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Cash Management DSS based on System Dynamics for MFIS

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Keywords: *microfinance, decision support system, system dynamics, cash management.*

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Cash Management DSS based on System Dynamics for MFIS

Ritika Singh [α] & Chandan Bhar [σ]

Abstract- All the institutions which share a commitment to serving clients with low-incomes that have been excluded from the formal banking sector are part of the microfinance industry. The Consultative Group to Assist the Poorest (the apex association of international donors who support microfinance) regards microfinance as "a powerful tool to fight poverty" that can help poor people to "raise income, build their assets, and cushion themselves against external shocks". Microfinance institutions (MFIs) have reached well over 100 million clients and achieved impressive repayment rates on loans. Because of the increase in the scale of operations, the concept and practice of microfinance have changed dramatically over the last decade and the microfinance is increasingly adopting a financial systems approach, either by operating on commercial lines or by systematically reducing reliance on interest rate subsidies and/or aid agency financial support.

The objective of this paper is to identify the need of a support system for MFIs, select a domain for developing one such system and suggest an approach to develop the system. The paper introduces the reader to three terms 'Microfinance', 'Cash Management' and 'Decision Support System'. This introduction is necessary as Microfinance is the chosen sector where the need for such a system is identified. Cash management is the chosen domain for which this system will be used. Decision support system is a technology which is used in different industries to develop such a system. The paper further defines the methodology for developing such a system. This methodology describes the tools and techniques which will be used to achieve the goal.

Keywords: microfinance, decision support system, system dynamics, cash management.

I. Introduction

Microfinance industry has assumed great importance in the last decade. This is true not just for India but also globally. This is because microfinance tries to empower the poor through its innovative approaches. Poverty alleviation is the objective of all the underdeveloped nations. But the policies in place do not yield satisfactory result. Microfinance in Bangladesh has shown good performance and therefore it is being replicated all over the world. On the other hand technology is playing a vital role in giving livelihood access to the poor. Even UN has emphasized the role of both micro credit and technology. This paper highlights the use of technology in microfinance to enhance its effectiveness. Decision support systems are often used by the organizations to enhance the performance of the processes involved.

This paper has targeted cash management process for improvement in Microfinance Institutions. As cash is the lifeblood of the business. The paper suggests an approach (System Dynamics) to build the Decision Support System for microfinance. It also helps the reader identify the tool to be used for this purpose. Finally the paper suggests a research methodology for building the system.

II. Microfinance

United Nations Millennium Goals state that by 2015 the number of people living in extreme poverty should be half of what it was in 2000 (World Bank, 2000). The Consultative Group to Assist the Poorest (the apex association of international donors who support microfinance) regards microfinance as "a powerful tool to fight poverty" that can help poor people to "raise income, build their assets, and cushion themselves against external shocks" (CGAP, 2004a). Microfinance – financial services tailored to the poor (Despallier et al., 2011), spans a range of financial instruments including credit, savings, insurance, mortgages and retirement plans, all of which denominated in small amounts (Khavul). Historically, efforts to deliver formal credit and financial services to the rural poor in developing countries have failed. The recent proliferation of innovative microfinance programs has been inspired largely by the belief that such programs reach the poor and have a positive impact (Coleman, 2006 and Mallick, 2012). The United Nations proclaimed 2005 as the "Year of Microcredit" (Coleman, 2006).

Microfinance institutions (MFIs) have reached well over 100 million clients and achieved impressive repayment rates on loans (Cull et al., 2009). Because of the increase in the scale of operations, the concept and practice of microfinance have changed dramatically over the last decade and the microfinance is increasingly adopting a financial systems approach, either by operating on commercial lines or by systematically reducing reliance on interest rate subsidies and/or aid agency financial support (Hulme and Arun, 2009). A few MFIs have implemented best business practices and made transition to fully regulated financial institutions. Many more are in the process of undertaking this transformation or at least considering it

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(Tucker, 2001). Some advocates of innovation say transformation from non-profit to commercial enterprises is the only way to go. It is further believed that this commercialization approach will increase MFIs' operational efficiency, sustainability and the outreach, and decrease the dependency on the donor agencies (Hoque et al., 2011). But the commercialization of MFIs gives rise to the need for new and advanced support systems. (Karmakar, 2008) At present the MFI central system helps in generation of customized management information system (MIS) reports at any desired level of aggregation right down to the most granular level. It also facilitates tracking and monitoring of a customer across multiple relationships.

