) are availing credit facilities from banks, while 28.3 % of this income segment have bank accounts. This leaves millions "unbanked and unaddressed" as mentioned by Dr Chkarabarty, deputy Governor of India's Reserve Bank, in a recent speech[1].

What kinds of benefits can technology be expected to deliver to MFI stakeholders, and what is the experience of MFIs in adopting technology?

As per a recent survey (May 2009) of 152 MFIs by CGAP (CGAP, 2009 a), an increasing number of MFIs are computerizing their operations, particularly for tracking transactions and loans. Currently, only 18% use manual systems, compared to 46 % who were doing so as per an earlier survey in 2004 conducted by CGAP. The same survey also reports that currently 53 % of respondents use customized software, while 29% use off the shelf commercial software packages. Thus, there is a clear indication that MFIs recognize the need for automation, and are rapidly moving in this direction. It has been reported (www.microfinancereport.com, 2009 a) that smart phones, biometrics and mobile phones are making MFIs more efficient and cost effective. Indeed, it is no exaggeration to say that some technologies like mobile banking have revolutionized the microfinance landscape, empowering hundreds of millions of poor clients with access to banking and financial services, which would have otherwise remained out of their reach (www.microfinancereport.com, 2009 b).

In the following discussion, our view of IT applications is based on the customer as a key stakeholder and user. It is recognized that IT applications currently used by MFIs primarily focus on data processing and back office applications, and do not address the client as a user. There are several good reasons for this state of affairs, some of which are discussed in detail in later sections. However, we believe that going forward, IT applications will have to address the client as user, sooner rather than later, and in the process, also solve a number of problems.

The discussion of requirements creates major challenges for systems designers, and we consider a few promising technologies, which have the potential of playing significant roles in meeting the requirements stakeholders in the MFI sector.

The following sections include a discussion of the background of stakeholder analysis and IT applications in MFIs followed by the main section which addresses some key, system level requirements, their decomposition and representational aspects.

BACKGROUND

Stakeholder Analysis

The term "stakeholder" has been widely used in management literature, and may be traced to Freeman's seminal book, "Strategic Management: A Stakeholder Approach" (1984).Freeman defined stakeholders as any identifiable group of individuals, who can affect the achievement of an organization's objectives, or be affected by the organization's objectives. Some of the key ideas in the stakeholder framework are that the management needs to specifically recognize and cater to the needs of all stakeholders, going beyond the traditional boundaries of investor, customer, vendor and employee. In many contexts, the term is also associated with corporate responsibility, since such a definition of stakeholders is inclusive of the public at large, civil society organizations and the Government.

> Stakeholders include not only financial claimants, but also employees, customers, communities, governmental officials, ("and, under some interpretations, the environment, terrorists, blackmailers, and thieves.") (Jensen, 2000, p. 1)

Stakeholder Analysis has been used in a number of contexts, and has been found to be very useful where multiple stakeholders are involved. It has been argued (Jensen, 2000), that there is a need to maximize the overall *value* across multiple stakeholders. Indeed, Jensen, a professor at the Harvard Business School, raises fundamental questions regarding what one is trying to achieve, and how one can measure impact qualitatively and quantitatively. This highlights the centrality of defining goals, and the ability to measure actual achievement or performance against such goals.

In a paper on "Stakeholder Value Metrics" (Mize and Hallam, MIT), the authors stress the importance of explicitly recognizing stakeholders in a system, defining high level requirements (such as *Customer Satisfaction*), decomposing such complex requirements into lower level requirements (Product / Service Quality; Relationship with Corporation; Cost of ownership; cycle time), and specific metrics (acquisition cost, operating cost, maintenance cost, supply lead time, rejection rate), and finally mapping performance against importance levels, in order to derive overall values.

Another discussion on stakeholder analysis (Berry, Hungate and Temple, IBM, December 2003) looks at User Engineering and User Centered Design (UCD) as specific techniques used in IBM, for the same purpose. UCD, which is a cornerstone of User Engineering, positions user needs as the driving force behind all design activities, explicitly recognizes that setting business goals includes a determination of user needs, evaluates designs based on user feedback, and integrates user needs into overall product plans and product engineering.

The area of decomposition, quantification and representation of multiple stakeholder requirements has been treated in detail (Gilb, 2005) in his book "Competitive Engineering". Gilb has also proposed a structured representational language, called *Planguage***,** developed specially for representing quantified requirements.

Thus we see that stakeholder analysis is a well known and well proven method, applicable to situations involving multiple stakeholders, values and metrics.

The purpose of stakeholder analysis, as applied to IT applications, is that such an analysis will explicitly identify all those who determine the success of such systems, and will also identify and analyze the specific requirements of each such group. Stakeholders' requirements serve as the goals of the system, and are critical in defining what the system must do in order to be considered successful.

Stakeholder analysis, the elicitation of requirements and their quantification are also critical in all the downstream processes involved in systems development, such as design, construction, testing / validation, implementation, operation and ongoing support and maintenance.

Stakeholder analysis will also facilitate the early identification of conflicting requirements. Such conflicts may arise within the requirement set specified by one class of stakeholder, or, more commonly, between requirements of different stakeholders. For example, there may often be a tradeoff between price and performance, and stakeholder analysis helps in early stage identification and resolution of such conflicts.

