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A COMPUTATIONAL FRAMEWORK TO SUPPORT SOCIAL ENTREPRENEURS IN CREATING VALUE FOR RURAL COMMUNITIES IN INDIA

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ABSTRACT

Over 250 million people in India currently lack access to basic services needed to live a rudimentary lifestyle. Most of these people reside in rural parts of the country. Lack of employment, economic opportunities, and development in rural areas are foundational to low socio-economic levels in these communities. Added to this are environmental issues such as natural resource depletion, yearlong droughts, climate change. We hypothesize that social enterprises developed at the community level can improve the quality of life of people in rural India.

The lack of access to investment and resources to identify and develop social enterprises are major challenges for the creation of social enterprises. We hypothesize that a successful partnership between two major stakeholders, namely, social entrepreneurs and corporate social responsibility (CSR) investors is the key in developing multiple social enterprises to foster rural development. However, CSR and other investors require quantitative information along with impact evaluation of the value proposition before investing. Social entrepreneurs lack tools to develop and present value propositions for the village in a quantitative form .In this paper, we propose a computational framework to fill this gap and to facilitate dialog between CSR investors and social entrepreneurs that may result in a mutually favorable investment.

KEYWORDS

Sustainable Development, Social Enterprise, System Dynamics, Baseline Sustainability Index

GLOSSARY

Drivers of sustainable development: People (social), Planet (environmental) and Profit (economic)
Index: An overall value calculated for a driver or aspect
Indicator: Indicator represents sub-parts of a driver. Multiple indicators added together become an Index
Construct: A basic model/method that is developed as a structure.
Tool: Tools are used for direct implementation to solve a problem. Basic constructs a modified to fit the problem at hand. This modified version is considered as a tool
Social Enterprise: An enterprise with the aim of solving social problems or effecting social change
Sustainable Development: Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Opportunities for People to make a Profit with conscious usage of Planet.
Value Proposition: A service or feature intended to make a company or product attractive to customers

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1. FRAME OF REFERENCE

Enterprises and industries have played a crucial role in improving the quality of life of the people around them. In the last two centuries, multinational companies have contributed to the increase in GDP of countries drastically. This increase in GDP has bypassed rural areas resulting in drastic inequity in standards of living. The government of India has embarked on a policy of inclusive growth.

In India, one of the fastest growing developing economies in the world, 800 million people live in rural areas and of those 270 million continue to live in poverty [1]. Weerawardena and co-authors [2] suggest that social enterprises need to be anchored in the sustainability drivers for long-term survival and growth. According to these authors, "the role of the social mission goes hand in hand with the sustainability of the organization. Sustainability resulting from a balance of the entrepreneurial drivers of innovativeness, proactiveness and risk management is not seen as an end, but sustainability is focused on ensuring the continuation of the organization because of its social mission."

The challenges such as lack of proper education, health care, housing, sanitation, electricity, droughts, and floods continue to be the blockades for development in rural areas. Further, the replication of strategies embodied in industrialization and globalization for rural development are not appropriate. Therefore, for rural areas we suggest a modified approach, namely, creating micro-enterprises focused on eradicating poverty and catalyzing rural development by creating social value. The challenges faced by social entrepreneurs in creating social enterprises and the gap in the literature is presented in Section 1.2. For a critical review of the literature and the rationale underlyiing what we present in this paper see by Yadav [3].

1.1 Social vs Business Entrepreneur

A social enterprise plays a key role in uplifting the condition of the poor and facilitating community development [2]. Social entrepreneurs provide appropriate leadership that results in achieving a sustainable advantage, thereby achieving their social mission [2]. In Table 1, developed by Cisco IBSG, 2011, the differences between a business and social entrepreneur are shown.

TABLE 1: SOCIAL VS BUSINESS ENTREPRENEURS

	Business Entrepreneurs	Social Entrepreneurs
Goal	Capture a market securely	Fill a market gap; change the world
Objective	Build a business; earn profits	Create sustainable solutions for social change
Profit motive	Maximize shareholder value; profit as an end	Advance social aims; profit as a means to financial sustainability
Risk	Basic business risk	Basic business risk plus social aspect
Link to social problems	Indirect	Direct
Feedback	Established consumer and market information sources	Need to be creative in obtaining market and responses
Competition	Win" for one business over others in a market	Exists because no one else is adequately solving problem, "win" for society
Growth	Competitive for one company	Collaborative for societal impact
Capital	Benefit from robust financial managerial services	Contend with unpredictable and fragmented financing

Social entrepreneurship is defined as one of the ways to address the social needs by creating solutions that have social value [4, 5]. Social entrepreneurs are those who create a not-for-profit solution to address a social need. As shown in the Table 1 a business entrepreneur seeks to capture and retain/grow market share whereas a social entrepreneur seeks to fill a market gap and bring about social change. For social entrepreneurs, the motive is social change and creating social value. For business entrepreneurs, the motive is to make a profit, and in this process, if they create social value, it becomes an added advantage. The difference is between the goals that each of the entrepreneurs has for their enterprises, the growth path they choose and the profit motives they have. For example, SunMoksha, a social enterprise is working towards sustainable rural development. SunMoksha's strategy is to provide solutions based on resources that are available in rural areas to address socio-economic development. SunMoksha's social development model is presented in Figure 1. Intelligent assets such as Nanogrid™ for smart electricity, AQUAnet™ for precision agriculture, cold room, etc. are deployed with the aim of improving the quality of life of the residents in a rural community that promotes employment and empowers the residents to become micro-entrepreneurs. Employment of the current generation, so that the next generation can be Educated and thereby Empowered to increase and sustain the socio-economic development of the rural community. Therefore the primary question that we address is:

> "How can ***limited resources*** be used to ***empower people*** living in rural communities in India to continue improving their quality of life by addressing the inequities associated with the nexus of the three drivers of sustainable development, namely, ***people, planet and profit***?"

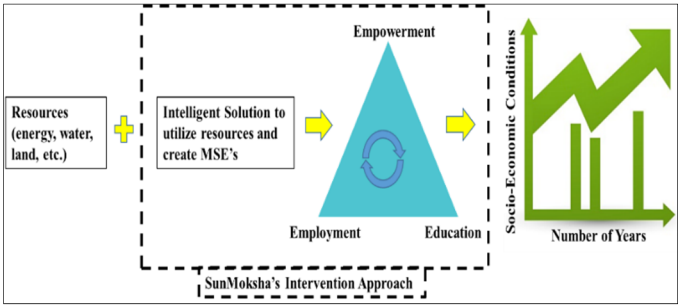

FIGURE 1: SUNMOKSHA'S SOCIAL DEVELOPMENT: THREE E'S FOR SOCIAL-ECONOMIC DEVELOPMENT

1.2 Gap Analysis

We suggest that sustainable rural development necessitates the development of Micro Social Enterprises (MSE's) focused on improving the quality of life of people in the rural community and spurring the growth of micro-entrepreneurs in it. We recognize that people in rural communities invariably lack business and management skills and find it difficult to attract investmentl [6].

In 2013, the government of India enacted Section 135 of the Indian Companies Act prescribing a mandatory CSR spend of 2% of average net profits during the three immediately preceding financial years for all companies meeting specified financial thresholds [7]. This has fostered partnerships between social entrepreneurs, CSR investors and the government to undertake projects to irradicate poverty in rural India. However, as described by Dr. Ashok Das[3] a social entrepreneur there is a need for a tool to facilitate a dialog between social entrepreneurs and CSR investors. CSR and other investors require quantitative information along with impact evaluation of the value provided by MSE's before investing. A critical review of the literature is presented by Yadav[3].

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2. THE PROPOSED COMPUTATIONAL FRAMEWORK

We have learned from Asok Das and his fellow social entrepreneurs that there is a need for some means for the social entrepreneur and the investors to dialog and arrive at a mutually acceptable solution. Our goal in this paper is to introduce the readers to a computation framework that is easy to use, systematic in intialiting a dialogue between the CSR investors and social entreprneuers to increase the pace in rural development projects.