According to Ly and Mason (2012), now the microfinance promises to deliver poverty alleviation while allowing its providers to be financially sustainable. Also according to Charitonenko and deSilva (2002) at the micro level, MFI commercialization implies institutional progress along a continuum which involves at least progression towards Financial Self-Sufficiency (FSS). FSS is an increasing concern in microfinance and is now widely studied (Stephens, 2005; Hudon and Traca, 2006). Gibbons and Meehan (2000) suggest that FSS is necessary for a MFI in order to obtain the large amount of funds required to reach and benefit truly large numbers of the poor and poorest households.

FSS is defined as the ability of an MFI to cover all actual operating expenses, as well as adjustments for inflation and subsidies, with adjusted income generated through its financial services operations (Gibbons and Meehan, 2000). According to the United Nations Capital Development Fund, "covering financial costs is a necessary hurdle for access to capital markets." Capital availability is a fundamental constraint to the growth of an MFI. Having access to capital markets gives an MFI greater financial freedom and makes an MFI less reliant on donor capital (Brandt et al.). Unless at least 100% FSS is reached, the provision of financial services in the long term is undermined by the continued necessity to rely on donor funds (Ledgerwood, 1998; MicroBanking Bulletin, 2009). Globally, from 2003 to 2007 around 40% of the MFIs (entire sample of MicroBanking Bulletin) had FSS less than 100% (Gaul, 2009).

Indian banking industry has seen reform policies to boost self-sufficiency (Mohan). Such policies have not yet been framed for the Indian MFIs by the Government. Therefore it becomes imperative that the micro level policies at the institution level be framed such that FSS of the MFIs improve further and come at par with the banking sector.

It cannot be argued that delivering small loans to a poor and relatively hard-to-reach clientele (outreach) is inherently costly. However, to say that financial self-sufficiency and deep outreach can be complementary is not to say that achieving both is in any sense easy, a point demonstrated by the relatively small number among thousands of MFIs that have achieved financial self-sufficiency. (Woller and Schreiner; Ylinen, 2010)

According to Stephens (2004) 'Deep outreach' sustainable MFIs have very high level of profitability this is because of their funding structure. These MFIs have the lowest leverage and access the lowest levels of deposits of all institutions (segmented by target market). By funding themselves through equity, the growth strategy (or market reality of access to funds) of these institutions may well rely on re-capitalization through retained earnings. Improvement in FSS without affecting outreach can be achieved by better cash management. It is the task of cash manger to decide optimal financing method for implementation of projects and control cash collection and disbursement on a day-to-day basis (Thierauf, 1982).

Thus this includes answer to following questions:

1. How the funding should be decided?
2. How the revenue should be controlled?
3. How the expenses should be controlled?
4. How the above should be synchronized to achieve improvement in FSS?

Answer to the above questions will lead to establishing policies for the firm. Therefore the next section elaborates on cash management.

III. Cash Management

Cash consists of cheques, drafts, demand deposits and currency. (Chandra, 2008) A firm needs cash to fulfil following motives:

Transaction motive: Some cash balance is required as buffer for the transactions.

Precautionary motive: A firm requires some cash balance to protect itself against uncertainties.

Speculative motive: Firms like to tap profit making opportunities arising from fluctuations in commodity prices, security prices, interest rates and foreign exchange rates.

(Srivastava, 1996) The inherent problem with cash is that ample cash is helpful to meet unexpected adversities and useful to exploit favourable opportunities that may come along from time to time. Furthermore, credit standing of the firm with sufficient stock of cash is strengthened. A strong credit position helps the firm to secure from banks and other sources generous amount of loan on softer terms. However, keeping any excess stock of cash is largely a waste of resources because it is a non-earning asset and the same could be invested elsewhere to earn some income. Here the dilemma is between liquidity and profitability. This dilemma can be resolved by forecasting and regulating cash inflows and outflows. (Pandey, 2010) Cash management is concerned with the managing of:

1. Cash flows into and out of the firm
2. Cash flows within the firm

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3. Cash balances held by the firm at a point of time by financing deficit and investing surplus cash

It can be represented by the cash management cycle (Figure 1).