The overall perspective of this discussion is to use stakeholder analysis in order to discuss some of the main stakeholders and their key requirements. We then look at the problem of decomposing complex and abstract requirements of potential users, such as Accessibility, Affordability and Availability. The goal of such an exercise is to reduce complex requirements to elementary, quantifiable and measurable requirements which can be made operational. Once such goals have been identified, they need to be represented in a structured manner in order to facilitate the level of specification required by architects and designers of IT systems. This is the representational aspect of the problem, and this is also discussed with reference to a specific method called Planguage, which was developed by Tom Gilb.

The following sections will examine some of the key stakeholders in the MFI context, from the perspective of stakeholder analysis. Based on this analysis, we identify some critical problem areas and discuss a few promising technologies for the future, that have the potential to improve the effectiveness and efficiency of MFIs in the future. While the current discussion focuses on the requirements of customers / borrowers as a type of stakeholder, we note that a similar analysis in respect of other types of stakeholders and their requirements is a very useful exercise, in the context of design of IT applications.

Technology in the Microfinance Sector

The need for technology in the MFI sector has been well recognized, and studies also indicate the increasing rate of adoption of these technologies by MFIs.

Any discussion regarding technology and microfinance inevitably includes mobile phones and the variety of services being supported on them. The rapid growth of mobile phone users, coupled with technological advancements which support a growing number of services and solutions on this platform, has led to mobile phones becoming a de facto standard in terms of end user access in a few countries. Of particular importance is the ability to execute transactions on mobile phones, which has been successfully implemented in India and in Indonesia. It has also been reported that the deployment of technologies such as smart phones and biometrics is making MFIs more efficient and cost effective. Biometrics applies biological authentication systems, such as those based on fingerprints, in order to execute secure transactions. Smart cards contain real time financial data, enabling users to interact directly with biometric teller machines (BTMs) and ATMs. ICICI bank in India and Danamon in Indonesia have successfully deployed these technologies, and these initiatives are a clear indication that technology can be effectively used in reaching poor and underserved segments of the population.

However, as we discuss in the following sections, a number of other technologies, such as Interactive Voice Response systems (IVRS), support for Indian languages, text to speech technology (TTS) and WiMax, among others, offer great promise in terms of making IT applications accessible, available and affordable to the target user groups.

STAKEHOLDER ANALYSIS & QUANTIFICATION OF KEY REQUIREMENTS

In the following sections, we identify some of the major stakeholders, and some of their main requirements in the MFI context. The MFI System, as used here, includes all the major stakeholders including MFIs, their Agents, Clients, Investors, Regulators and Employees. As indicated in Figure 1 below, such stakeholders include current and potential borrowers, service providers, investors, agents, regulators and employees.

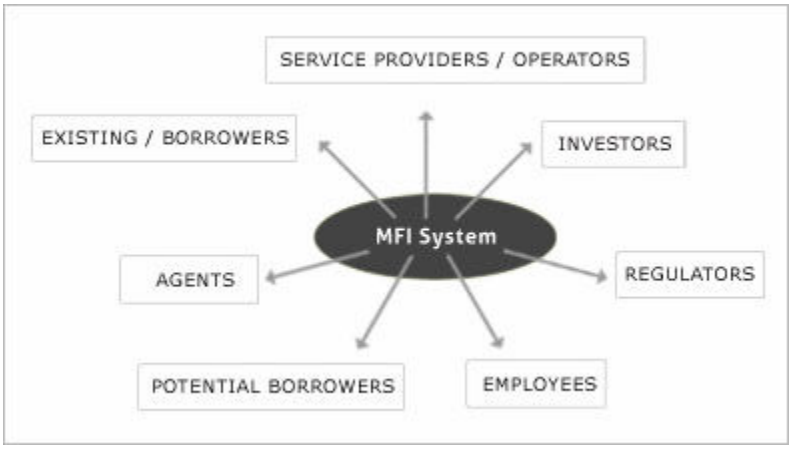

Figure 1: Some Stakeholders in the MFI System

Now, let us consider two types of stakeholder for further analysis, and identify some of their high level requirements. We have considered two types of stakeholders, namely, clients and investors and some of the main requirements of each of these stakeholders are indicated below in Figure 2. These requirements are termed as high level requirements, identified at an abstract level. For example, it appears axiomatic that a given service must be affordable. It is not possible to measure affordability per se, but we may see that affordability is a function of the cost of the service and the income levels of the user group.

Clients / Borrowers: Main Requirements	Investors: Main Requirements
Availability	Availability
Affordability	Scalability
Accessibility	Security

Functionality	Integrity
Usability	Auditability
	Profitability

Table 1: Main requirements for two types of stakeholders

If the usage of technology based solutions were to be a chargeable service, then the criterion we would look for is *Affordability*. Here, one could go on to say that affordability could be defined and measured using some other, proxy, attributes, such as:

a) User fees as a % of the transaction value.
b) User fees as a % of the relationship value
c) User fees as a % of average monthly income of the target segment.

