

Project Evaluation Using SD Modeling

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Abstract

Adaptation of SD: System Dynamics modeling approach may sometimes confront with already existed approach and methodology. For example, PCM: Project Cycle Management methodology is commonly accepted for design and M&E: Monitoring and Evaluation of socio-economic development project in developing countries assisted by developed countries. This paper aims to explain effectiveness to merge SD modeling approach with existed approach for M&E of socio-economic development project in developing country in case of Philippines.

Keywords: socio-economic development, project evaluation, PCM

1. Objectives of this study

Though SD modeling approach is powerful tool for provide insight of nature on program structure in management area. However, in some situation, SD modeling approach confronting with existing approach and methodology commonly accepted by experts in that field. It is true in area of M&E: Monitoring and Evaluation of socio-economic development project of developing countries sponsored by developed countries.

Among experts of project evaluation, quantitative evaluation is one of key issues. Main model for evaluation adapted on standard approach for M&E of project evaluation is score model, and this type of model is categorized as qualitative model. For supporting weakness of qualitative model, many attempts still suggested for enhance quality of evaluation, or support qualitative evaluation with quantitative evaluation. Author also has been suggesting support qualitative evaluation by merging with ST/SD modeling approach and enriching evaluation with quantitative evaluation.

This paper aims to explain author's approach of merging ST/SD model building approach with traditional project evaluation methodology, PCM: Project Cycle management [1].

2. Literature studies

This section explains SD study on agriculture development or rural community development in Asia. Although project evaluation normally conducted by participatory approach, this paper does not list up literature of participatory ST/SD model building. There are rich literatures of participatory SD model building, but this paper focus on merge of approach with other methodology, as well as agriculture modernization in Philippines.

Nenigno [2] studies rice production of Philippines and presented ISDC 1977, however, his paper does not including SD model. His study insists, production of rice influenced by adapting technology and style of farmer on harvesting, custom and style of cultivating, drying process, distribution style and process. Therefore improving technique and process for shipping products to market may makes big difference. Author can completely agree with this study, however, target area of his study is Luzon. Target area of the paper is Northern Samar, and development stage is quite different. Modernization of agriculture in Northern Samar is far behind from Luzon. Style of cultivating relays on rain fall but not irrigated. Farmer leaves growing of rice after seeding and waiting until harvest. Target setting of the project in case study of the paper itself is not much ambitious. His study is useful to know pre-harvesting loss and farmer support system, though author cannot get much information on agriculture infrastructure development from his study.

Parayao [3] studies relation of agro reform and eradication of poverty. His paper is not including SD model, however, could understand brief structure of his model from information of paper by

Saheed [4], because Parayao mentions his model adapt from model of Saheed. Author could get useful information on effectiveness of agro reform, however, progress of agriculture modernization is comparatively slow in target area and agro reform is not main issues of the project. However, author can agree for incorporate view of agro reform and eradication of poverty in rural area into model for evaluating agriculture modernization project.

Professor Khalid Saheed is pioneer of SD study in socio-economic development and presents 4 major papers on this topic. [4], [5] and [6] explain relation with tenant farmer and land owner based on traditional agriculture economic model of income redistribution. SD model on [4] is model Parayao adapts to his model. There is not SD model in [5], however Saheed explains logic and idea based on his model in this paper. [6] is co-authored paper but explains study in Thailand. Since his model focuses on agro reform and author could get useful information on farmer support system, however, agro reform is not major issues of the project. Literature [7] is Forester Awarded paper of 1995 and explains his concept and idea on sustainable development.

Some reader may puzzles for incorporation of healthcare and medical issues in agriculture modernization project. However, author hopes them to understand labor efficiency is one of key factor for improving agriculture productivity. Bantkes [8] develops such model of rural community development incorporate with healthcare and sanitation in case of Sudan with SD model. Model developed for evaluation of agriculture modernization project in this paper adapts his idea and concept. Similar but simpler model is mentioned on community development in Norway by Asheim et al, [9].

3. Background of project evaluation

(1) Objective of project evaluation

Huge amount of government budget spends for socio-economic development project in development countries mainly with two types, directly assisted by government agencies of developed country (bi-lateral) or through international assistant agencies (multi-lateral) including the World Bank, Asian Development Bank, or units of United Nations. These assisting organizations assist to strengthening governing system of target government unit or sometimes assist construction of infrastructure including bridge, road or facilities for public services by government. Some developing countries heavily rely on such international assistance and sometimes assistance rises to 5% of their GDP.

Since many developing countries require foreign assistance, however, source of these financial assistances come from tax from taxpayer in developed country, assisting agencies required accountability to taxpayer including effectiveness of assistance. For accomplish duty of accountability to taxpayer, project evaluation is mandatory for many developed countries. (*1) This is significant requirement for bi-lateral type assistance.

