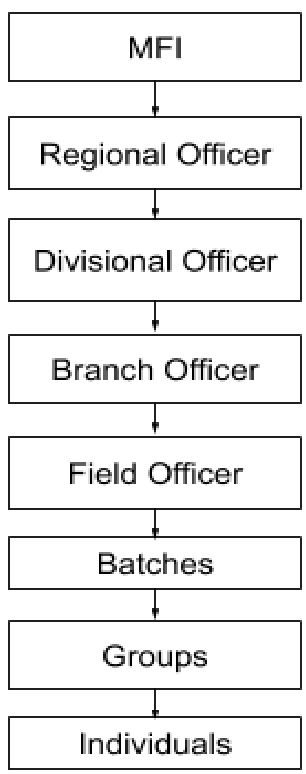
[1]**What is Microfinance?**

Microfinance, also called microcredit, is a type of banking service that is provided to unemployed or low-income individuals or groups who otherwise would have no other access to financial services ie unbanked or underbanked. While institutions participating in the area of microfinance most often provide lending, many banks offer additional services, such as checking and savings accounts, and micro-insurance products; and some even provide financial and business education. Ultimately, the goal of microfinance is to give impoverished people an opportunity to become self-sufficient.

Loan Originators / Banks	Microfinance Institution's	Microentrepreneur
Wants to help people get out of poverty and have global loaning opportunities	Microcredit institutions should fund their loans through savings accounts that help poor people	People below the poverty line who want microloan to start a new business

[2]**Hierarchy of Microfinance Institution -**



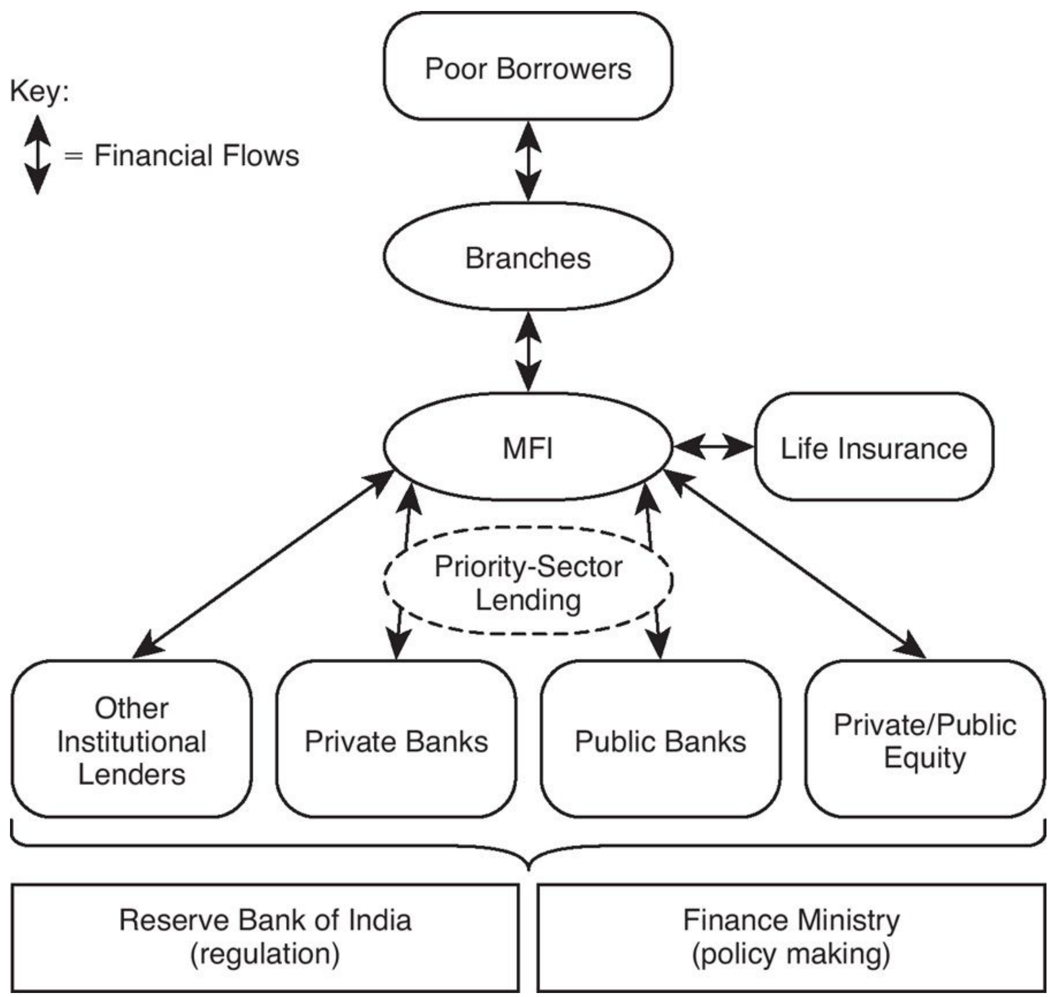
Traditional and Modern Day Microfinance Working -

[3]**Traditional Microfinance -**

Working -

- A village is evaluated to see if microfinance is needed.
- If the village is found suitable, an orientation is held to explain the functioning of the MFI.
- Those interested must make groups (of about 5) where all members are guarantors for each other i.e. they're all responsible for paying back the collective loan and in case one fails, peer pressure is put on him to submit timely payment.
- A village center is chosen for the weekly collection of payments that are overseen by the field officer.
- Loans are provided by the Branch officer.