These proxy attributes are easy to define, quantify and measure, and hence may be used instead of the high level requirement, namely, affordability. In the process of deriving elementary attributes from affordability, we have also defined the requirement in precise, numerical terms, necessary for very many other related processes.

Scalability

As mentioned earlier, over 50 million households in India already benefit from microfinance. In the global context, it is estimated that over 130 million households are clients of the MFIs. These large numbers highlight the issues related to *Scalability* and *Performance*. Software system scalability is an important requirement in a context where the user base is large and growing rapidly. It is important that the system should have adequate capability to handle high traffic levels without adversely affecting the user experience. It may also be noted that this requirement is of critical importance to Service Providers, even though it is also of interest to investors and clients.

Availability

This is another key requirement from the user's perspective. It is evident that in order for a system to be effectively used, it must be available for the intended user. Thus, if one considers ATMs, it is easy to see that only if they are *easily available*, that they are likely to be used. Let us now consider how we may quantify this requirement, and express it in clear, measurable terms. Here are a couple of possibilities:

Availability: A function of the distance the user needs to travel in order to access the service.
: A function of the time taken (transport time + queuing time)
: A function of the cost incurred.

If we apply these criteria, to, say, our ATM example, we can see that each of these three measures (time, cost, distance) are likely to have "ceilings", beyond which the user will not find it worthwhile to make use of the service. In similar fashion, we may postulate specific numbers for these *elementary attributes*, and specify that the system availability must be below specified ceiling values.

Next, if we consider the geographic spread of the target population, it turns out that important "catchment areas" lie in rural and semi urban areas. Referring once again to the Indian context, we note that the basic communication and power infrastructure, required for supporting computer based applications, is absent in large parts of the country, much of it in the catchment area for MFIs. Consider for example, that the Internet penetration rate for India as a whole is just 5.2 %, and also the fact that a large proportion of this group is urban dwellers, not in the target population for MFIs. While the internet penetration rate varies across countries, the rates are just 5 % for Africa and 17 % for Asia, with the world averaging 23 %. Since traditional online information systems require basic internet connectivity infrastructure, we may see

that the *Availability* of the IT application, in target geographic areas, is another key requirement. Hence, we note that making IT systems available to the target segment poses immense challenges to systems designers and technologists, given the mismatch between what current technology ecosystems require and the ground reality.

Accessibility

Continuing our analogy of ATMs, given that the service is affordable and available, as defined in detail in earlier sections, there is one more important condition to be met, namely, the intended user should be able to interact with the ATM, and carry out a given set of actions, in order to meet the criterion of *Accessibility.* If we consider the example of visually handicapped persons, then films, for example, are not accessible to this group. Similarly, the set of services which MFIs intend to provide to their customers through technological interventions, must meet the criterion of *Accessibility.*

Let us consider now some relevant statistics from India. A large proportion of target customers lack English language skills, computer literacy and indeed, literacy of any kind. Looking at the indicators for India, of a total population of 1.147 billion, 61 % (55% for women) are literate, 10 % are English speaking and 6 % are computer literate (http://www.nlm.nic.in/lsi.htm). Given that most current IT applications are based on an English language interface, it is clear that such an approach would exclude *90 % of the target country's population***.** Hence, we see that *Accessibility* is a key high level requirement, which needs to be addressed in the design of information systems. While the proportion of literacy varies widely, ranging from 99.8 % for Cuba (ranked No 1) to 25.7 % in Chad (ranked 174), the need to provide access, is a key requirement worldwide. If one considers the female literacy rates and socioeconomic profiles of target users, it is obvious that the accessibility issue assumes even greater importance. Hence, the issue of making information systems accessible to target groups, who currently lack the skills which such systems demand, is another key challenge for systems design. Here again, we may use the approach of decomposing accessibility into some of its elementary attributes, which may be quantified. Thus, we may postulate that:

Accessibility: A function of % of target population, in the target geography, with the ability to perform a defined set of operations, with error rates less than defined rates.

While we shall discuss this particular aspect of quantification in a later section, it may be noted that this approach helps in specifying measurable outcomes, which are in turn derived from the higher level requirements.

In the following sections, we discuss some important requirements of other types of stakeholder, and one of the aspects to be noted that a specific requirement may be, and often is, relevant to multiple stakeholders.

Usability

This is an important attribute to be considered in any discussion regarding the usage of technology based solutions, and refers to *how well* a typical user is able to perform a defined set of functions. It is useful to consider learning and operation as two separate aspects of usability, and common metrics used in assessing usability include ease of learning, ease of use, and error rates. Ease of learning and ease of use, in turn, may be measured by the time taken to learn a defined set of functions and the time taken to perform a set of defined functions, while the measure of error rate is self explanatory. We may formulate requirements for usability as follows:

A function of the (% of target population which is able to learn a set of defined functions within a defined time period, % of the target population which is able to perform a defined set of functions within a

specified period of time, % of target population which is able to perform a defined set of functions with error rates of less than 1 %).

Functionality

This is another key requirement from the perspective of users, and refers to the set of tasks which may be performed by the user. For example, a user of an MFI may be permitted to obtain his account balance, payment history, make or receive payments, purchase insurance products, and these constitute the systems' functionality as seen by the user.