The proposed computational framework, presented in Figure 2, embodies a systematic step by step process for social entrepreneurs to develop a value proposition and evaluate its *expected* impact. The framework embodies three constructs (used as tools) that are developed for social entrepreneurs to *identify* the gap/area of focus, *create* a value proposition, and *evaluate* its impact towards rural development. The flow of information in the framework is as follows. First, a social entrepreneur performs a baseline assessment of the village where she/he wants to start a social enterprise; see Step1. The baseline assessment is anchored in the 3 P's[4] that are foundational to sustainable development. Based on the assessment a social entrepreneur identifies the areas of inequity present in a rural community. In Step 2, the social entrepreneur evaluates this inequity from different perspectives to identify dilemmas/conflicts that lead to the generation of one or more value propositions; information on how to identify dilemmas is presented in [8] and in the interest of brevity is not presented here. Once a social entrepreneur has developed the value proposition, the next step is to evaluate the expected impact of the value proposition in terms of social, environmental and economic drivers on the rural community; see Step 3. On completion of Step 3, a social entrepreneur is in a position to share various proposals with the investors and demonstrate the impact the investment would have on the rural community; The framework functions as a "living document" serving as a means for a social entrepreneur and the investors to dialog and arrive at a mutually acceptable solution.

The three constructs presented in Figure 2 are developed as part of the proposed framework. These constructs are developed to be used as tools by social entrepreneurs. The constructs developed are as following:

1. The Village Level Baseline Sustainability Index (**VLBSI).** This index is used to identify the inequity in the village by giving current values of different indicators that represent a village. Value is calculated in terms of drivers of sustainability (social, environment and economic).
2. Dilemma Triangle Approach. Includes steps for the development of value propositions for consideration by investors, social entreprenuers, villagers [8].
3. Village Level System Dynamic (**VLSD)** Model. This model is developed and used as a social impact assessment tool to evaluate the expected outcome of any value proposition.

The method for developing the value proposition is presented in [8] and is not repeated here. In this paper, we discuss the Village Level Baseline Sustainability Index (Construct 1) and social impact assessment construct developed using system dynamics, Village Level System Dynamic model (Construct 3). In Section 3, a review of the literature on baseline assessment index is presented. How baseline assessment can be used in directing attention towards the right value proposition is also discussed. In Section 3.1, the Village Level Baseline Sustainability Index (VLBSI) is introduced. Anchored in adaptability and reusability, the working principle of the index is presented. In Section 4, for VLSD, the relevant theory on social impact assessment is presented. The gap in the current literature on social impact assessment is identified. In Section 4.1, the use of System Dynamics to fill the gap is discussed and the VLSD model is presented in Section 4.2. In the same section, the working of the model is illustrated. We take example of a village to show the utility of VLSD construct. In Section 5, our commentary is aimed at identifying a way forward. Closing remarks are in Section 6.

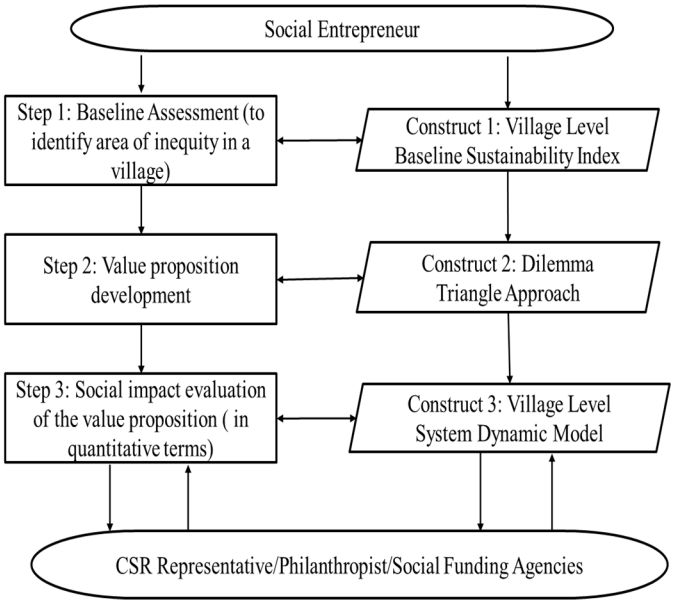

FIGURE 2: PROPOSED FRAMEWORK FOR VALUE PROPOSITION DEVELOPMENT AND IMPACT EVALUATION (VPIE)

3 BASELINE ASSESSMENT INDEX Figure 2 Construct 1

The main goal in baseline assessment is to identify the present status/condition of a rural community. To create sustainable social value, social entrepreneurs need to garner information in the context of the three drivers, namely, people (social), planet (environment) and profit (economic), of sustainable development. Baseline assessments are designed to decide when and what kinds of interventions are needed [9]. Baseline assessments are also used by social entrepreneurs in identifying inequities that warrant attention in a rural community [10]. Wallace [11] suggests that finding inequities in a community helps highlight specific issues and identify the areas of focus. Solveig and Judith [10], present a framework for baseline assessment. Other authors also present a step by step guide to creating different baseline assessment tools. The framework presented in the literature is generic, adaptable by different organizations and stakeholders for baseline assessment [10]. The VLSBI presented in this paper is built upon the framework presented by Solveig and Judith [10]. The working principle of Solveig and Judith's framework is taken for VLSBI and developed for rural communities.

Challenges faced by social entrepreneurs include collecting the right information that is easy to evaluate and is understood by all stakeholders, transforming qualitative information into the quantitative form and evaluating this data to arrive at a baseline assessment. Since each village is different, the baseline assessment of one village cannot be used for another village. To overcome these challenges, we look at the theory of indices and indicators. Indices have been used to measure various international, national, local characteristics related to human

[4] People, Planet and Profit

lives (Wellbeing Index, Human Development Index, Sustainable Nation Income, etc.) [12-14]. Indices have been used to rank countries in terms of their annual growth, unemployment rate, environmental degradation, etc. United Nations has been using indices and associated indicators to calculate sustainable development progress at international and national levels [15].

Indices and their indicators are popular in the field policy evaluation [16]. With the use of indicators, the information is calculated in a simple form. Indicators are also used to quantify qualitative information. The collective information from indicators is used to calculate the value of indices. Indices can be developed for different levels – community, sectoral, national and international. Same indices can be reused in different communities, countries with minimum changes.

Indices have been used for sustainability assessment [17]. At the international level, these are developed for comparing one country to other, such as Wellbeing Index, Environmental Sustainability Index (ESI) and Human Development Index (HDI), etc., each providing a different measure for sustainable development. To measure sustainable development at the national level, few indices that are developed are, Sustainable National Income (SNI), Adjusted Net Saving (ANS).

All the proposed indices are at either international, national or urban level or project specific. Social entrepreneurs need an index to measure the sustainability of an intervention at the village/community level. The indices at the national, urban level for sustainability assessment are different from the indices that can be used at the local level. Rural communities are distinct from urban communities in terms of economic growth, the standard of living, social interactions and environmental variables [18, 19]. We concluded that the indices that are currently available in the literature are inadequate to be used as a baseline assessment tool at village level and are inappropriate for social entrepreneurs working for the development of rural communities in India.

3.1 Village Level Baseline Sustainability Index

The first challenge in developing a village level baseline sustainability index is to identify variables that affect the sustainability of a village. The second challenge is based on the variability of villages within the same state and country. Each village is different and developing one sustainability index that can be reused by social entrepreneurs is key. Harger and Meyer [20] suggest some characteristics of a good index. The index must be simple and quantifiable. Added to this, we also include the secondary requirements for our framework for quantifying the village level sustainability index:

1. The village level sustainability index must be adaptable so that a diverse data can be used as input into the index and standardized.
2. The village level sustainability index must be modifiable so that social entrepreneurs can add or delete individual indicators/sub-indicators based on the demographics of a village and still calculate a true sustainability score for the village.
3. The village level sustainability index must be easily applied and understood so that that social entrepreneur can determine the index for a village with minimum difficulty.