[2]**Flowchart -**



[4]Modern Day Microfinance -

Modern-day MFIs (MDMFIs) use alternative data, specifically mobile phone data, as the underlying source and foundation of their credit solutions. MDMFIs have lower operating costs and are digitally native, allowing them to offer cheaper and more efficient credit solutions to borrowers.MDMFIs are able to assess the creditworthiness of potential borrowers in a manner that is automatic, automated, and driven by big data.

Working and Flowchart -

The borrower **installs** MDMFI's app. This app gives the MDMFI complete **access** to the borrower's mobile phone (from call duration records to SMS)

Borrower **uploads** relevant ID documents. This allows the MDMFI to create a unique record under which, the mobile phone is associated with a specific borrower, and local **Know-Your-Client** obligations are satisfied

The MDMFI **analyzes** the borrowers mobile phone data and, if possible, any **available credit data** from local credit bureaus based on the borrower's ID, to assess **creditworthiness**

Upon the borrower's request for credit, the MDMFI uses algorithms to analyze mobile phone data in order to generate a **probability of repayment score**. The MDMFI then offers, within minutes, a **line of credit** to the borrower. This line of credit is often for 60 days or fewer and typically for less than $350

The borrower's repayment of the loan in addition to mobile phone usage and habits are **analyzed repeatedly** by the MDMFI and used to inform the MDMFI's algorithm

Key data points assessed -

The type of data which it collects includes regularity of phone usage, the regularity of phone charging, how long it took borrower to complete a loan application, answers on the loan application, etc and then the data is put into 3 parts - Own data, Inferred data, and Relative data.

[5]Microfinance Apps -

- Tala (Kenya, 30 Lakh)
- EasyPaisa (India, 7.5 Lakh)

[6]Problem associated with Microfinance Institutions -

- High rates of interest (25-40%) as compared to mainstream banks (8-12%) because of the high risk involved also money transactions are quite slow and unsafe. Due to this, a situation of over-indebtedness arises and may result in higher suicide rates of borrowers.
- Property risk - Keeping all the assets in the form of cash is sometimes risky because of the living environment
- Lack of risk management framework and multiple borrowings by most clients can lead to over-indebtedness and hence result in a microfinance crisis as it did in India 2008. To prevent this, MFIs usually increase their cost of monitoring.
- In such a setting, the people who put money into microfinance are completely invisible to the people who get microfinance, and vice versa. Hence, there is no provision for accountability.
- Most of the MFIs are NGOs and get funded for their lending activities by commercial banks which are private and charge a high rate of interest for short periods of time. Over 80% of the MFIs funds come from these banks which leads to an overdependence to them.
- Presently the Reserve Bank of India (RBI) is the regulatory body for the microfinance industry in India. However, it has traditionally catered to commercial and traditional banks rather than MFIs. Not only has it led to constant structural and operational changes but also created ambiguity in norms of conduct. Therefore there is a need for a separate regulatory authority for this industry.
- Lack of awareness of financial services provided by the Indian microfinance industry is a challenge for both customer and MFIs'. This factor not only causes a hindrance for villagers to join hands with MFIs' to meet their financial needs but also makes them financially excluded. MFIs' are faced with the task of educating the people and establish trust before selling their product. Microfinance institutions struggle to make their business more financially viable due to this lack of awareness.

[7]**What happens when payments default -**

Unfortunately, the credit bureau data does not include bank lending to SHG members, and research has shown that MFI borrowers often have formal and informal loans from other sources.26 Additionally, the credit bureaus have grappled with the lack of a national ID, though the acclaimed Aadhaar program is rapidly issuing biometric identification cards to hundreds of millions of Indians. Yet, this hands-off stance included scenarios presented in interviews by the MFIs when, in our opinion, groups were acting inappropriately, such as taking a delinquent borrowers' belongings or locking her out of her home. At a certain point in delinquency, usually, if several missed payments are not covered by the group, the Indian loan officer visits the borrower, often accompanied by higher-ups—either branch, regional, or area managers. These initial visits were framed as both an opportunity to exert pressure, and to understand the reason behind the default. As a result, the lender pulls in its own staff, group members, and defaulter family members or neighbors to pressure the individual for repayment, which seems to impinge on the debtor's right to privacy. One MFI stated that it was normal for such a collections group to sit at a delinquent borrower's house for five to six hours until she repaid.