Unique Identity

One of the problems faced by clients, MFIs, regulators and investors is related to the fact that a large proportion of the target segment does not possess credible proof of identity. From the customer's perspective, this is a serious problem, since it restricts access to formal credit channels to begin with, even though she may otherwise be eligible for such credit facilities, and despite the fact that formal channels typically charge lower interest rates, often because of specific credit subsidies from the Government. Hence, from the customer's point of view, lack of identification may be seen as something which restricts entitlement. The gap between entitlement and provisioning is a serious problem affecting large segments of the population.

From the MFI operator's perspective, customers' lack of identification is an equally serious issue, since it brings in a risk factor related to the same customer availing multiple lines of credit, from different sources, without disclosing her current debt status and repayment ability. In private conversations, executives from the MFI sector speak about the kite flying syndrome, which they use to describe the act of a borrower taking multiple loans, using one loan to repay another.

This is also a critical requirement for the Regulator a stakeholder in the context of monitoring the flow of funds with a view to controlling money laundering and terrorism related funding.

We see that the issue of unique identity is an important requirement for both the customer and the MFI. It may also be observed that in order to make such unique identities operational, it becomes necessary for all the MFIs in a given area to cooperate and share their databases, much in the way that credit rating agencies operate. Indeed, this is a very important requirement for the MFI system as a whole, when viewed from the perspective of technological interventi

Looking at the Indian context, it is reported that the number of Below Poverty Line (BPL) cards issued actually exceeds the total number of families in several states. Now, the BPL card is an important form of identification, which entitles the holder to a variety of benefits including subsidized food and fuel, and the entire system has been demonstrably compromised. The same holds with Permanent Account Number (PAN) cards issued by the Income Tax department, with millions of fake cards and numbers being unearthed by investigative agencies. It is important to understand the serious problem faced in ground level implementation by Governmental agencies which are charged with the responsibility of issuing such critical forms of identity proof. Recognizing the criticality of this problem, the Government of India has constituted an Authority to issue Unique Identities to all Indians, and has appointed Nandan Nilekani, one of the founders and former CEO of Infosys Technologies, as the Chairman of the Authority, with the rank of a Cabinet Minister, in order to lead a high priority national Unique Identification Authority.

Decomposition and Quantification

I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it;
Lord Kelvin, Lecture to the Institution of Civil Engineers, May 1883

In the foregoing sections, we have identified important stakeholders, and some of their main requirements, such as accessibility, availability and identity. These requirements, when applied to the microfinance context, generate major challenges for designers and operators of IT systems, which have also been discussed briefly. Our discussion also introduces ideas as to how these requirements can be identified and quantified, explaining the need for decomposing complex requirements (such as availability and accessibility) into elementary attributes of the system.

In this section, we discuss the operations of decomposition and quantification in greater depth, with particular reference to the attributes which have already been identified.

We illustrate the approach of decomposition and quantification by considering two very important client requirements, namely *availability* and *usability*, represented in Table 2 below.

Elementary attributes for: Availability	Elementary attributes for: Usability
System availability in urban, semi-urban and rural areas	Time to learn [defined functions][defined skills]
Access to data communication infrastructure	Time to perform [defined functions][defined conditions]
Customers literate versus less-literate	Error rate
Language support: Local / regional	
Local assistance	

Table 2: Elementary attributes for Availability and Usability

The first process in decomposition is to recognize those elementary attributes which make sense, in serving as a proxy for the "original" attribute. It may also be noted that a given high level attribute (like availability) may be represented by a number of elementary attributes, as represented in Figure 3. Thus, we may consider local language support, and availability of infrastructure, as two proxy attributes for availability.

Having identified relevant proxy attributes, we then need to identify suitable scales of measure for each such attribute. For example, if we consider the availability of infrastructure, it is logical to look at the % of target population, which is able to access infrastructure, within 30 minutes, and (in the Indian context) within Indian Rs 10 of expenditure, and hence these become the scales of measure. Similarly, usability may be represented by the average time taken by the target group *to learn* a defined set of functions, the time taken to *perform* a defined set of functions, and the error rate. We also need to identify the meter (the instrument for measuring the identified attribute) and the method of recording the readings, but we do not intend discussing these any further, except to note that in choosing a suitable scale, one also needs to ensure that they are able to measure and record the identified usability metrics.

Let us consider the general case, with *n* stakeholders. Each stakeholder has a certain number of key requirements, represented as R(i,j) . This represents the requirement(i) belonging to stakeholder(j).

The approach of decomposing complex and abstract requirements may be represented as follows:

{Availability} = f {(travel time), (travel cost), (transaction cost), (others)}

Or,

R(i,j) = f {r(i,j,1)..r(i,j,m)} where the requirement R(i,j) is decomposed into m elementary attributes represented as r(i,j,x) where x varies from 1 to m.