The proposed Village Level Baseline Sustainability Index for a village includes all three drivers of sustainability: social, economic, and environmental. Within each driver, the index contains a set of indicators representing the driver; some of these indicators are presented in Figures 4 and 5. The number of indicators varies between the drivers and can be changed by the social entrepreneur depending on the characteristics of the village. As presented in Figure ***3***, at the lower level, each indicator consists of sub-indicators that add value that particular indicator, that is, there are three "layers" of calculations; sub-indicators, indicators, and drivers. Equations 1, 2 and 3 used to quantify the village level sustainability index follow:

- SOC = Social Indicators
- ENV = Environmental Indicators
- ECO = Economic Indicators
- a = total number of social indicators
- b = total number of environmental indicators
- c = total number of economic indicators

$$\frac{SOC1 + SOC2 + \cdots + SOCa}{a} = SOC \qquad \text{Eq 1}$$

$$\frac{ENV1 + ENV2 + \cdots + ENVb}{b} = ENV \qquad \text{Eq 2}$$

$$\frac{ECO1 + ECO2 + \cdots + ECOc}{c} = ECO \qquad \text{Eq 3}$$

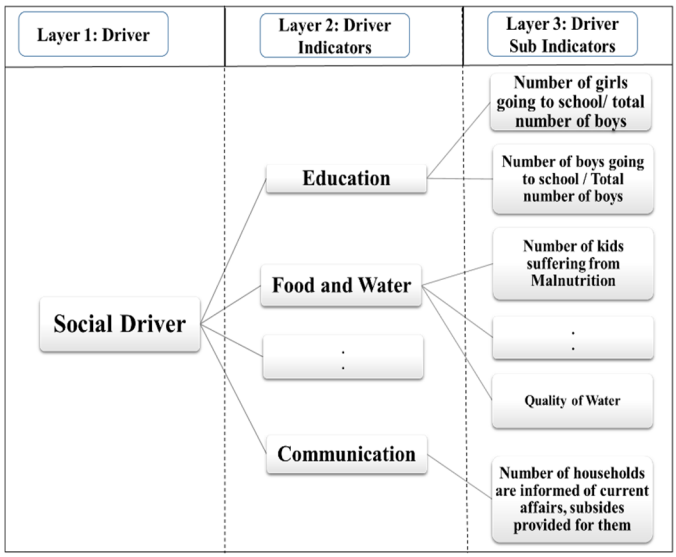

FIGURE 3: LAYERS IN VLSB INDEX

The preceding equations provide averages of the indicators for each driver of sustainability. To make the results from the VLSBI easy to understand, the result is presented on a 0 to 10 scale, with 0 being the least desirable and 10 being the most desirable. The range of the scale is arbitrary and could be changed to 0 to 5 or 0 to 100 as desired by social entrepreneurs. The index must be based on the data that social entrepreneurs collect when surveying a village.

In the proposed index, social entrepreneurs have the freedom to "weigh" each indicator and sub-indicator based on the indicator 's significance in a village towards sustainability. In, the "Weight for each indicator" Column C3, Figure 4 and Figure 5, is where the social entrepreneur can adjust the weight for each indicator. The weights are given as a fraction of 1, and the total weight MUST add up to 1.

The indicators presented in Column C1 of Table 1 and Table 2 are the indicators that are developed for social, environmental and economic drivers, respectively. For a village, there can be many indicators that represent social, environment and economic driver. The indicators mentioned in Table 1 and Table 2, are exemplars developed to illustrate the efficacy of the proposed framework. Social entrepreneurs can add or remove indicators based on the characteristics of the village. For example, a social entrepreneur can add 'Crime Rate' as an

indicator of the social driver for a given village. The only rule to remember is the weights of all the indicators combine MUST add to 1.

The VLBSI, social driver in this example consists of six indicators that are mentioned in Table 1. Weights for each of these indicators are assigned by the social entrepreneur. Each indicator consists of multiple sub-indicators. Sub-indicators examples for '***Education Indicator'*** of ***'Social driver***' are presented in Figure 4. The value for each indicator is based on multiple sub-indicators. Each sub-indicator is also assigned some weight; total weight added must be 1. As shown in Figure 6, the values in Column C4 and Column C6, for each sub-indicator are assigned by social entrepreneur. Similar to indicators (Figure 4 and Figure 5), the sub-indicator for the index are selected and developed to collect maximum information and can be modified by the social entrepreneur, based on the data available from the village.

The value for the environment driver and the economic driver is calculated in a similar manner to the social driver. Calculations and sub-indicators of the environment and economic drivers are not included in this paper in the interest of brevity. Details are provided in Yadav [3].

3.2 Graphical Representation of VLSBI

Once the value for the indicators is calculated, the results for each driver are presented in easy to read and understandable format. In the proposed VLSBI, the output of the drivers and overall index is presented in graphical form as well as tabular form. The best way to analyze and compare many values on the same scale is by utilizing spider diagrams. The final value of each indicator of the social, environmental and economic drivers in Table 2 and

Table ***3*** (Column C4) is presented as a spider diagram in Figure 5. Such pictorial representations are useful to visually identify the inequity in any driver of a village. For example, based on the information represented in Figure 5, we can say the lowest area in the social driver of a given village is '***Communication***' with a value of 0.89/10. The value of Health is 0/10 because data was not available, and therefore is not considered as an area with the lowest score. From this information, social entrepreneurs can choose to investigate more on ***Communication*** or ***Sanitation and Hygiene*** (1.43/10) of the village.

Similarly, the spider diagram for the environment and economic driver are also developed and presented in Figure 5. In Figure 6 a graphical representation of the overall sustainability of the village is presented. The values in Figure 6 are representative of each driver. The value is obtained by summing up all the indicators of the driver. From Table 2 and

Table **3**, the value in the last row of Column C4 (Right and bottom most) the final values of baseline for each driver (social, environment, economic) is taken and presented (Figure 6) in graphical format. Similar to a specific driver, this representation is useful in identifying the driver that has the lowest value among all the three drivers. Based on the value represented in Figure 6 the lowest value is achieved for social driver 2.86/10.

TABLE 2: SOCIAL DRIVER INDICATORS AND THEIR CALCULATION

	Social Indicators (C1)	0-10 scale value * (C2)	Weight assigned for each indicator (C3)	Each indicator score corrected by weight assigned (C4)
SOC 1	Education	1.67	0.18	0.30
SOC 2	Electricity	6.58	0.18	1.18
SOC 3	Food/Water	5.71	0.18	1.03
SOC 4	Sanitation	1.43	0.18	0.26
SOC 5	Health	0.00	0.18	0.00 (Data not available)
SOC 6	Communication	0.89	0.10	2.86
	Total		1** Column sum must add to 1	2.86 = Social Driver score

TABLE 3: ENVIRONMENT DRIVER INDICATORS (LEFT SIDE), ECONOMIC DRIVER INDICATORS (RIGHT SIDE) AND THEIR CALCULATION

Environment Indicators (C1)	0-10 scale value * (C2)	Weight assigned for each indicator (C3)	Each indicator score corrected by weight assigned (C4)
Agriculture	4.67	0.14	0.67
Animal Husbandry	2.00	0.14	0.29
Aquaculture	5.43	0.14	0.78
Energy Usage	5.71	0.14	0.82
Environmental Quality	8.60	0.14	1.23
Environmental Degradation	5.71	0.14	0.82
Natural Human Disaster	6.50	0.14	0.93
Total		1** Column sum must add to 1	5.52 Environment Driver Score

Economic Indicators (C1)	0-10 scale value * (C2)	Weight assigned for each indicator (C3)	Each indicator score corrected by weight assigned (C4)
Income Stability	6.21	0.25	1.55
Income Disparity	7.05	0.25	1.76
Economy Structure	4.32	0.25	1.08
Employment Structure	6.76	0.25	1.69
Total		1** Column sum must add to 1	6.09 Economic Driver Score

Assigned by the Social Entrepreneur/CSR

Education		C1	C2	C3	C4	C5	C6	C7
Sub-Indicators		Number of children attending school	Total number of boys/girls in the village for each sub-indicator	Current percentage of children attending school [(C1)/(C2)*100]	Target percentage of children attending school	Conversion to scale of 0-10 (C3)/(C4)*10	Each sub-indicators weightage	Value of sub-indicator toward Indicator [(C5)*(C6)]
1.1	Boys of age 6-13 attending primary school	20	30	66.67	100.00	6.67	0.12	0.80
1.2	Girls of age 6-13 attending primary school	20	30	66.67	100.00	6.67	0.13	0.87
1.3	Boys of age 14-16 attending secondary school	0	33	0.00	100.00	0.00	0.12	0.00
1.4	Girls of age 14-16 attending secondary school	0	33	0.00	100.00	0.00	0.13	0.00
1.5	Boys of age 17-19 attending senior secondary school	0	33	0.00	100.00	0.00	0.12	0.00
1.6	Girls of age 17-19 attending senior secondary school	0	33	0.00	100.00	0.00	0.13	0.00
1.7	Boys of age 18-24 who pursue higher education	0	33	0.00	50.00	0.00	0.12	0.00
1.8	Girls of age 18-24 who pursue higher education	0	33	0.00	50.00	0.00	0.13	0.00
	Total People between (6-24)	40	260		Total Indicator Weight (Must be 1)		1.00	
						SOC1 Indicator Value:		1.67