Types of Groups formed in India-

[8]Joint Liability Groups -

Enabling Joint Liability Groups (JLGs) within and outside SHGs

A few members of SHGs may graduate faster to start or expand economic activities requiring much higher levels of loans than other SHG members. In such cases, other members may not like to stand a mutual guarantee for large-sized loans for these members. In such cases, a “Joint Liability Group (JLG)” may be created consisting of such members of one or more SHGs.

General features of JLG :

A Joint Liability Group (JLG) is an informal group comprising of 4-10 individuals coming together for the purpose of availing bank loans on an individual basis or through a group mechanism against the mutual guarantee. Generally, the members of a JLG would engage in a similar type of economic activity. In certain groups, members may prefer to undertake different types of economic activities as well. The members would offer a joint undertaking to the bank to enable them to avail of loans. JLG members are expected to provide support to each other in carrying out occupational and social activities.

Criteria for membership:

i) Members should belong to similar socio-economic status, background, and environment carrying out farming and Allied activities and who agree to function as a joint liability group. This way the groups would be homogeneous and organized by like-minded farmers/Individuals and develop mutual trust and respect.

ii) The members should be residing in the same village/ area/neighborhood and should know and trust each other well enough to take up joint liability for group/individual Loans.

iii) Members who have defaulted to any other formal financial institution, in the past, are debarred from the Group Membership.

iv) More than one person from the same family should not be included in the same JLG.

[9]Self Help Group -

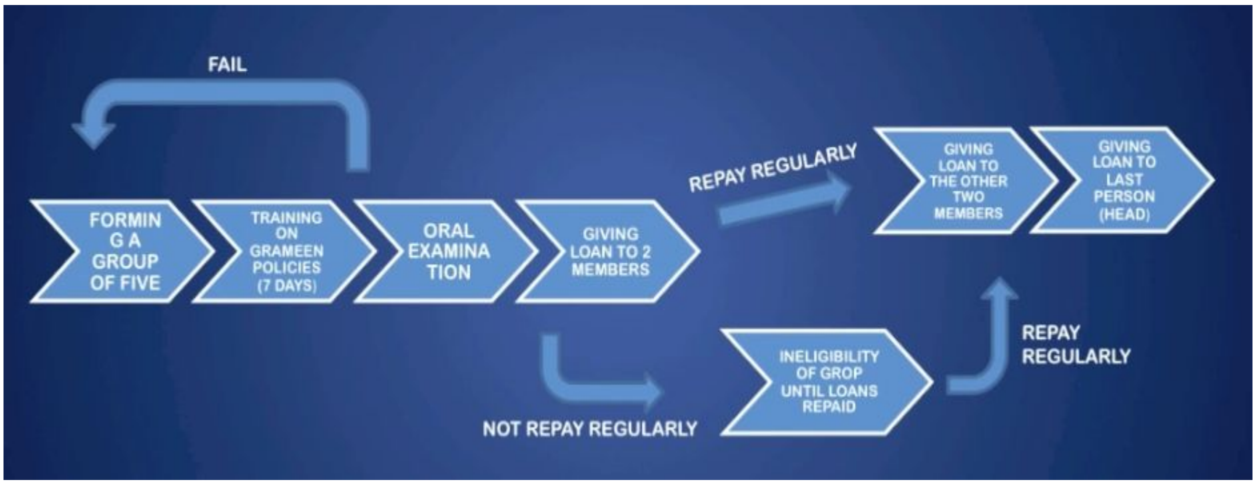
Members Selection -
Only one responsible person from a poor family can become a member of the group by paying the membership fee. Rs....... Or whatever fixed by the Group in consensus.
The size of the Group shall be around 15 to 20 members.
Group Meeting -
Once in a week.If fails the member is liable to pay a fine for the absence as decided by the group.
Executive Committee -
An Executive Committee consisting of three representatives elected unanimously in the Group should take overall responsibility for the smooth functioning of the Group.
Two out of the above three shall jointly operate the Group's Bank Account. This committee is responsible for the Group's cash at hand, cash at Bank or Post office.
Member saving in the group related -
Each and every member should save at least Rs. .... per week or Rs..... per month in the Group which should be maintained in each individual members name.
However, the members should maintain a minimum balance of Rs. 1000/- in their savings account.
No interest will be paid for the member's savings with the group. But 12% interest shall be paid for the amount kept in the Group as a fixed deposit for a minimum period of six months.