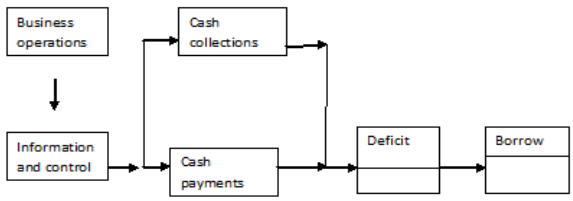

Figure 1 : Cash Management Cycle

The objective of any cash management program should be to increase revenue but at the same time it should help the firm become cash sufficient. This can be done through proper control of cash collections, cash disbursements and determination of minimum cash balance.

(Pandey, 2010)Two of the techniques of cash management are cash planning and cash budgeting. These techniques help to anticipate the future cash flows, need of the firm, reduce the possibility of idle cash balances and cash deficits. Planning consists of setting priorities, initiating program and establishing policies (Thierauf, 1982). Since the current study is about establishing policies therefore cash planning is that effective technique which will be used for building the present system.

Cash is that current asset which is essential for completion of operation in any organisation. It is also the stock which is traded in microfinance sector pointing out to a complex relationship between the fund needed to meet expenses and the fund disbursed by the MFIs. Therefore cash management assumes greater importance. It is imperative that MFIs manage their own cash, as an internal treasury management capacity is essential for institutional survival (Churchill and Coster, 2001).

At present MIS for MFI provides information for better handling of various issues related to cash management. Micrfin 4 is a MIS for MFIs, is a spreadsheet based tool which provides the information necessary for cash planning to the managers (Lunde et al., 2006). A financial self-sufficiency ratio can help the managers to decide when to employ different control mechanisms for regulating cash flows. But this tool fails to report the effect of any regulation on the subsequent cash flow thus making it difficult for the managers to put in place effective control mechanisms. DSS with its advanced techniques can help to resolve such issues. As suggested by (Published search) an effective cash management program should have the ability to perform the following functions:

1. Understand the present cash flow, its nature, timing and source
2. Estimate the pattern of future cash flows

IV. System Dynamics to Build DSS

Sprague and Watson (1993) define DSS as: Computer-based systems that help decision makers confront ill-structured problems through direct interaction with data and analysis models. Present DSS for financial planning, Interactive Financial Planning System (IFPS), includes function that simulates the budget to compute NPV and IRR (Thierauf, 1982). Thus used for cash budgeting. There is no cash planning tool. System dynamics is suggested as an approach to build such a tool. The reasons for it are discussed below.

System dynamics modelling, developed by Professor Forrester of MIT, has proven to be useful tool in the study of the system behaviour. Its initial application was study of the behaviour of industrial systems, where the short-term dynamics of production rates and inventory levels were analyzed. More recently, however, it has been applied to the study of much larger and complex systems where long-term dynamics are important (Stover, 1975).

The system dynamics can be defined as a rigorous method for qualitative description, exploration and analysis of complex systems in terms of their processes, information, organizational boundaries and strategies, which facilitates quantitative simulation modelling and analysis for the design of system structure and control (Wolstenholme, 1990).

System dynamics paradigm is built upon a cross-fertilisation of three diversified disciplines – traditional management of social systems, feedback theory or cybernetics and computer simulation. System dynamics is thus a higher order syncretised construct with a strong interdisciplinary flavour.

It allows one to use a systems approach in visualizing and solving a problem holistically (Coyle, 1977).

Roberts et al (1983) have suggested that the feedback thinking is an important way of looking at and making decisions concerning social, economic, environmental, managerial and political problems. In essence, feedback thinking consists of three concept areas, each of which contributes to the system dynamics view of solving problems.
These are:

1. Thinking in terms of feedback loops - This draws attention to the fundamental causes of the problem under investigation.
2. Thinking over time - This concept implies that feedback system problems are problems that show varying pattern of behaviour over time.

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3. Exploring how system structure, especially feedback loops and time delays, cause change over time.