It may be seen that the *elementary* attributes, such as travel time, or travel cost can be easily quantified and measured, and the overall idea is that *a set of identified elementary attributes serves as a proxy for the corresponding high level requirement.*

Once we define the elementary attributes which make up a given complex requirement, it becomes much easier to *specify* what we want. For example, we may specify that at least 90 % of the target segment should be able to avail the IT application (or ATM in our other example) in less than 45 minutes of travel AND incurring less than $ 1 in cost. Given such a precise, quantified specification, it becomes possible to *test* whether a given system satisfies such a requirement. It also enables systems designers to use such a specification as an input in designing their solutions.

We have provided a summary of a few high level requirements related to users and investors in the following figure, which also indicate how elementary attributes are associated with and derived from the higher level requirements. For example, profitability, which is a requirement from the investor's perspective, may be specified in terms of Return on Investment (RoI), Internal Rate of Return (IRR), or Net Present Value (NPV).Similarly, Security, which is a requirement for investors as also clients, may be decomposed into compliance with specified security policies, and success rate in planned vulnerability assessments.

Requirements	Quality Measures
Integrity	% Discrepancy under defined conditions
Auditability	Availability of information / documentation under defined conditions
Profitability	ROI, IRR, NPV
Security	Compliance with defined policies
	% Success in breaching security under defined conditions

Table 3: Associating Investor Requirements with Quality Attributes

Structured Representation
Now that we have discussed the *process* of decomposition, we still need to be able to represent the requirement in a structured manner, using necessary qualifiers, entities and concepts.

Given below is an illustration of representing the *Availability* attribute. The representation uses the *Planguage* constructs developed by *Tom Gilb*.

Representing the Availability Attribute
Our discussion regarding the Accessibility attribute may be represented using Planguage, developed by Tom Gilb, as illustrated in Table 4 below for the Indian context. Planguage uses a well defined set of key words, such as Type, Scope, Ambition, and Scale, as also Goal, Past and Fail.

A summary of commonly used Planguage terms and symbols is provided below:

GIST: A short, simple description of the concept contained in the Planguage statement
SCALE: The scale of measure used to quantify the statement
METER: The process or device used to establish location on a SCALE
PLAN: The level at which good success can be claimed
MUST: The minimum level required to avoid failure
FAIL: Level below defined acceptance level.
GOAL: Level of achievement which is targeted.
PAST: An expression of previous results for comparison
TREND: An historical range or extrapolation of data
RECORD: The best known achievement
WISH: A desirable level of achievement that is not yet thought to be attainable through available means
DEFINED: The official definition of a term
Fuzzy concepts requiring more details: <*fuzzy concept*>
Qualifiers (used to modify other keywords): [*when, which, …*]
A collection of objects: {*item1, item2, …*}

The importance of this technique may be understood by looking at the definition of Scale. Firstly, we note that in any decomposition exercise, as we identify elementary attributes, we also need to identify a suitable scale of measure. In this particular case, we suggest a scale which is the % of the target population able to access a particular service. Here, we also see the use of qualifiers, such as geography, time scale and services. The idea is to make the representation as precise as possible.

Some of the key words such as Goal, Past and Fail help to provide a context for the requirement, as also to provide criteria for testing whether the system is a success or a failure. Thus, in the example below, if the target population able to access defined services is less than 50 %, then it counts as a failure.

Type	Key system level requirement.
Scope	For information systems in the MFI domain.
Context	Many clients of MFIs are likely to reside in rural communities with limited infrastructure in terms of data connectivity and electricity. The challenge then is to identify technologies which are “available” to such a group
Ambition	Make MFI IT systems actually available in practice, to all potential 'clients'.
Scale	% probability that a defined [Customer type] with defined [Literacy] using defined [Agents] can get defined

	[Service levels] within a defined [Time: default 24 hours] using defined [Devices: default PC] within defined [Geography].
Past	[Customer = {Village, Woman, New Client}, Literacy = None, Agents = Village MF Agent, Service = All New, As Of = 2009] < 5%
Fail	[Customer = {Village, Woman, New Client}, Literacy = None, Agents = Village MFI Agent, Service = All New, As Of = 2011] < 50% ,
Goal 1	[Customer = All, Literacy = {English, Written}, Agents = None, Service = All, Device = Smart phone, As Of = 2012] > 95%
Goal 2	[Customer = {Village, New Client}, Literacy = {Any Major Indian Language, Oral}, Agents = MF Agent, Service = {Application, Application Status}, As Of = 2013, Device = {Smartphone, PC, Office Visit}, As Of = 2012] > 99%

Table 4: A Planguage illustration of the 'Availability' Attribute

Design Ideas for Improved Availability and Accessibility

The foregoing discussion highlights certain very unique and challenging characteristics and system level requirements, which apply in the MFI sector. A summary of literacy rates and internet penetration in India is provided below in Table 5. Indeed, these statistics raise questions about the feasibility of technology based solutions at one level, and also help to identify challenges for innovative technological developments.

Against this background, we discuss a few design ideas, which have the potential to deliver huge impacts in the MFI sector.