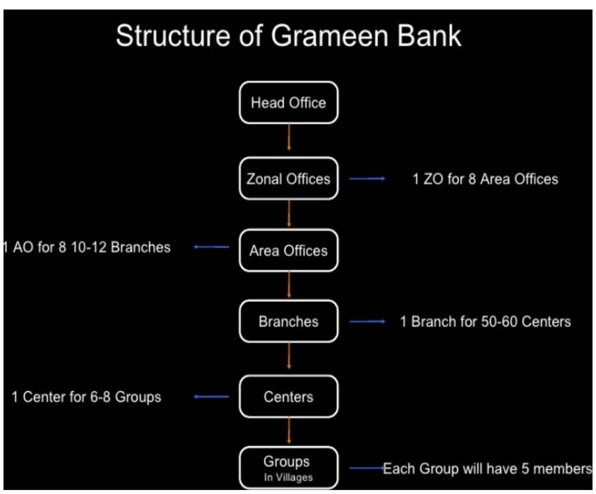
[10]Difference between SHGs and JLGs-

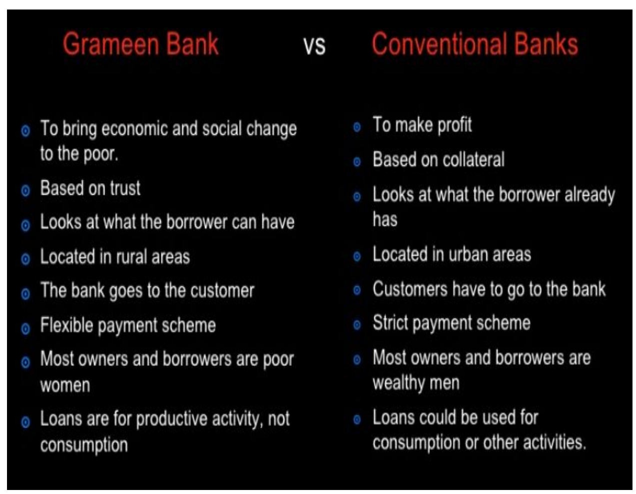
SHGs	JLGs
10-20 Members	5-10 members
The loan is given on the basis of savings (loan is usually given up to 5 times the savings amount)	Credit Oriented
Executive Committee consists of Treasurer and secretary	Consists of a leader, all members are liable for the repayment of loan however
Lend to the SHGs name (Group Lending)	Can be lent individually to people in the group or to the entire group
Mostly consists of very poor people	Consists of moderately poor people

[11]**Grameen Bank Model -**

Grameen Bank is a microfinance organization and community development bank founded in Bangladesh. It makes small loans (known as microcredit or "Grameen credit") to the impoverished without requiring collateral.







[12]Agricultural cooperative -

The default meaning of 'agricultural cooperative' in English is usually an agricultural 'service' cooperative, which is the numerically dominant form in the world. There are two primary types of agricultural service cooperatives, 'supply cooperative', and 'marketing cooperative'. Supply cooperatives supply their members with inputs for agricultural production, including seeds, fertilizers, fuel, and machinery services. Marketing cooperatives are established by farmers to undertake transportation, packaging, distribution, and marketing of farm products (both crop and livestock). Farmers also widely rely on credit cooperatives as a source of financing for both working capital and investments.

[13]NABARD -

More than 50% of the rural credit is disbursed by the Co-operative Banks and Regional Rural Banks. NABARD is responsible for regulating and supervising the functions of Co-operative banks and RRBs. NABARD works towards providing a strong and efficient rural credit delivery system, capable of taking care of the expanding and diverse credit needs of agriculture and rural development.

Table VI.1 Ownership Pattern of Financial Institutions
(As on March 31, 2011)

Institution	Ownership	Per cent
1	2	3
EXIM Bank	Government of India	100
NABARD *	Government of India	99
	Reserve Bank of India	1
NHB	Reserve Bank of India	100
SIDBI **	Public Sector Banks	72.2
	Insurance Companies	21.4
	Financial Institutions	6.4