Merely thinking in feedback terms can reveal that certain systems will probably be stable or unstable. It is urged to explore, how the structure generates behaviour over time. This exploration can either be intuitive or aided by computer simulation.

With the system dynamics approach, a description of the system is developed, based on the modeler's perception and understanding of how the system actually works. The linkages among variables are described fully. The completeness of the description of the system makes it much more useful in understanding the behaviour of the system. When a model is used for policy analysis, it is changed in some way, to simulate the effect of the policy and then used to show the new behaviour of the system (Stover, 1975).

A "Management system" is simply a regularly interacting group of people, machines, etc., whose activities involve allocation and control of the resources of the organization. System dynamics simulation models can be constructed to study the information-feedback characteristics of "management systems" to show how organizational structure, response to information, and time delays to influence results (Veit, 1978).

The present accounting or financial model, whether optimizing or simulating, includes a surrogate for the environment in the form of a few exogenous variables, their behaviour and interrelationships is not understood. A closed loop simulation technique of system dynamics offers added advantages in modelling the environment as a closed system, the results of which can be used to study the open sub system within it. The system dynamics methodology provides insight into the working of the system, using computer simulation as a tool of analysis.

Coyle (1977) has stated that the system dynamics study is to find policies which will control the firm effectively in the face of shocks which will fall upon it from the outside world. The system dynamics study has two fold objectives. Such as,

1. Explaining system behaviour in terms of its structure and policies.
2. Suggesting changes to structure, policies, or both, this will lead to an improvement in behaviour.

Kumar and Vrat (1989) have suggested the following seven stages in approaching problem from a system dynamics point of view.

1. Problem identification and definition.
2. System conceptualization
3. Model formulation
4. Analysis of model behaviour
5. Model evaluation
6. Policy analysis
7. Model use or implementation

The Figure 2 shows the research methodology adopted for the current study.

V. A Short Note on the Tools to be Used

The tools which have to be used in the process are I THINK and SPSS. I THINK can be used as it not only helps in drawing and simulating of the stock-flow diagram but also helps in creating the interface for business purpose. Two of the most popular system dynamics tools are I THINK and Stella but Stella is only for understanding the model it is not used for the business purpose. Since this work is about creating a DSS for the business managers therefore I THINK has been used. Secondly SPSS has been used for forecasting the future values of some of the variables based on the regression equation as this is difficult to achieve in I THINK as it only uses extrapolation for predicting future values.

According to Rizzoli and Young (1997) following are the modelling and simulation tools for DSS:

1. Modelling languages (SIMULA)
2. Tools for scientific calculus (MATLAB)
3. Visual simulation environments, based either on systems theory or on the world dynamics or system dynamics approach to modelling (STELLA, iTHINK)

With the advent of graphical user interfaces for common operating systems, "visual programming" has become the norm. Data visualisation is provided, and models are designed "visually" by connecting blocks and aggregating them at different levels of resolution. STELLA and iTHINK are such softwares (Rizzoli and Young, 1997). Seeing the picture one can "get operational" about levers to pull such that the performance changes (Systems thinking and the iTHINK software). Users can drag model components (including state variables, rate variables, and connections) to build a SD model. These softwares not only display simulation results with graphics and tables but also with animation. Users can input model parameters with graphical controls, and simulation results are displayed by animations or controls. (Zhnag et al., 2011).

Zhnag et al. (2011) suggest that at present, the commonly used SD softwares are DYNAMO, STELLA, iTHINK, Powersim, and Vensim. Costanza and Voinov (2001) present a tabular comparison of these softwares. It suggests that the user-friendliness and learning curve are highest for I THINK/STELLA and Vensim. Notes on Vensim-Stella (Vensim-Stella) suggest that a typical group of science students might end up with 40% choosing Vensim and 60% choosing Stella. Dimauro et al. (2007) indicate that STELLA employs the object oriented technique using the notation of Forrester which was based on the DYNAMO simulation language.