Data Source: **Literacy rate, as included in the** **United Nations Development Programme Report 2007/2008**	
INDIA Literacy Rank	147
INDIA Literacy Rate	61.0%

Data Source: Internet World Stats. Copyright © 2001 - 2008, Miniwatts Marketing Group World Internet User Statistics were updated for June 30, 2008 **INDIA**	
Literacy Rank	147
Literacy Rate	61.0%
Internet Usage Rank	4
Population (2008 Est.)	1,147,995,898
Internet Users Latest Data	60,000,000 users
Penetration (% Population)	5.2 %
% Of World Users	4.1 %
User Growth (2000 - 2008)	**1,100.0 %**

Table5: India Statistics

Voice based technologies

Voice based technologies have the potential of impacting accessibility in a significant manner, since they do not require literacy, English language skills and computer literacy as pre requisites to be met by potential users. It may also be noted that the specific technologies which are discussed here, have been well proven in other contexts, mitigating possible risk factors associated with new technologies. In other words, these technologies present proven applications, worthy of serious consideration by system designers, developers and operators.

The two specific technologies discussed here are *Interactive Voice Response Systems (IVR)* and *Text to Speech (TTS).*

Interactive Voice Response IVR) Systems and Voice Portals

IVR solutions have been successfully deployed in various sectors such as banking, insurance, credit cards and other financial products, as also in several retail segments, by service providers, and utilities. It may be seen that these sectors represent a large number of retail users and a range of functions which are supported. The development of related technologies such as Voice XML has led to the next generation of Voice Portals, which enable richer functionality.

Another encouraging aspect of this technology is the support for Indian languages, which has already been implemented by several commercial organizations. For example, Telsima offers a range of products, including Telespeech, which supports 10 Indian languages, making these products accessible to almost 90 % of the country's population (www.telsima.com). An Indian insurance Company, Max New York, recently launched IVR services in 10 Indian languages. Bhrigus Software Pvt Ltd, a Company based in Hyderabad, India, has announced a range of products and platforms to support Indian languages, including Text-to-speech (TTS) applications. HISAAB, an open source initiative for the development of Open Source software applications for Microfinance, has been experimenting with the design paradigm of numeric interfaces. These numeric interfaces only require the user to be familiar with numbers and not

necessarily literate, in order to be able to use the solutions. It is possible to conceptualize an application which combines voice and numeric interfaces, in order to support a variety of functions, including queries, reports, requests and even other types of support.

The above cited developments represent a significant potential for the MFI sector, in terms of being able to reach out to its clients and potential clients, in delivering informational and transactional services, using voice and numeric interfaces.

Text to Speech (TTS) Solutions

The problem of converting text to speech has received considerable attention in recent years, and Acharya, an initiative of IIT Madras has made significant progress in this area (www.iitm.ac.in). The phonetic nature of Indian languages facilitates the generation of synthetic speech, which is easily comprehended. One of the drivers for these developments is to enable visually challenged people, but it is equally relevant in communicating with groups lacking in literacy. Bhrigus Software Pvt Ltd, a Company based in Hyderabad, India, has emphasized support Indian languages, including TTS applications.

Computing platforms and Connectivity

Availability is the other major system attribute which we discussed earlier in the analysis of stakeholder requirements. The basic issue here is that the system needs to provide a good level of availability to users and potential users, which meet some defined criteria of time and cost to begin with. For example, one could postulate that a computing platform with suitable connectivity should be available to 80 % of the target population in a defined geographic area, within 30 minutes of travel time and at a cost of Indian Rs 10 or less.

Advancements in mobile telephone technology have transformed the voice communication scenario in India, and in much of the world. Currently, the mobile user segment in India numbers over 400 million, with monthly additions in the range of 15 million (http://www.zdnetasia.com/insight/specialreports/india/.) Given this background, one needs to consider whether this technology offers options for data connectivity, as required for access to IT applications.

Wireless broadband (WBA) represents another connectivity option, particularly well suited for data connectivity. The technologies to consider in this category include Wireless Fidelity (WiFi), Worldwide Interoperability Microwave Access (WiMax) and 3G services.

The following sections discuss the status of these technologies and their suitability in addressing the needs of the Microfinance customer community.

Cellular / Mobile Phones

The key advantages of this technology include high penetration rates and acceptance levels in the target population, service availability which is practically ubiquitous, low entry and operating costs and support for data services.

However, there are some key negative factors which need to be considered as well. The first problem we face is that the two major technologies, GSM (Global System for Mobile communications) and CDMA *(Code-Division Multiple Access)*, currently offer low data rates, in comparison with broadband alternatives, such as DSL and WBA, which are far better suited for high speed data connectivity. Thus any solution which is built on these technologies will need to contend with data speeds of around 230 kbps, which is indeed a low threshold, and corresponds to the first generation of wireless data networking, referred to as 1X. Current technologies, which are at 3X offer much higher connect speeds, with CDMA 2000 3 X offering downlinks up to 3.1 Mbits per second and uplink speeds of up to 1.8 Mbits per second. Similarly, GSM with Evolved Edge supports peak data rates of 1Mbit per second and typical rates of 400

kbits per second. It is expected that mobile phone networks will upgrade data services to 3X levels in the near future, thereby improving connectivity to a significant extent.

It has also been the experience of many countries and service providers that the revenues from data services account for less than 5 % of their total revenues, while consuming a disproportionate amount of bandwidth, which constitutes a major part of the service provider's costs. This combination of high prices and low bandwidth is certainly a constraint in the usage of data services by the MFIs' target population.