(2) Methodology adapted for project evaluation

From design to evaluation of project, PCM: Project Cycle Management is commonly adapted methodology.

1) Project design phase

Normally, government of developing country request assistance to government of developed country (embassy or country office of assisting agency, such as USAID, CIDA, JICA), or international organization (United Nations, World Bank, Asian Development Bank, etc.), and agency accept request. Then agency considers assistance and prepares conceptual design of the assisting project for internal discussion and decision making. Then, preparatory study team is formulates and the team visit target country, and conducts PCM workshop while collect necessary data for concrete project design and prepare agreement. PCM workshop proceeding:

- Stakeholder analysis: in project design phase, PCM first analyze relation and expected behavior of stakeholders with stakeholder analysis. Stakeholder includes target beneficially, supporting

group (normally government and other donor agencies), opposite group (if any), as well as directly related group and in-directly related group. Stakeholder analysis analyzes their nature, opinion, behavior, expected behavior, their concerns, strengthening, weakness, opportunity and threat to planning project.

- Problem analysis: then, list up issues and problems related with planning project and analyzes structure of issues and problems with relation of cause and effect. This analysis similar with causal loop analysis of SD: System Dynamics, though analysis is straight linier and not consider feedback at all. Result is show tree shape structure of problem with relation of cause and effect. Sometimes management consultant calls this as "As-Is model". This analysis called problem structure analysis. Anyway, core problem on top of the structure is normally not easy to solve and step by step approach may necessary from problems on bottle of the tree structure one by one.
- Objective analysis: After problem structure analysis, then consider what would be after all problems are solved. This may show also similar tree structure of achieved (objective) and cause (mean). This structure of problem solved situation by means called To-Be model by some management consultant. This analysis called objective analysis.
- Selecting scope of work: since resources (financial, human, materials, etc.) are limited in normal case, therefore, consider secure of resources, select target area of planned project on objective structure model (To-Be model) in term of most effective, and may give high impact, or relation with other project.
- Summarize: after selection of target area, them prepare summary of planned project with style of PDM: Project Design Matrix. Based on this PDM, pre-evaluation is conducted.
- Action plan: lastly prepare PO: Plan of Operation, sometimes management consultant calls action plan, matrix list of activity, schedule, necessary resources and expected outputs. This list used for monitoring of the implementation.

As result of PCM workshop, two materials are prepared, draft PDM and draft PO. These two materials are incorporate for project agreement between target country and assisting agency. After signing of project agreement, project is officially starts. (*2)

2) Monitoring and evaluation

It depends, however, normally, donor agency conducts monitoring and evaluation three times, pre, medium and post. Pre-evaluation conducted just after finish the design and before move to implementing. This evaluation mainly confirms sufficiency of the project in term of expected results, impact, efficiency and effectiveness and gives go-sign.

Medium evaluation conducted in the middle of implementation. Since normal project required 3 to 5 years and medium term evaluation conducted 2nd to 3rd years after start of the project. Mainly this evaluation confirms implementation is on right truck and inputs consumes on schedule and achieves expected outputs on schedule. If project has not serious issues and problems, and activities are going on schedule, evaluator may give go-sign, however, if not, consider re-design, or adjustment, or in worse case, suspending.

Post evaluation is conducted normally last year of the project or within two years after completion of the project. Main objective is re-confirming result (outcomes and impact) and sustainability.

Normally, evaluator prepare score model for evaluation and this model called PDMe (PDM for evaluation), simply prepare matrix including 5 criteria and arrange data from PDM to PDMe. Then list on item or information necessary to evaluate 5 criteria. After that, collect data with interview, questionnaire survey or model analysis forwarding conclusion. Evaluation is normally carry on with participatory approach and concluded in evaluation team of expert from donor agency and selected member from recipient stakeholders. PCM workshop is recommended for project evaluation.

(3) Problem and issues of evaluation

In project evaluation, two items are commonly accepted agreeable among evaluators, namely 1)

evaluation criteria, and 2) methodology. Normally, evaluator evaluates 5 areas namely effectiveness, relevance, impact, efficiency and sustainability, so called 5 evaluation areas of DAC: Development Assistance Committee, OECD: Organization for Economic Co-operation and Development. This 5 evaluation areas of DAC is standard criteria in ODA project evaluation. DAC of OECD developed and issued policy of ODA project evaluation and member of DAC follows this policy for evaluation to their ODA projects (OECD 1991, 1992 and 1998, [10] and [11]). Evaluating on these 5 criteria is first commonly accepted item. Second is not much rigorous, but commonly accept to use PCM methodology or approach of PCM, and outputs are shared information among project designer, implementer and evaluator, though in reality, donor only provides PDM and PO to evaluator.