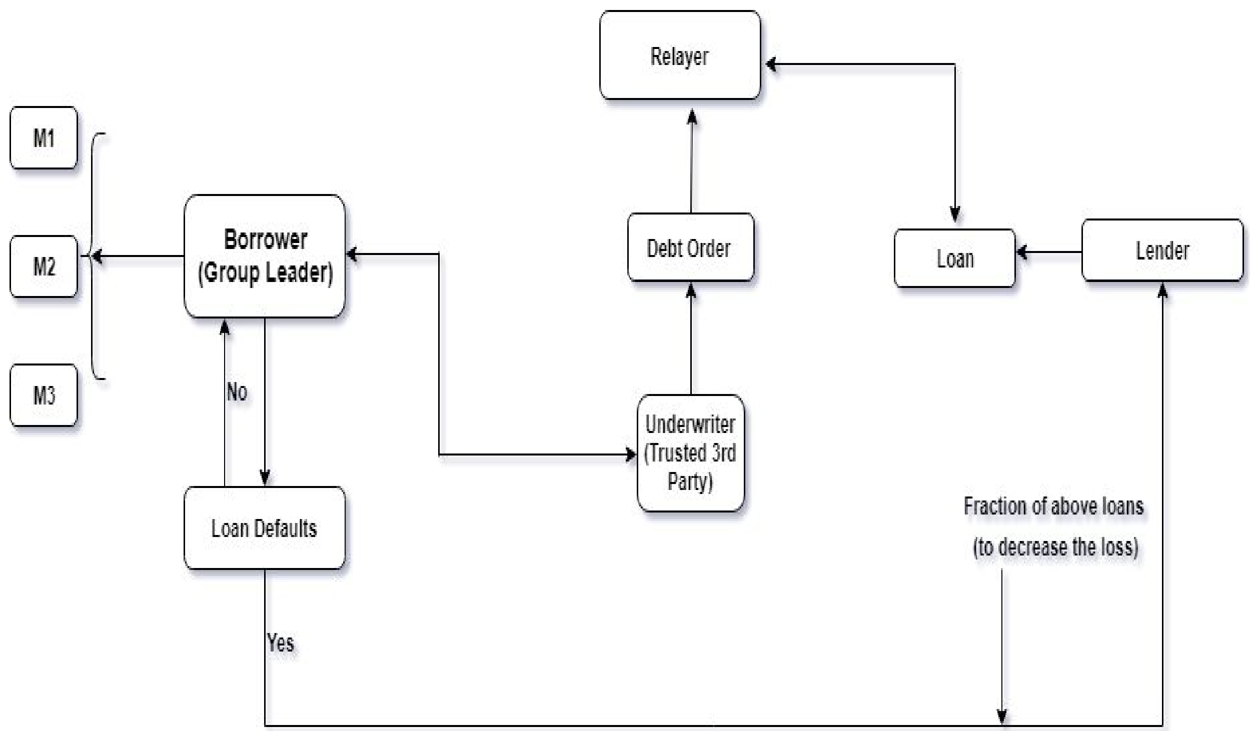
* In terms of GOI notification dated September 16, 2010, with effect from September 16, 2010, the share of GOI and RBI in NABARD equity stands at 99 per cent and 1 per cent respectively.
** IDBI Bank Ltd. (19.2 per cent), State Bank of India (15.2 per cent) and Life Insurance Corporation of India (14.4 per cent) are the three major shareholders in respect of SIDBI.

[14]Ownership distribution w.r.t. institutions

Why blockchain solution -

- Offering a new and innovative way of verifying a borrower's identity
- Creating shared and trusted credit histories ie precise analysis of capital flow of an ecosystem and will allow investors to invest effectively
- Enabling the sharing and maintenance of sensitive data in more secure ways
- Allowing for cheaper and quicker flows of capital to and from borrowers and hence less risk and lower the interest rate

Proposed Solution -



Participants -

- Members of the group
- Borrower (group leader)
- Underwriter
- Relayer
- Lender

Who are Underwriter and Relayer -

[14]Underwriters -

The underwriter is a formal part of the process of generating a Debit Order. Their existence solves another key problem that how can lenders evaluate the credit risk?
An Underwriter is a trusted party that performs the following functions:

- Negotiates the terms of the loan with the borrower
- Produces a Debit Order, based on these terms
- Commits to a risk rating of the borrower, which is the likelihood that the borrower will repay his loan in full
- Cryptographically signs the Debit Order, including their risk rating for that order – you can think of this as equivalent to "co-signing" the loan
- Doing everything within their reasonable power to ensure timely repayment according to the loan's terms. This is known as debt servicing

[15]Relayers-

Relayers are a crucial part of the protocol. Their existence solves a key problem: if a borrower needs to find a lender to fill their Debt Order, how do they find a prospective lender?

[16]Ragpicker (Borrower) -

Ragpicker is a term for someone who makes a living by rummaging through refuse in the streets to collect material for salvage. Scraps of cloth and paper could be turned into cardboard, broken glass could be melted down and reused, and even dead cats and dogs could be skinned to make clothes.

[17]DWCC (Underwriter or Lender)-

Dry Waste Collection Centres (DWCCs) facilitate the streamlining of the entire process of waste management in the city, by concentrating exclusively on dry waste. They are equipped with an appropriate infrastructure capable of purchasing, collecting, aggregating and processing both high value and low-value dry waste such as plastics, paper, glass, tetra packs, etc.

[18]Interest Calculations for Loan Accounts -

Interest calculation can be done in following types -

- flat interest rate,
- declining balance,
- declining balance interest with equal principal installments, and
- declining balance with interest recalculation

EMI Definition: EMI (Equated Monthly Installment) is the amount payable to the lending institution every month, till the loan is paid back in full. It consists of a portion of the interest as well as the principal.