Another possible negative factor arises from the relatively high prices of phones with data connectivity and computing environment support, commonly referred to as Smart phones. Currently, most such models cost US $ 250 or more in India, compared to entry level phones, which cost around $ 20. This represents a huge gap, and the high prices of smart phones constitute an entry barrier, which needs to be addressed.

WiMax and Wireless Broadband

This group of technologies holds great promise in terms of enabling high speed and reliable data connectivity to under served geographies and the corresponding potential users. Currently, WiFi (Wireless Fidelity) technology has gained popularity and has penetrated consumer devices such as laptops and smart phones, to a significant level. The service availability is also good, and all these factors have certainly helped in making WiFi a mainstream networking technology.

A major drawback of WiFi is its range, which is limited to a few hundred meters (typically 300 to 500 meters), and hence the service is typically available in pockets or zones, such as airports, hotels, offices and homes. This is the problem which is well addressed by WiMax (Worldwide Interoperability for Microwave Access), which has a range of a few kms (typically 5 to 8 kms) for each tower, thereby making it possible to provide ubiquitous coverage over large areas. Mobile WiMax is already available in various forms, and holds the promise of delivering wireless broadband services, much in the same way that mobile voice services are currently delivered.

The potential significance of WiMax is that it is capable of providing broadband internet access to remote areas, and rural settlements, which are otherwise outside the coverage of wire line technologies, such as Digital Subscriber Line (DSL) and E1 links. The importance of broadband connectivity is that it is capable of supporting a variety of services, such as data, voice and video, thus empowering rural populations.

Wi Max has already been deployed by over one hundred operators and is available in 50 countries. The deployment of this technology in India has been significantly delayed due to issues in spectrum allocation, and even as of October 2009, such deployment appears to be at least 12 to 18 months away.

Kiosks / Shared Infrastructure Solutions / Common Service Centres

Kiosks are composite computing facilities, comprising hardware, software and data connectivity, which are being deployed in small towns and villages in India, as part of private and publicly funded initiatives. Such kiosks are meant to offer a number of citizen services, including, for example, land records and identity cards in Karnatka state. These kiosks address a number of high level requirements of their clients including affordability, availability and accessibility from the user's perspective. One interesting initiative from Drishtee has combined the kiosk model with entrepreneurship development and has promoted 1700 entrepreneurs in 10 Indian states, as per a World Bank report. Comat, another organization active in e-governance, has set up over 2,000 kiosks in Karnataka state alone. E-Governance refers to initiatives by government organizations and private operators to deliver a variety of citizen services, using the Internet, and shared computing infrastructure. By some estimates, there are as many as 150 rural PC-kiosk projects

across India, some of which already have, or are planning, thousands of installations. (Toyama et al., 2004). Most of these projects were started within the last five years, riding on India's booming IT industry. Reflecting the nation's diversity, these initiatives differ in goals, models, operating paradigms, and geographic distribution. Every sector is involved – large enterprise, entrepreneurs, universities, government, and NGOs – with motives ranging from turning a commercial profit, to driving socio-economic growth, to streamlining government bureaucracy.

In a recent interview with Business Line, India's Minister for IT, Sachin Pilot, mentioned that there were already 40,000 kiosks in operation and that the Government plans to install another 100,000 kiosks rapidly. He also said that the low internet penetration in India would not be an obstacle for users, since such shared infrastructure would become available across the country.

From the perspective of MFIs, kiosks present an immediate possibility, for connecting with dispersed populations of clients and potential clients.

Envisioning the Technology Ecosystem

We summarize some of the concepts which have been discussed in the foregoing sections, and attempt to synthesize them into our prediction of how the MFI sector technology ecosystem will evolve, given its unique requirements.

These predictions arise from the perspective that IT based solutions in the future will leverage available technologies in order to improve the attributes of Availability, Affordability and Accessibility, as discussed in the foregoing sections.

First, we expect that current and traditional methods of computing, with English language interfaces and a requirement of basic computer literacy, will not have much relevance to users of MFIs. There is a need for providing *voice based communication,* in the *local language,* to support a set of defined interactions. There is also scope for deploying *numeric interfaces* which are language independent, and which will also support a defined set of functions. Thus, we are likely to see radically different user interfaces, and perhaps even the base products are likely to change substantially.

Next, we see that *mobile phones* and *kiosks* are likely to be the access devices of choice, representing a level of convergence between computing and communication. We also expect that high speed, ubiquitous, wireless communication infrastructure, based on *3G and WiMax*, to become available in the near future. Even today, we have satisfactory levels of security implemented in mobile payment systems, and hence this is not expected to pose any significant difficulty. Kiosks are also expected to play a major role in making services available in remote and rural areas.

We expect that biometrics will play a key role, in establishing identity and uniqueness. One can think of a solution in which each user of the MFI service, is provided with a smartcard, which also contains his fingerprint, and details of his accounts. Such a system will permit the use of shared devices, and even community devices, and kiosks with multiple user access, which is the expected mode of functioning.