FIGURE 4: SUB INDICATOR OF EDUCATION INDICATOR (SOCIAL DRIVER)

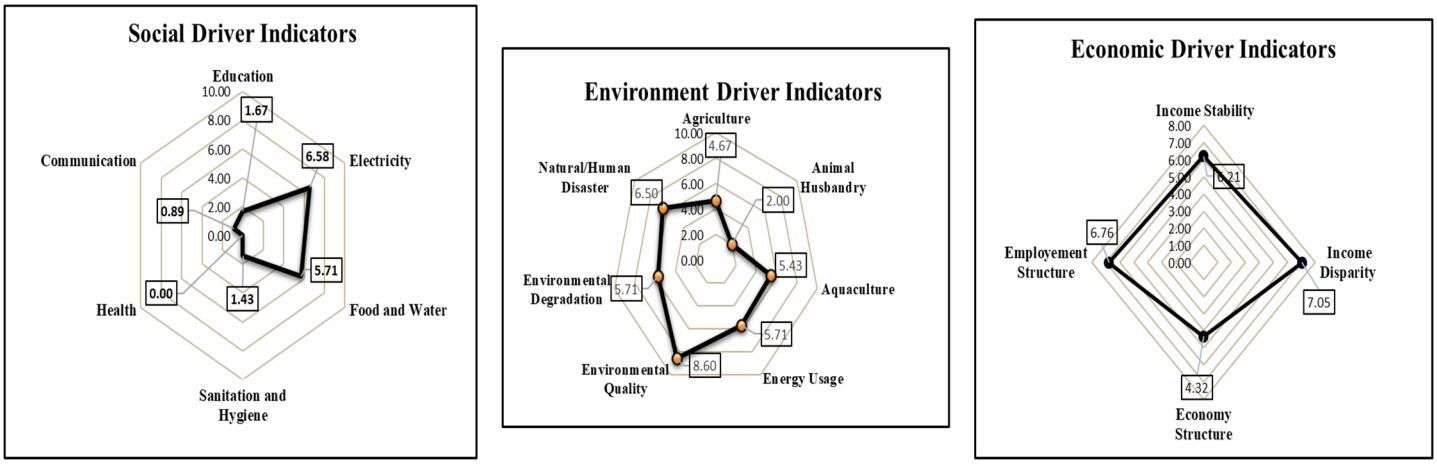

FIGURE 5: SPIDER DIAGRAM FOR EACH DRIVER: SOCIAL (LEFT), ENVIRONMENT (CENTRE), ECONOMIC (RIGHT)

The VLSBI construct presented can be used directly or can be modified to fit the needs of a social entrepreneur, CSR investor. The VLSBI construct provides a quantitative method to present a village in terms of sustainability drivers. The focus here is on providing a VLSB index that is general and flexible for social entrepreneur to focus on indicators that deem important to them and are quantifiable. The number of indicators is proportional to the accuracy of information. Small number of indicators will provide an aggregated global picture and using larger number of indicators will be useful in getting more local image. This decision must be taken by stakeholders involved. Once the baseline value is calculated, the inequity/inequities can be identified in the village and dilemma triangle construct (not discussed in this paper) can be used to develop a value proposition that is tailor made for a specific village. The user of the framework can skip the usage of dilemma triangle if needed and can jump to identifying the *expected* impact of a value proposition (thirds construct of the framework presented in Figure 2) that is developed (Village Level System Dynamic Model). In the next section, a discussion is presented on the need of social impact assessment, the gap identified in current work. VLSD model developed is presented later to be used for impact assessment by social entrepreneurs, CSR investors

4. SOCIAL IMPACT ASSESSMENT
Figure 2 Construct 3

The impact is defined as *'any effect of the service [or of an event or initiative] on an individual or group'* [21]. For social entrepreneurs both phases of impact assessments are crucial. By knowing the impact of a value proposition created, a social entrepreneur can approach the CSR investors/philanthropist and present the expected social impact evaluation of the value proposition proposed.

Social impact assessment is conducted with the perception that decision makers (In our case, social entrepreneurs and CSR investors) will make better decisions if they understand the consequences of their decisions. An accurate social impact assessment will help decision makers in answering various questions such as: "What will happen if a proposed actions were to be implemented – why, when, and where? Who is being affected? Who benefits and who loses? What will change under different alternatives? How can adverse impacts be avoided or mitigated, and benefits enhanced?" [22].

With an increase in the number of social enterprises around the globe, need for methods and tools to calculate their social impact becomes crucial [23]. The nature of social enterprise and value created by it is complex, and understanding this value for the enterprise and all stakeholders is important [24]. That is, if social entrepreneurs can qualitatively show the value that can be created by the success of their enterprise, it is possible to initiate the dialog between CSR investors and them, leading to a successful partnership between both.

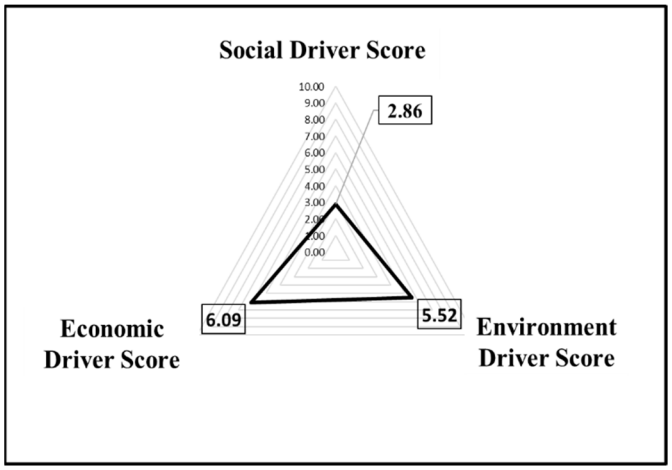

FIGURE 6: GRAPH OF OVERALL SUSTAINABILITY

In order to assess the impact, some social entrepreneurs currently use performance metrics appropriate for business entrepreneurs/ enterprises [25]. However, business enterprises performance metrics are based on the monetary return of investment. This metric therefore is unsuitable for use as a single metric for impact assessment in social enterprises. Although social enterprises have finance as an important aspect for sustainment, the real performance is assessed by the social value that is created. That is, the social value is qualitative, intangible and difficult to measure [25].

One of the most important aspects of a social impact assessment is a comparison of two social interventions [26]. This comparison is helpful for investors (CSR, philanthropists, non-profit government organizations, and different levels of government) to identify the impact of different social programs and rank them in terms of either priority or maximum impact. The institutions can then select one or more programs to support. Challenges, as described by Kroeger and Weber in [26] for comparing social value, are (1) heterogeneity of social interventions, and (2) the social aspect of each community.

The heterogeneity of social intervention calls for a uniform social value construct that meets the need of different social enterprises in measuring social intervention. However, each rural community differs in cultural norms, the resources available and opportunities for investment and economic development these resources provide.

Hence, the need is to create an assessment tool that can be used in different communities with different cultures and different resources.

The gap in the literature on social impact assessment is in how social value is measured. That is, the process to calculate social value created on the implementation of a value proposition, the social initiative is missing. Kroger and Weber suggest a useful set of requirements for a method to calculate the value created in a single unit of measurement [26]. In addition, there is a requirement to understand and identify all the positive and negative impacts of a value proposition, and ease of use.-To understand how one aspect of village interacts with other (for example, how education aspect will affect the overall health aspect of the village), we look at the village from a systems perspective and develop a system dynamics model for the same.