Flat Interest -

Definition: Flat interest refers to charging interest on the full original loan amount, rather than on the declining balance. For example, with group-based loans, a common "interest rate" is "3% per month, flat, for four months". This means that a $100 principal amount lent is multiplied by 3%, and then by 4 months to come up with $12 in interest. Thus, $112 would be repaid over four months in equal installments.

This is the most common calculation used in Grameen Style MFIs (most MFIs). Also, there is no incentive for repaying early since customer still has to pay the total interest as was calculated at the start of the loan.

The use of "flat" interest rates is usually explained as facilitating understanding by poorly educated and illiterate clients. "Flat" interest is easier to calculate than “declining balance” interest. However, "flat" interest also disguises the "effective" interest rate (APR, or internal rate of return) to the loan. Based on how often the principal is collected (weekly, monthly or at the end of the term), and assuming there are no additional fees, the above loan has an APR of between 39% and 71%.

Formula: Interest = P * r/100 * n
P = loan amount- Initial amount
r = rate of interest
n = term of the loan
Examples:
P=100, r = 3/100 per month, n = 4
Interest = 100 *(3/100) * 4 = 12
Monthly payments of 112 / 4 = 28
Note: The above formula holds for loans disbursed in between two meetings also.

<u>Declining Balance Interest (EMI of Principal and Interest)</u>

Declining Balance Definition: Interest is computed at periodic intervals on the amount of the original principal that has not yet been repaid. Since the borrower only pays interest on that amount of original principal that has not yet been repaid, interest paid is smaller every period. However, to make sure that the borrower sets EMI, the formula is:

EMI formula:
EMI = i*P / [1- (1+i)^-n]
Where,
P = Loan amount
r = Rate of interest per year
n = Term of the loan in periods
l = Length of a period (fraction of a year, i.e., 1/12 = 1 month, 14/360 = bi-weekly.)
I = Interest rate per period (r*l)

Examples:
P=1000, r = 5/100, l = 6/12 n = 2, i = 0.025
EMI = 0.025 * 1000 / [1-(1+0.025)^-2]
EMI = $518.83

Declining balance interest calculation with equal principal installment

This feature allows MFIs to calculate interest using equal principal installments, and simple declining balance formula to calculate the interest. This means that the borrower pays equal installments of principal for the duration of the loan, and the interest is calculated on the principal that has not been paid for the loan period.

Formula Interest = (P-Pp) * r * n
Where,
P = loan amount
Pp= Principal paid
r = rate of interest
n = term of loan
The following example illustrates this:
Principal = 15,000
Int. Rate = 25 %
No of payments = 25
Payment schedule (Every 2 weeks) = 14 days
Principal = 15,000/25 = 600

The following additional logic is needed in the Loan Repayment and Interest Calculation:

1. Calculate the Principal per Installment (PPI = Total Principal/ No of Payments)
2. Interest Per Period = (P-Pp) * r * n Where, P = loan amount Pp= Principal paid r = rate of interest n = term of loan

Payment Schedule			
Installment	**Principal**	**Interest**	**Total**
1	600	(15,000 – 0)*0.25*14/365 = 143.83	743.83
2	600	(15000-600)*.25*14/365 = 140	740
3	600	(15,000 – 1200)*.25*14/365 = 132.32	732.32
Repeat			

Declining balance calculation with interest recalculation

Declining Balance - Interest Recalculation gives the user a new possibility in configuring and managing cash flow on loan accounts. The main role of Interest Recalculation is to control early and late payments of each installment. When loan repayment is on time, then Interest Recalculation works in the same way as normal Declining Balance interest rate type. Interest Recalculation can be most useful in cases such as early payment with less than installment amount, due date payment with the excess amount, or late payment with equal installment amount.

In case when a client pays late, an excess interest is charged from him on the principal he is late on, and for the number of days, he is late in making the payment. This excess interest gets added to the next installment and will be shown along with the installment's interest.

In case the client pays early, only the interest due until the payment date is recovered from the payment applied. The remaining amount is allocated towards the principal payment and is reflected against the next installment's principal.

Interest due to date is recovered first because the installment date for the installment in case of early payment is yet to occur. The installment will not be marked as completely paid in case of early payment. For the date of early payment to the installment date, interest will be calculated on the overall unpaid principal for those number of days.

In each case it is necessary to count daily rate of interest:

id = (r/100)*(1/365)

where :

id - the rate of interest per day
r - the rate of interest per year

The loan amount in the example is 1000$ and it is taken for 4 terms, the rate of interest is 25% per year. Using id formula we see that the rate of interest is 0.000684915 per day. Disbursal date is 25-VIII-2010

Generally, the Principal is a difference between the early amount left to repay and the actual amount left to repay, but when payment is greater/lesser than it was specified during the loan creation, it becomes a difference between the amount paid and interest. As it is shown in the table above, the second principle is:

739.08$ - 510.09$ = 228.99$

According to the disbursal date, we see that the Client repays the first installment earlier than one month. Also, the Client repays more money than required. Interest formula for Interest Recalculation is the same in every case:

Example

Payment is early and more than required.