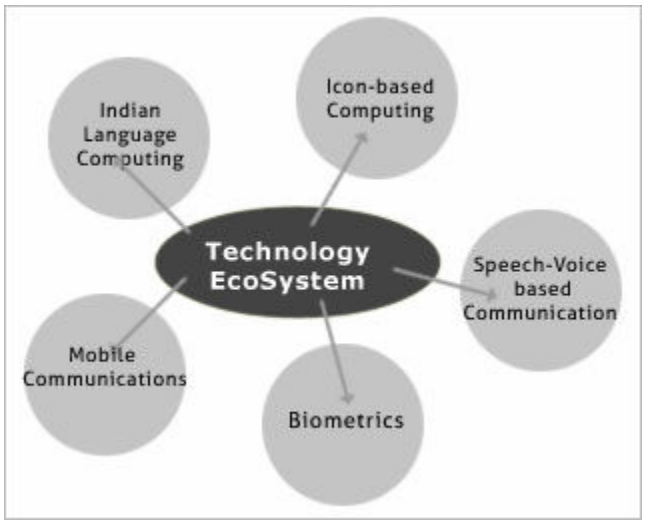

Figure 2: Need for User interfaces relevant to MFI Customer

FUTURE RESEARCH DIRECTIONS

Non-English Language Computing
This is a major requirement, to make the IT systems accessible to a very large segment of the target market for MFIs .In India (and in other regions of the world as well) the many languages and scripts with which MFIs target users to communicate pose significant challenges to designing user interfaces which are easily accessible to these target users. However, developing user interfaces in languages comprehended by MFI clients and target clients is not the only challenge facing designers of IT systems; such solutions also need the ability to search, sort, compute, report and print in many non-English languages. There are several approaches available at present and there is a need to evaluate current technologies and products, in order to define further work which is needed.

Voice based Communication
We have discussed the key role which voice based communication can play, again in the province of accessibility. There is tremendous scope for interactive voice based communications in foreign languages, which can solve the problems of lack of English skills and lack of computer literacy. It is indeed encouraging to note that Interactive Voice Response solutions in Indian languages are already available from several commercial solution vendors, and they have also been deployed in pockets. The challenge is to develop more functionality and capability by deploying Voice and related services supporting multiple Indian languages.

Access Products
Given the scale of operations in the MFI sector, we believe there is a good potential for design, development and deployment of purpose specific computing devices, targeting users in this sector. Such devices need to incorporate the required data communication functions, voice and icon based interfaces, as also biometrics, and multi user scenarios. There are many examples of kiosks which have been designed specifically to provide services in remote areas, which are indicative of this particular line of development.

CONCLUSIONS

Technology based solutions have the potential of improving service levels and operational efficiencies in the MFI sector, by making such solutions more accessible and easily available to their clients. Designers and operators of such technology based solutions will need to address specific and significant challenges arising from characteristics of the target users, as also from limitations in terms of certain elements of infrastructure.

The present discussion uses stakeholder analysis to examine certain key requirements from the clients' perspective, namely availability and accessibility. These requirements will need to be satisfied by any IT based solution in order to effectively engage their clients. Stakeholder analysis, combined with techniques of decomposition and quantification, as used in the present discussion, facilitates the specification of such high level requirements at an operational level. The challenge to designers and operators of IT based solutions is to design and build innovative solutions, using appropriate technology components, in order to improve availability and accessibility to their clients, leading to improved efficiencies and enhances services.

REFERENCES

Mize, J., & Hallam,C. (2002). *Stakeholder Value Metrics*. Massachusetts Institute of Technology.

Jensen, M.C. (2000). *Value Maximization and Stakeholder Theory*. Harvard Business School Working Knowledge.

Berry, D., Hungate, C., & Temple, T. (2003). *Delivering Expected Value to Users and Stakeholders with User Engineering*. IBM Systems Journal.

Gilb, T. (2006) *Quantifying Stakeholder Values* .Working Paper

Gilb, T. (2005) *Competitive Engineering*, Butterworth Heinemann.

Srinivasan, N. (2008) *Microfinance India: State of the Sector Report 2008,*Sage Publications

ADDITIONAL READINGS

Freeman, R.E. (1984) Strategic Management: A Stakeholder Approach

Robinson, M.S. (2001) The Microfinance Revolution

Srinivasan, N. (2008) Microfinance India: State of the Sector Report (2008), Sage Publications.

Woodside, M. (2001) Scalability Metrics and Analysis of Mobile Agent Systems

Start, D., and Hovland, I. (2004) 'Tools for Policy Impact: A Handbook for Researchers', London: ODI (http://www.odi.org.uk)

Websites:

http://www.cgap.org/p/site/c/template.rc/1.26.10622/

http://www.cgap.org/p/site/c/template.rc/1.11.1792/

www.drishtee.com

www.indiamicrofinance.com

www .microfinance .in

www.microfinanceindia.org

www.microfinancefocus.com

www.microfinancegateway.org

http://www.microfinancereport.com/2008/01/biometrics-and.html

http://www.microfinancereport.com/2008/01/the-rise-of-mob.html

www.telsima.com

www.worldbank.org

END NOTES

[1] Available at http://www.microfinancefocus.com/news/2009/08/16 last accessed on 14Oct, 2009.