4.1 Village Level System Dynamics Model (VLSD)

We use System Dynamics (SD) to perform social impact assessment; Figure 2, Construct 3. The stock and flow model of System Dynamics is used to simulate the process over a time period. Various city level System Dynamics models have been developed to speculate about the future state of these cities. System dynamics has been shown to be useful in many policy evaluation projects [27-31], however, these models are not reusable. The proposed Village Level System Dynamics model is anchored in filling this gap. The VLSD model is reusable and can be modified to simulate different rural communities' minimum effort.

The Village Level System Dynamics model in its current form is developed as a template of the village. That is, VLSD includes population structure, population segments, education structure for any village. The user (social entrepreneur, CSR investor) of the model needs to add the specific characteristics (birth rate, sex ratio, age segments contribution to births, etc.) of the village/community and value proposition for which the social impact is to be calculated. The steps used to develop the VLSD model are commonly used in the field of systems dynamics and are not discussed in this paper; the steps are described in [3].

4.2 Village Level System Dynamic Model Description (VLSD)

The VLSD model, as discussed before is developed as a template. Description of the full VLSD model is out of the scope of this paper. However, a smaller part of the model is presented in the paper (Figures 10 through 14). The VLSD model presented in this paper is presented into two parts (loops), 1) Village demographics loop (Figures 7, 8 and 9) and 2) Education loop Figures 10 and 11.

4.2.1 VLSD: Village Demographics Loop Figures 7 through 9

The first part of VLSD model is developed to capture the population dynamics of a village at different age groups (presented in Figure 7). Sometimes value propositions are developed for a specific age group, gender. To capture the impact of such value proposition effectively, the VLSD model must be appropriate. Therefore, in village demographics loop of VLSD presented in Figure 7, the projection of population is done in 5 age categories. In VLSD model the population representation for Kids (0-5) years old category, Kids (6-12) years old category, Teens (13-19), Adults (20-49), and Seniors (49+) is done seprately. The village demographics part of the model includes population projection (Figure 7), age-wise literacy rate (Figure 8) and overall literacy of the village (Figure 9). In population projection (Figure 7), the flow of the population from one age category to other age category is also developed. Each stock in Figure 7 represents the number of people in that age category. The data from a village is collected for each category and is added as an initial value for stocks of the particular age category. On simulating this part of the model, social entrepreneurs will get approximate data of population breakdown in different age categories for years to come if the birth and death rate of the community are approximated to real values. The flow of information presented in Figure 7is as follows;

- 'Number of births' in a community is a function of 'Birth rate' and 'Adults'. In some rural communities, families get teenagers married and that also contributes to the number of births in the community. To make it a general model, the number of births in this model is a function of the birth rate from both adults and teens.
- In communities, where teens do not contribute to population increase can change 'Birth rate from teens (13-19) = 0'. The "Number of births" in one simulation round adds X amount of value to "Kids (0-5)", that is the number of kids born are added in this age category.
- Use of 'Ageing rate' variables in VLSD is to move stocks from one age category to another as Time T changes in the model. For example; if a stock is added (child is born) at time T=0 Years in 'Kids (0-5)' stock, at T=6 Years this stock should move from 'Kids (0-5)' to 'Kids (6-12) stock, this movement of stock is modeled using 'aging rate for kids (0-5)'. Similarly, for each stock (age category) in Figure 7 ' aging rate' function is used to model the flow of population.

For each age category of the stock, "Number of deaths" is also modeled. This variable removes X number of people from a given stock. In a community "Number of deaths" depends on various reasons and not each aspect can be modeled. In VLSD "death rate" for each age category is a static value, however, the user can change it based on different variables. For example, the user can model 'death rate' to be a function of the health system of the community. The user can also model "birth rate" in the community as a function of "literate adults (presented in Figure 8)", that is, as the number of literate adults in the community increase, 'birth rate from teens (13-18)' decreases drastically and 'birth rate from adults' decreases slowly.

The population breakdown model is useful in developing the remaining model; for example, given that user knows population of kid's in the age category of 6-12 years, the plan to improve enrollment on the primary school can be done efficiently. Similarly, for age category of 'Teens (13-18),' the planning will be possible on secondary schooling and employment opportunities. The education submodel is discussed in the later part of the section, the value from "Kids (6-12)" and "Teens (13-18)" is taken and education sub-model is developed. The population breakdown model is useful in developing the remaining model; for example, given that user knows the population of kid's in the age category of 6-12 years, the plan to improve enrollment on the primary school can be done efficiently. Similarly, for the age category of 'Teens (13-18),' the planning will be possible on secondary schooling and employment opportunities. The education submodel is discussed in the later part of the section, the value from "Kids (6-12)" and "Teens (13-18)" is taken and education sub-model is developed.

Based on the value obtained from education sub-model (presented in Section 4.2.2), literacy part of village demographics sub-model is developed. This submodel is presented in Figure 8. As there is a different impact of female literacy on education, birth rate and health of the family, the VLSD model is developed to calculate "female literacy" separately. The literacy sub model of VLSD presented in Figure 8 is similar to Figure 7, The stock of literate teens moves to literate adults and literate seniors as time progresses. The value of population and the literate population is also calculated in the model. In Figure 9, the part of village demographics sub-model developed to calculate the population value and total literacy is presented. The calculation is based on the total number of literate people in village by total population of the village. To verify the consistency of the population prediction part of VLSD, the social entrepreneur can take

data from the last two censuses of any village and model the village using this data. After running the VLSD model till next census, the user can verify if the values obtained for the population are approximately close. If the values are approximately close, the VLSD model is said to be internally consistent. In the next section, the Education loop of VLSD is presented.

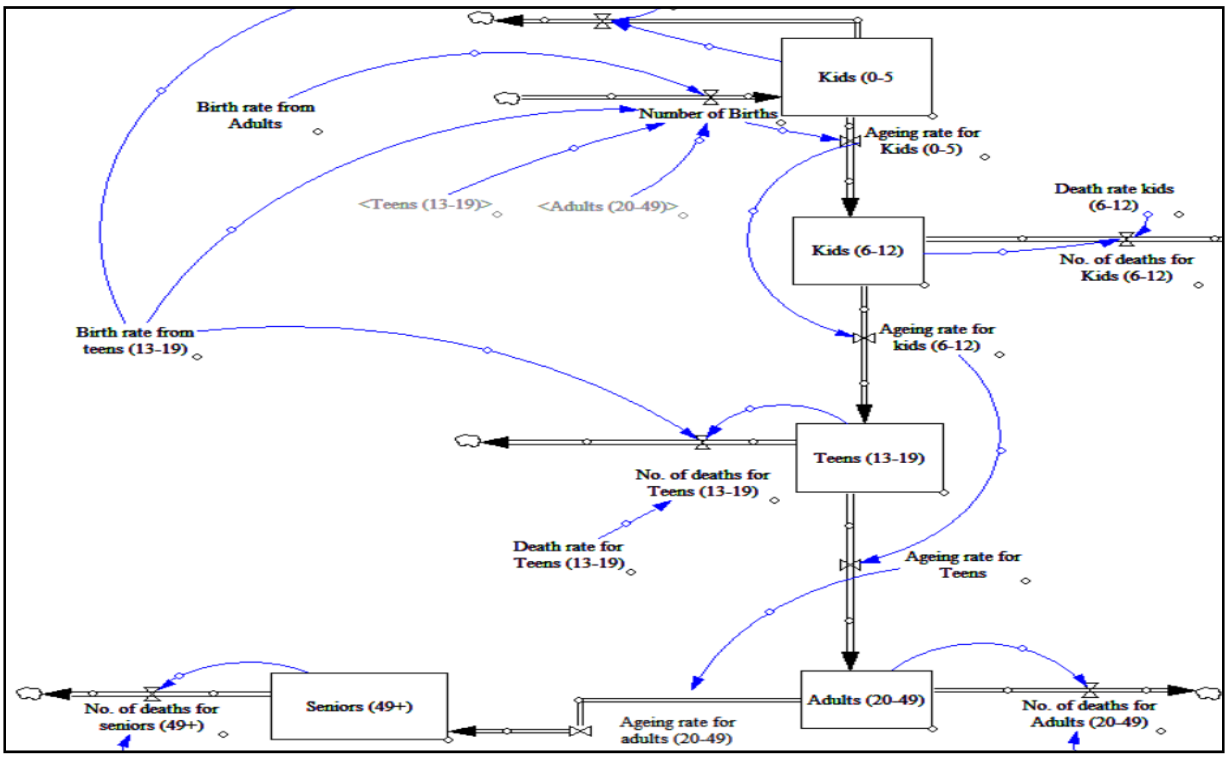

FIGURE 7: VILLAGE DEMOGRAPHICS SUB-MODEL 1 (POPULATION IN AGE - CATEGORIES)