Installment	Due Date	Principal	interest	Total	days	o/s p
1	23-IX-10	260,92	19,08	280,00	29	739,08
2	25-X-10	228,99	15,56	244,55	32	510,09
3	25-XI-10	252,22	10,40	262,62	31	257,87
4	25-XII-10	257,87	5,09	262,96	30	-
TOTAL		**1000**	**50,14**	**1 050,14**		

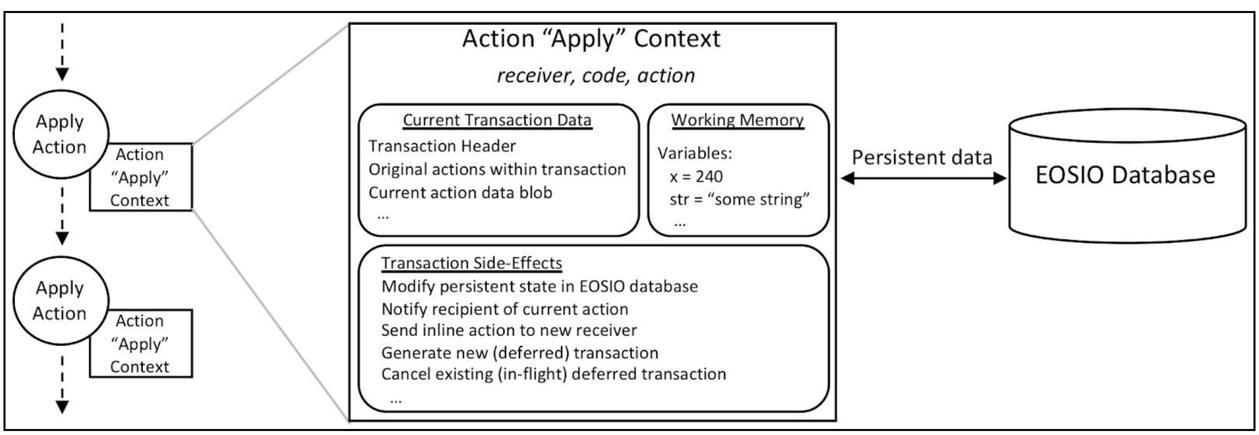
Interest = (o/sp)*days*id
where:
o/sp - amount left to repay
days - number of days since last repayment
id - interest rate per day

[19]Communication Model in EOSIO -

EOSIO supports two basic communication models, inline and deferred. An operation to perform within the current transaction is an example of an inline action, while a triggered future transaction is an example of deferred action.

Inline Communication -
Inline actions can be spawned from a contract and are then executed within the same transaction as the original action. They are reliable as they are guaranteed to execute and they can make the whole transaction fail, reverting any changes of previous actions of the same transaction. (A transaction is a list of actions executed in the same block.)

Deferred Communication -
Deferred actions are actions being scheduled by a contract to be executed at some time in the future. The biggest difference to inline actions is that they are not even guaranteed to run. The transaction could as well just be dropped by the nodes. Also if they fail, the transaction scheduling the deferred action is not reverted. In fact, there's no way to revert them, they were already applied to the blockchain in a previous block at the time the deferred transaction is executed. Deferred transactions can also be canceled from code again.
Deferred actions get scheduled to run, at best, at a later time, at the producer's discretion. There is no guarantee that deferred action will be executed.



[20]*Communication Model*

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[2]-https://www.finmarketguru.com/microfinance-institutions-work/
[3]-https://www.sup.org/books/extra/?id=28408&i=Introduction.html
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[7]-https://www.smartcampaign.org/storage/documents/what_happens_to_microfinance_clients_who_default_eng.pdf
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[15]-https://dharmaprotocol.github.io/developer-docs/#/?id=relayers
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[18]-http://mifosx.openmf.org/Mifos%20website/mifos.org/functional-specifications/system-processing/interest-calculations-loan-accounts.html
[19]- https://cmichel.io/deferred-transactions-on-eos/
[20]-https://developers.eos.io/eosio-cpp/docs/communication-model