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According to Ouyang (2008) STELLA and i THINK are commercial software packages by I see systems. They use an iconographic interface to facilitate construction of models and then assigning the appropriate values, mathematical functions to the system. The key features consist of the following four tools:

1. Stocks, which are the state variables for accumulations. They collect whatever flows into and out of them.
2. Flows, which are the exchange variables and control the arrival or the exchanges of information between the state variables.
3. Converters, which are the auxiliary variables. These variables can be represented by constant values or by values depending on other variables, curves or functions of various categories.
4. Connectors, which are to connect among modelling features, variables, and elements.

STELLA is primarily used by educators; I see offers I THINK for business simulation. Thousands of individuals and organizations in over 80 countries use I see software to gain insight and shared understanding of environmental, financial, organizational, biological, chemical, mathematical, humanistic, and other systems (I see systems, 2012).

Schulstad (1997) describe the internal working of I THINK software. I THINK is based on a continuous simulation modelling strategy, described through differential equations calculating the time of regulation of control variables causing state variables to change. The time of regulations (Δt) in the simulation algorithm is used to approximate an idealized continuous curve, using the method of Eulers or Runge-Kutta. I THINK first calculates the initial state, including start-up data for state variables corresponding to a Stock in the system, along with constants including exogenous variables represented in I THINK's Converter symbol. From this information it computes all intermediate converter variables, which in turn determine the control variables, corresponding to the Flow regulator. The flow regulator multiplied by the time increment Δt increases or decreases the stock and determines new state values for the next point in time. This time step through the model simulates the causal linkage among all elements identified in the decision support model.

I THINK can be used for following functions:

1. Reduce the risk of policy or process change
2. Identify key leverage points for improving business performance
3. Build models that simulate your business
4. Create what-if scenarios for decision support
5. Develop shared understanding across functional teams (Isee systems, 2013)

(ATUL) From the simulation of iTHINK model, data are collected as if a real system were being observed. This simulation- generated data is used to estimate the measures of performance of the system. New policies, operating procedures, decision rules, information flows, organizational procedures, and so on can be explored without disrupting ongoing operations of the real system.

It should be emphasized that it is impossible to describe the dynamics of socio-economic processes by a single empirical equation or classical formula in I THINK due to complexity of issues. With regard to this, a set of empirical equations were developed based on different combinations of input variables. Factors were processed to retrieve regression analyses using the SPSS statistical software (Feng et al., 2013).

Advances in system modelling software, such as STELLA/ I THINK provide a user friendly tool for constructing and simulating a corporate system (Hall, 1999). Therefore the DSS for cash management of Indian MFIs model will be built using the ITHINK simulation language. We follow in this path for two reasons. First, graphical models seem to us to be easier to understand initially. Second, I THINK makes it easy to create a simulation using a graphical model. The simulation then makes it possible to study the implications of the model under a variety of circumstances. The methodology further employs SPSS for future prediction of variables using regression equations.

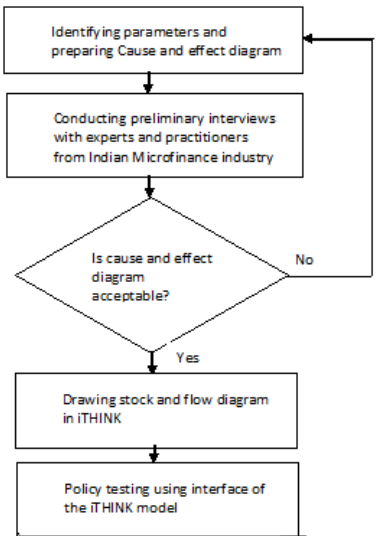

Figure 2 : Above is the proposed research methodology

VI. Conclusion

The paper establishes need of a DSS in Microfinance sector. This DSS is proposed for cash management in the MFIs. Further the paper elaborates on the cash management. Finally, the paper proposes System Dynamics to build DSS. It elaborates on the benefits of using this technique. The paper compares tools to build the system dynamics model and

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recommends I THINK software for this. At the same time it proposes a research methodology to build the model.

The implications for future research are that the methodology can be used to build the model. This model would be used for policy testing. System dynamics based DSS can help in simulating the cash planning and thus help in visualizing the effect of changes in the policies which is not possible with any of the existing systems. Such a tool will help in avoiding the problems like AP crisis at the policy level. As the microfinance is a new field and HR is mostly recruited from the banking industry therefore their experiences are limited. This software will be a learning tool for them.

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