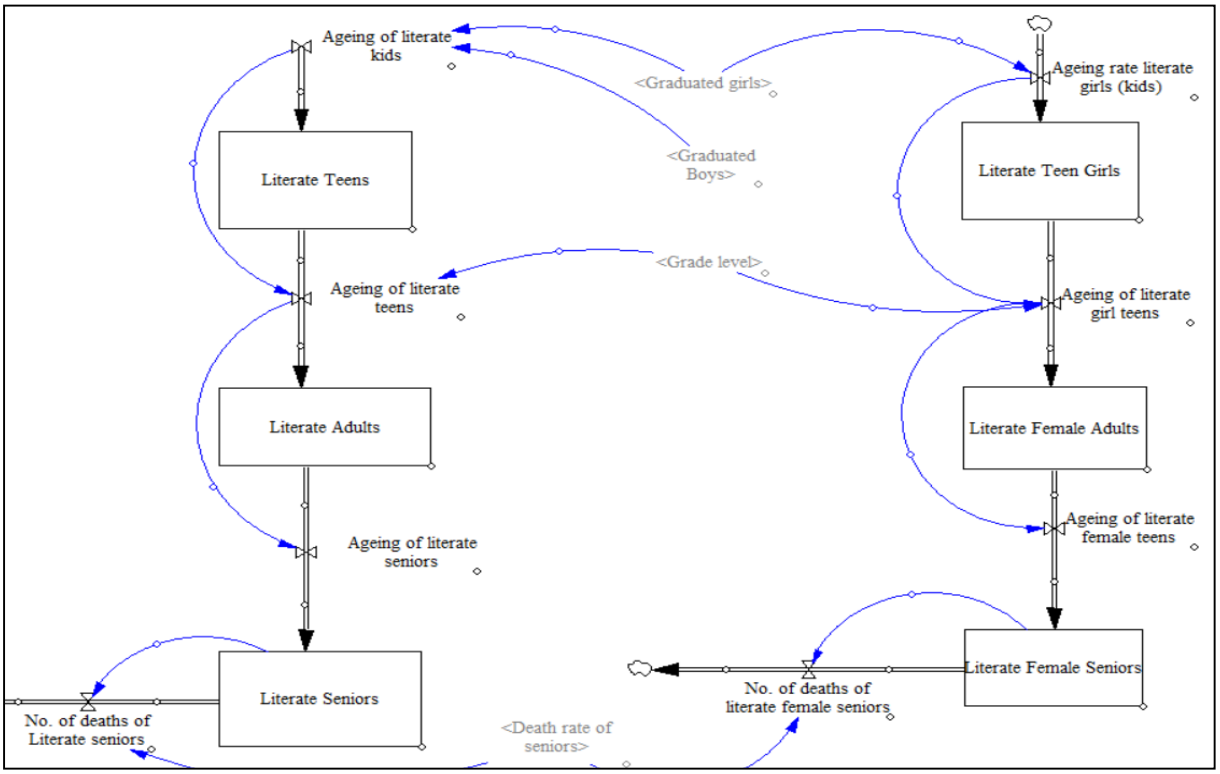

FIGURE 8: VILLAGE DEMOGRAPHICS SUB-MODEL 2 (LITERACY IN AGE - CATEGORIES)

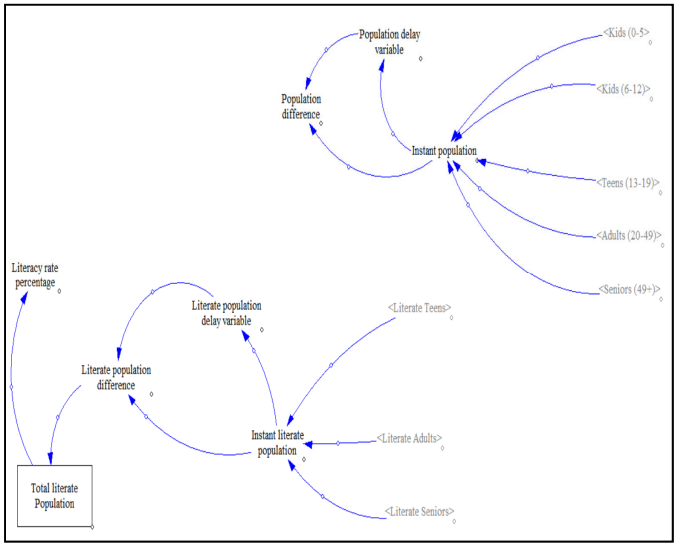

FIGURE 9: VILLAGE DEMOGRAPHICS SUB-MODEL 3 (TOTAL LITERATE POPULATION)

4.2.2 VLSD: Education Loop Figures 10 and 11

The education sub-model of VLSD is presented in Figure 10 Figure 11. In Figure 10, the primary school loop is presented. In primary education loop, "Kids (6-12)" stock is taken from the village demographics loop (presented in Figure 7) and divided in 'number of boys' and 'number of girls.' Percentage of boys and girls can be added as input based on the collected data from the village. To evaluate the impact of value proposition developed to improve the life of a particular gender the division between boys and girls becomes critical. In rural communities, girl education is comparatively low and therefore in VLSD model girl's enrollment is developed separately. The elements of the education loop presented in Figure 10 is as follows (from the left side to the right side of the figure);

- 'Kids 6-12 (increase)' is a function of "Kids (6-12)" stock and "aging rate for kids (0-5)". At any given time 'T,' the variable will have a value of kids between ages 6-12.
- 'Kids 6-12 (increase)' is divided into 'Number of boys' and 'Number of girls.' The division to boys is girls is calculated by '% of Boys' and '% of Girls' variables respectively.
- 'Number of boys' and "Number of girls' variable are input to 'Number of boys enrolled' and 'Number of girls enrolled' respectively.
- 'Number of girls enrolled' and 'Number of boys enrolled' is calculated by multiplying the 'enrollment rate in primary school' for boys and girls to a number of boys and girls in the village.
- The 'Number of girls enrolled' and 'Number of boys enrolled' are input to the stock 'Total enrollment of girls' and 'Total enrollment of boys' respectively.
- The stocks 'Total enrollment of girls' and 'Total enrollment of boys' hold the value of total boys and girls enrolled in the school.
- The stock 'Total enrollment of boys' is a function of 'Enrolled boys' (in-flow; added to the stock in each iteration), 'Graduate boys' (out-flow; removed from the stock in each iteration) and 'dropped out boys' (out-flow; removed from the stock in each iteration). Similarly, 'Total enrollment of girls' is calculated.
- "Graduated boys' and 'Graduate girls' are a function of 'Grade level' in the school. 'Grade level' is the highest-grade thought in the school. The 'Grade level' is based on the community and highest grade that is thought in school.
- Value of 'Grade level' variable is used to calculate the number of years for enrolled kids to graduate. For example; Kids entering school at Time T=1 year of the model will graduate from school based on the 'Grade level' value. If 'Grade level' is 5 (highest grade being 5th grade in the school), then kids that enter school at Time T=1 will graduate at Time T=6th year of the model.
- 'Dropped out boys' and 'Dropped out girls' are a number of kids dropping out of schooling each year.

In most of the rural communities, the kids do not go to school before they are six years old, but the social entrepreneur can model input for primary school with kids from 4 years old. The next part of the education loop (secondary schooling) is presented in Figure 11. Similar to primary school, the stock on total enrollment is divided into girls and boys. The input to secondary schooling loop is the number of girls, and boys graduated from the primary school, that is 'Graduated boys' and 'Graduated girls' as presented the on the left side of Figure 11. The input is only 'Graduated boys,' and 'Graduated girls' for this loop and not a number of teens or kids is because of the requirement of secondary schooling. Kids who have not finished primary schooling are not eligible for secondary schooling and therefore cannot be enrolled in secondary schooling. Remaining model is similar to the model presented in Figure 10**.** The output from secondary schooling model is 'Graduated teen boys' and 'Graduated teen girls.' The value obtained from Figure 10 ('Graduated boys' and 'Graduated girls') and Figure 11 ('Graduated teen boys' and 'Graduated teen girls') are input to different parts of VLSD model. The literacy loop presented in Figure 11, collects the variables from education loop (Graduated kids and teens) to calculate a number of literate adults (and females separately). The female literacy is also an input to sub-model: Health Loop (not discussed in this paper, please refer [3]).