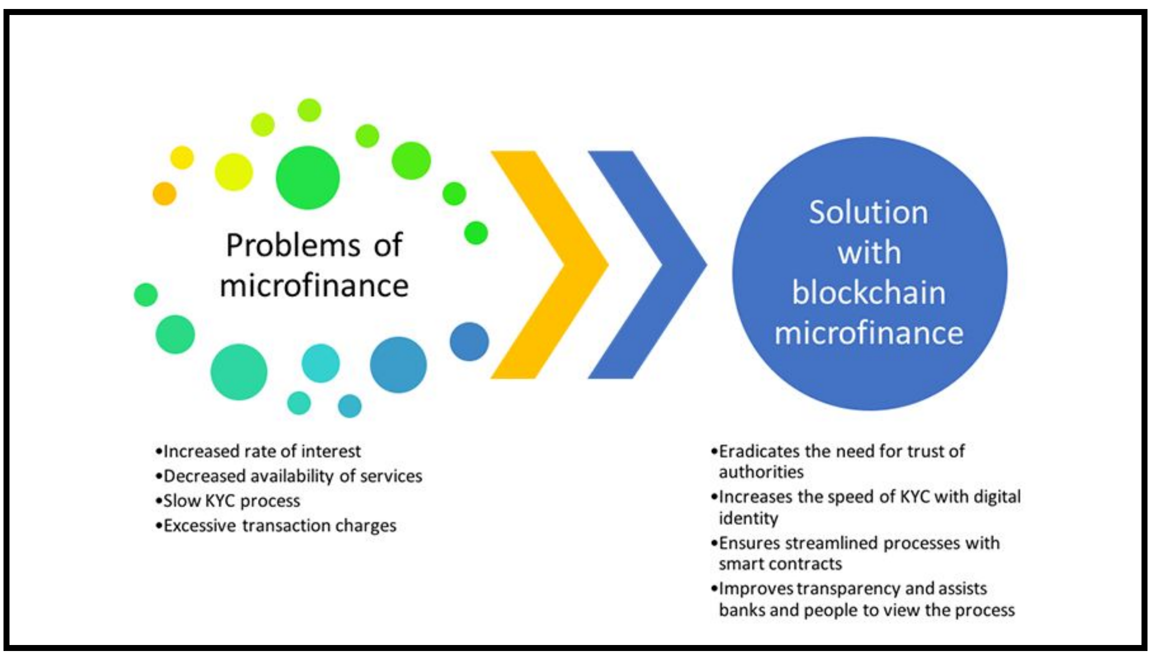
ADDITIONAL INFORMATION -

Max Limit of MFIs loan - 25000
Min for bank loan- 50000

Microfinance Benefits:
Priority Sector Lending is an important role given by the Reserve Bank of India (RBI) to the banks for providing a specified portion of the bank lending to a few specific sectors like agriculture and allied activities, micro and small enterprises, poor people for housing, students for education and other low income groups and weaker sections

Regional Rural Banks are local level banking organizations operating in different States of India. They have been created with a view to serve primarily the rural areas of India with basic banking and financial services

Where Cooperative banking is retail and commercial banking organized on a cooperative basis. Cooperative banking institutions take deposits and lend money in most parts of the world.



NABARD: National Bank for Agriculture and Rural Development

Major Objectives:

1. Fulfilling all credit needs of agricultural and rural development.

2. Providing refinancing facility to RRBs, Co-Operative banks, State governments for this purpose.

3. Promotes R&D in agriculture and rural development sector.

4. Promotes rural and cottage industries by providing loans to Co- operative banks.

SIDBI: Small Industries Development Bank of India

Major objectives:

1. promoting MSMEs by refinancing commercial and co-operative banks.
2. Credit guarantee fund trust for micro and small industries (CGTMSE) is an associate scheme of SIDBI.
3. **MUDRA** (Micro Unit Development and Refinance Agency) and **SVCL** (Sidbi Venture Capital limited) are subsidiaries of SIDBI.

The reason why the interest rates are so high is because microfinance institutions borrow from banks with interest rates that range from 12 percent to 15 percent, then spend about 10 percent on high costs, 5 percent to protect against high risk of default, 2 percent to 5 percent for supplemental support products such as insurance, and 5 percent to 10 percent for returns for investors.

Most microfinance institutions in India need to use private equity to raise capital because they are not allowed to collect savings, like traditional banks, as a way to fund loans; therefore, the microfinance institutions have a duty to provide their investors with an adequate return on investment. Capping interest rates at 24 percent could destroy the microfinance industry in India.

List of Microfinance Institutions in India (Name, No. Of Branches, Borrowers) -

- (Bharat Financial Inclusion Limited,1600, 7.3M)
- (Bandhan Financial Services Pvt Ltd, 385, 11M)
- (Spandana Sphoorty Financial Ltd, 586, 4.2M)

The major investors in the parent company of Bandhan Bank are International Finance Corporation , Singapore Sovereign Wealth Fund GIC, Financial Inclusion Trust, North Eastern Financial Inclusion Trust, Bandhan Employees Welfare Trust and Small Industries Development Bank of India (SIDBI).

ADDITIONAL LINKS -

- http://www.bcsbi.org.in/Codes_MSE_lending.html
- https://www.youtube.com/watch?v=3agckYg3hnA
- https://www.bankbazaar.com/personal-loan/microfinance-institutions.html
- https://www.allerin.com/blog/empowering-microfinance-with-blockchain
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