Also, use score model for evaluate 5 criteria is commonly accepted among evaluator. However, arguments are:

- Reappearance: result of evaluation should be mostly same even different evaluator evaluates. For avoiding confusion from different evaluations by different evaluators, evaluator request to do his work based on fact and measurable indicators as much as possible.
- Theoretical/logical: conclusion must be leaded with logic. It should not be concluded by impression or intuition. However, when adapt ST/SD approach, there is sometimes conflict on modeling concepts adapted on PCM and ST/SD. Logic adapted in PCM is straight forward approach and not including feedback concept at all. Adapted logic itself has problem or conflict sometimes.
- Quantitative: result would better to show quantitatively. Obviously evaluation must do based on quantitative model for achieving this requirement. Or, at least, evaluation should be supported by reliable quantitative measured indicators.
- What if analysis: model should be bear with what if scenario analysis.

1) Model for evaluation in PCM

Since PDM including summary information of project, evaluator prepares score mode for evaluation from PDM. This score model is just framework for qualitative evaluation. For supporting rigorousness of evaluation, evaluator also use support model, specially for requirement of quantitative analysis. Donor agency requests to quantitative analysis and quantitative evaluation to evaluator, however, in reality, quantitative analysis and evaluation is few, and most evaluator do only qualitative analysis and evaluation. There could be two reasons, a) evaluator has very limited capability and knowledge for quantitative modeling and analysis, as well as b) time is not enough for develop quantitative model.

Figure-1 is concept of score model based on PDM and evaluator prepares 5 columns evaluation sheet (efficiency, impact, relevance, effectiveness and sustainability). Evaluator list up necessary information for evaluate 5 criteria and break down more detail based on information from PDM. Then prepare series of questions for data collections. After he success to collect necessary data, then fulfil his judgment on 5 criteria and concluding.

Since score model lack the logic between elements of the projects, evaluator again prepare logic model for evaluation. Figure-2 is sample of such logical model for evaluation. Normally, evaluator use objective structure model from PCM workshop, because this model shows ideal status after project accomplish its purpose and objectives. However, original objective structure model normally does not including figures for quantitative evaluation. Therefore, evaluator adds figures for evaluation from targets of the project and judge project achievement on logic stream through elements. For example, "construction of 20km expansion" on 3rd level stands on "50 million Yen grant from foreign government" on second level on stream of right side. Evaluator confirms the project receives 50 million Yen and then confirms completion of construction, or other word, confirm financial resources is sufficient and sufficiently would construct facility. It may judge that 50 million Yen may too much for this type of construction, depend on judgment of evaluator, or fail of accomplishment may come from shortage of money.

	Efficiency	Impact	Relevance	Effectiveness	Sustainability
Overall goal			What is positive and negative impact and how relevance with other plan and projects	Still project purpose has meaning and useful to achieve the overall goal after completion of the project?	Could it be possible to sustain the results and achievement after completion of the project by recipient country by themselves?
Project purpose		How much the project purpose was achieved and how much the outputs contribute to achieve the project purpose			
Outputs	How input use efficiently for produce output				
Inputs					