The VLSD model presented in this paper is only a part of the overall construct developed to evaluate the impact of various value proposition on different aspects of the village. The work is presented to introduced readers to a framework for social entrepreneurs and explain its understanding. A demonstration of VLSD model for impact evaluation is presented in the next section. In this demonstration, a scenario of a CSR investors wanting to work towards child education, mostly focused on girl education is shown. The investors had asked the utility of our VLSD model. One of the examples is presented in the next section. More examples can be found in [3].

4.3 Demonstration: Evaluation of Value Propositions using VLSD

In this section, the evaluation of value propositions for a village using VLSD is presented. The value proposition is anchored towards the improvement of girl enrollment in primary school. In the given village a social entrepreneur plans to evaluate the impact of value proposition proposed to the CSR investor. The value proposition proposed is developed in the VLSD model and then the process is simulated.

The village under considerations has a population of 600 people with an almost even distribution of males and females. The village has a solar-powered microgrid providing electricity to all 140 households. There is a tribal primary school in the village, however only about 40 of 260 children attend, this is because, most children work in family farms, businesses, or as laborers. The nearest hospital is 10 kilometers away. The area suffers from land degradation and medium water pollution due to aquaculture and agriculturally focused households. Farming is a large source of income for households both as farm owners and farm hands. The reason kids do not go to school is because they help families at work or stay at home to do household work. To improve the enrollment of the girls in the school one the proposed value proposition is: Provide skills to women of the household in knitting, grinding, packaging, clay pot making, leaf pressing and in return, the women attending skill school have to send their kids to schools.

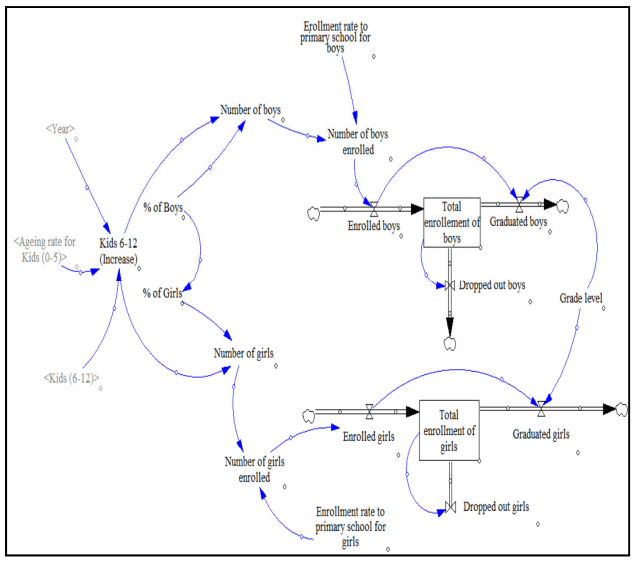

FIGURE 10: EDUCATION LOOP: PRIMARY SCHOOLING

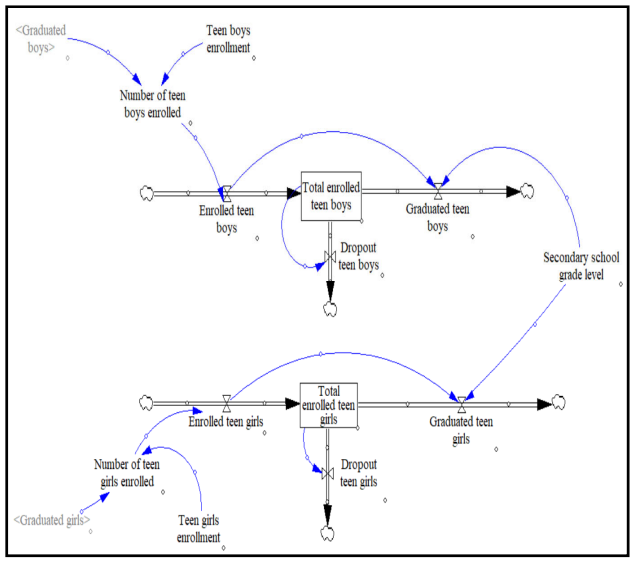

FIGURE 11: EDUCATION LOOP: SECONDARY SCHOOLING

To evaluate the value proposition using VLSD. Prior to the evaluation of value propositions, first, the population model of the village is simulated and verified if the model projects correct value for the population. In Table 4 the initial values of population that are entered in VLSD model are presented. The model is run from time T=0 (current time, with population 600) to time T=10 years. The values obtained by running the population model is presented in Figure 12. The population rise is as expected, for a low population the growth is low, and this is represented in VLSD model for the composite village. Given that the model is verified for the population part, the next step is to run value propositions on the remaining model and evaluate the outcome of the selected value proposition.

Value Proposition for Evaluation: *"To provide skills to women of the household in knitting, grinding, packaging, clay pot making, leaf pressing. The work can be done within the village, and one person can create a supply chain to the nearest city/town".*

Given that social entrepreneur can find right skill set for the females of the village, females can work from within the village and produce the products that can be sold by a social entrepreneur or one person from within the village. The Indian government has incentives to push female entrepreneurship and skill development in rural communities. These incentives will provide social entrepreneur funding for skill development. However, the tradeoff to join this skill school is to send the kids to primary school. Based on the input from villagers the model is developed.

The total number of adult females in the village are 130. A sub-model to represent skill development training was developed and added in VLSD model. This female skill development sub model is presented in Figure 13. In Figure 13 , two stocks are used to calculate the value of 'Number of females joining skill training' at any given time and 'Number of females that got employed' after receiving training. Assuming that almost all the females who go through training will be employed, the 'Joining rate' for training is dependent on 'Training Time' and 'Word of mouth.' If 'Training Time' is high, fewer women would be willing to join (information collected based on the survey). In general, initially, the number of women joining will also be low as there will be uncertainty regarding employment. After a period, as more and more females are employed, more untrained women will start to believe in skill development program (behavior captured in 'Word of mouth' variable), and more women will join the training program. In Figure 14, the effect of two different 'Training Time' is presented on 'Number of females joining skill training.' This value is calculated by collecting a survey from the women on the best training time and willingness to join.

As the value proposition proposed is to increase the enrollment rate for kids as a tradeoff for the skill development program, the VLSD education loop is modified to include the impact of skill training and employment of parent on the enrollment rate and dropout rate respectively. The values are added based on ***expected*** outcome. That is, based on the value proposition it is fair to assume that as females enroll in training skills, the kids will also be enrolled in primary school. The ***expected*** output obtained is presented in Figure 15. On the left side of Figure 15 graph present the 'enrollment rate for girls. As the number of women joining skill development program continues to increase (presented in Figure 14), the enrollment of girls and boys (not shown in the figure) continues to increase reaching the maximum value of 0.9. At time T=7 (for 'Training Time' = 2 months) and time T=8 (for 'Training Time' = 3 months), the highest enrollment rate is achieved; at the same time as 'Total number of females enrolled for skill training' (Figure 14) reaches a maximum value of 130. This increase in enrollment rate is due to the deal that is part of the value proposition. On the right-hand side of Figure 15, 'Number of girls dropped out' is presented. The value for a number of girls dropping out continues to increase as well till time T=8 and time T = 9 (indirect impact). This can be reasoned as follows: as soon as women are employed after attaining training, the families force back kids to drop out of school and help in the new employment. Based on the evaluation of value proposition using VLSD and applying systems thinking, it is identified that there are loopholes in the proposed value proposition. Now a social entrepreneur and CSR investor can go back to the blackboard and modify the value proposition.

Based on simulating the proposed value proposition using VLSD model, the value obtained is in terms of a) identifying the training time for which the maximum number of women will join, b) understanding that the value proposition can have unexpected outcomes (dropout of kids after a training period of women of families). The outcome is obtained only as an ***expected*** outcome. In real life, this scenario probably would not occur. However, by knowing this as a possible scenario, the value proposition can be modified to secure it from occurring altogether The output obtained from the framework and parts of the framework that is baseline index, Dilemma Triangle and VLSD are user perspective oriented. Therefore, it is important to capture the behavior of all the stakeholders involved, especially from the members of the community on which the value proposition is going to implement.

TABLE 4: VALUES RELATED TO POPULATION ADDED IN VLSD MODEL

Age category	Population
Kids (0-5)	60
Kids (6-12)	60
Teens	100
Adults	320
Seniors	60
Total	600

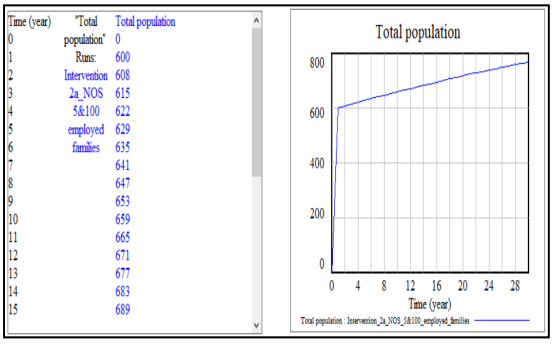

FIGURE 12: POPULATION GROWTH SIMULATION USING VLSD MODEL

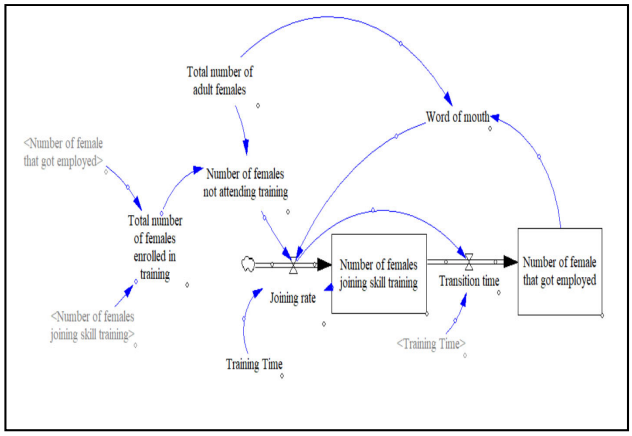

FIGURE 13: FEMALE SKILL DEVELOPMENT MODEL

FIGURE 14: NUMBER OF FEMALES JOINING TRAINING BASED ON TRAINING TIME

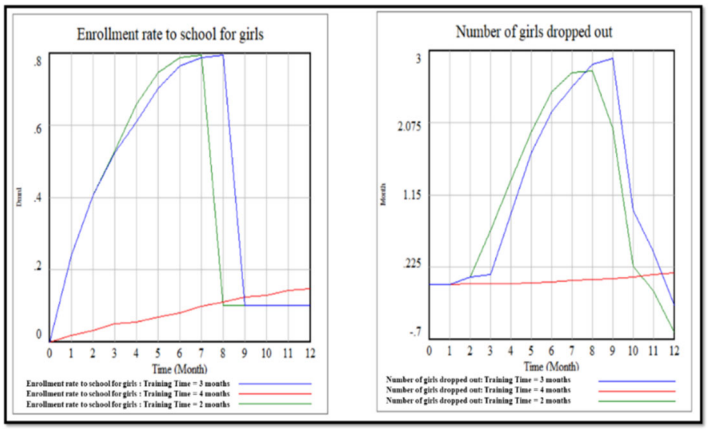

FIGURE 15: IMPACT OF THE TRADEOFF BETWEEN SKILL TRAINING AND ENROLLMENT INCREASE

5. COMMENTARY

The proposed framework and the constructs are tools that may be used by a social entrepreneur. However, they should NOT be perceived as black boxes and must be used with caution. The outcome clearly depends on the input..

The outcome for each stakeholder (including social entrepreneur, CSR investor) is different for the constructs presented as each stakeholder has a different perspective of the problem at hand. This is both a limitation and an advantage. The limitation is that for the same problem no two solutions will be the same calling into question the validity of constructs. The advantage is in being able to provide stakeholders a way to understand the problem from different perspectives.

In the VLBSI, weights of each indicator and sub-indicators depend on the stakeholder who inputs the data. That is, between two stakeholders calculating the baseline index value for the same village may have different values for the same indicators or drivers. This is possible, as they may weigh the same indicator and sub-indicators differently. Therefore, it will be misleading if the index is considered as a decision-making black box.

For VLSD construct, one of the biggest challenges is the validation of the model. As there is no data available on many villages or value propositions, validating the expected outcome is difficult and questionable. To overcome this challenge, we run the model for a village that has data available from past. We check the internal consistency of the model. Once satisfied with the output for known data we run the model for unknown data to anticipate the future state. The expected outcome from the model is based on the assumed change in different aspects of the given value proposition. This change is calculated based on the qualitative information and data available from previous studies.

The VLSD, in the field of social impact assessment for a community, makes it possible to capture the indirect effects of a value proposition. In almost all cases, the direct effects of a particular intervention can be anticipated with some probability. However, given the probability, understanding/knowing the indirect effect on the overall system is difficult to anticipate/calculate. We believe the VLSD covers this space. We recognize that a model is only as good as the understanding of the system by the modeler. The effect and relations between variables that constitute the model are either general knowledge, or articulated from previous case studies, or have been presented by field experts. Similarly, in order to have a VLSD model that can capture the complete dynamics of any community requires a rich database of community behavior, which currently is not available in any form. In this paper, we have provided an approach to develop the models that will add value in quantitative impact assessment. We know that the current model is not a complete representation of a village dynamics. However, using this approach, social entrepreneurs and CSR investors can continue to improve the VLSD model and continue to add value for social entrepreneurship. Even then, the model will not be complete or accurate; however, it will be useful [33].

The real value of a model is derived in understanding trends, trade-offs and relative impact of choosing and implementing alternative interventions in a village. For example, a social entrepreneur can assess the relative impact of three alternative interventions for access to energy, keeping the values of the rest of the indicators constant and only change the source of electricity: (1) solar lantern, (2) solar home lighting system and (3) smart microgrid. The social entrepreneur can arrive at a quantitative index for the three scenarios and present the case to a CSR investor to get funding to achieve maximum impact from energy intervention. It's the trend and relative impact that is of much more value than the absolute number. The model is being used to validate one such intervention made by SunMoksha in a remote village in a tiger reserve in Odisha [34].

The limitations of the framework are due to the requirements that we defined while creating the framework (reusable, modifiable, adaptable models). Whenever a framework is used to address a wide range of problems, it cannot be used to capture the specifics of the problems being solved. However, if a framework is developed to capture specifics of a given problem, it cannot be used to solve a bigger set of problems. This is a trade-off that we need to choose while developing a framework. In summary, we advocate the use of the framework with due diligence.

6. CLOSING REMARKS

Poverty and rural development are inversely related to each other in most of the developing countries. Further, the development of social enterprises has seen a direct impact on poverty enumeration. We suggest that in India, a partnership between a social entrepreneur, Corporate Social Responsibility investors and other funding agencies can play an important role in improving the socio-economic conditions of rural communities. We hypothesize that a successful partnership between two major stakeholders, namely, social entrepreneurs and corporate social responsibility (CSR) investors is the key in developing multiple social enterprises to foster rural development. However, getting people to agree on a way forward hinders forming successful partnerships. To further this hypothesis, in this paper, we present a computational framework to fit the social business model of SunMoksha; see Figure 1. The framework embodies a systematic process for understanding the requirements (choice between focus area/value propositions) and then quantifying the impact of each stakeholders' requirements. For example, if a CSR investor is interested in investing in education and a social entrepreneur working in the village believes that development of given rural communities is more impacted by the "Health of children" than "Improving Education". The framework can be used to estimate (quantitatively) impact of both the interventions and evaluate such scenarios, specially in relative terms. Therefore, the framework presented is a step toward design of a system that can be used for analysing of rural development projects. Reports generated as a result of exercising the framework may serve as a basis for fostering dialog between major stakeholders involved in social enterprise creation, namely, social entrepreneurs and CSR investors. The framework is offered as a decision support tool that will be helpful in directing attention to issues and challenges that are usually ignored/missed while addressing a social wicked problem [32].

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