Figure-1: Evaluation model based on PDM

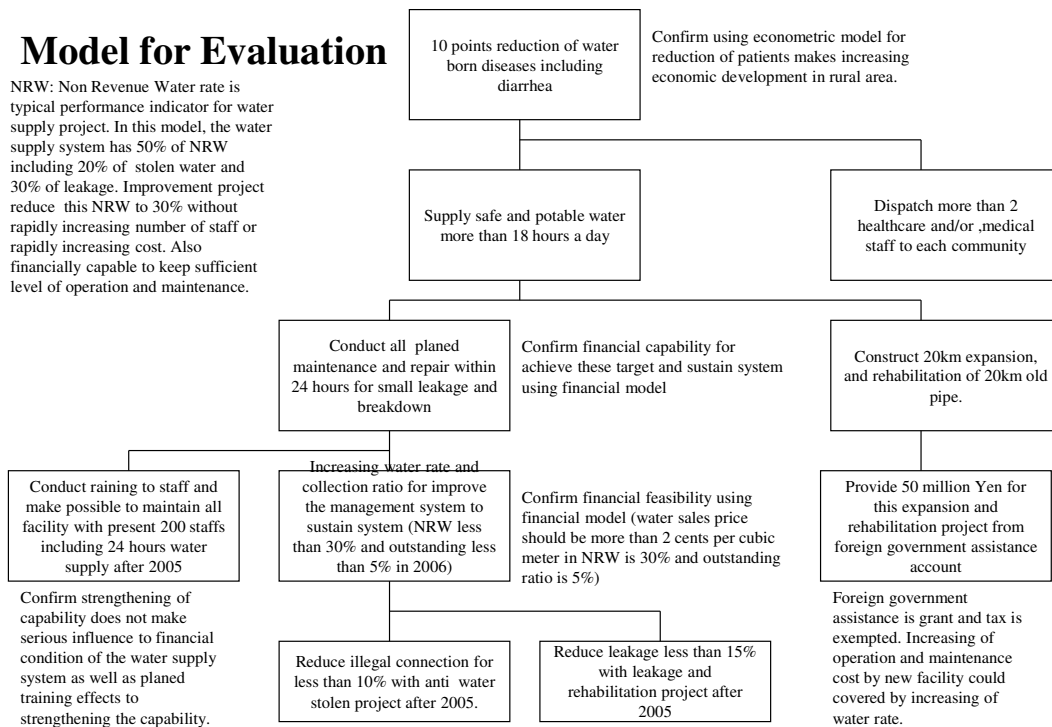
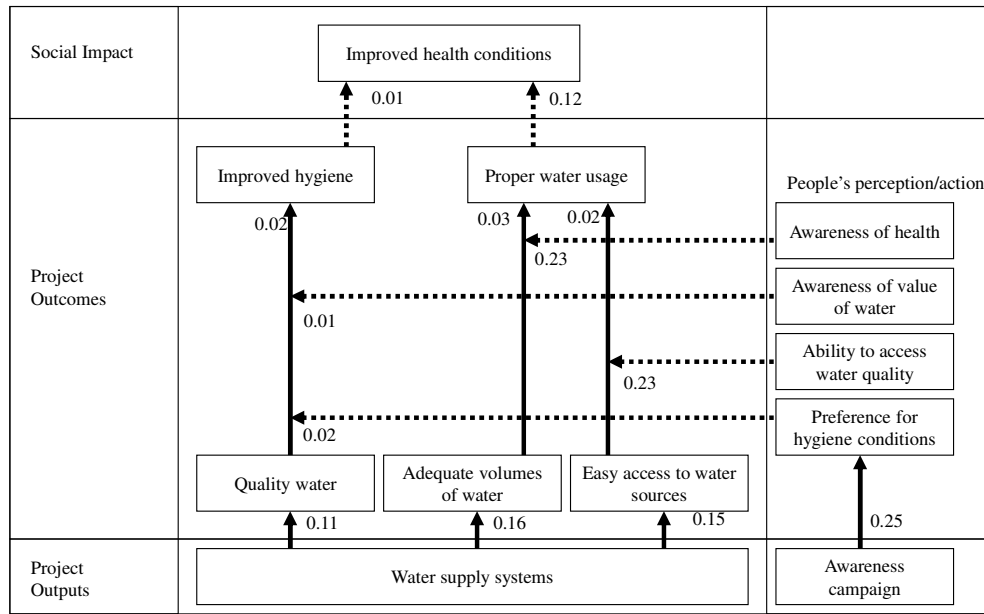


Figure-2: Sample of evaluation model based on objective structure model

Figure-3 is sample of statistic model for evaluation of water supply project. Purpose of this project is enhancing health condition of local people with improving water supply facility and awareness campaign on hygiene. Which elements may mostly effective on project purpose is concern on this model. Conducting questionnaire survey to recipient and select elements, then analyzes strength of

correlation among elements. If there is strong correlation, that elements gives strong impacts to other elements, though this type of model does not including feedback structure. However, statistic model provides information of impact.

Second type of quantitative model is econometric model, though again evaluator does not develop this type of model frequently for mainly two reasons, A) poor experiences, as well as B) difficult to adapted on non-economic issues.



← Cause and effect relations
 - - - - - Confirmed or highly probable cause and effect relations

Source: Kishi, Effectiveness of Water Supply Project in Developing country – analysis of process to make outcome, Proceeding of Spring Conference 2004, Japan Evaluation Society

Figure-3: Sample of statistic model

Table-1: Comparison of models using evaluation

	(1)	(2)	(3)	(4)	(5)
Qualitative model					
Score Model	×	×	×	×	×
Logical structure model	○	○	×	×	○
Balanced Score Model	○	○	×	×	×
ST model	○	○	○	×	○
Quantitative model					
Statistic Model	○	○	×	○	×
Econometric Model	○	○	×	○	○
Fiancial Model	○	○	×	○	○
SD model	○	○	○	○	○
(1) Bear on reappearance					
(2) Logic is incorporate in model?					
(3) Including feed back concept?					
(4) Result shows quantitative?					
(5) possible to do "what if" analysis?					

Financial model is typical and mandatory model for supporting project design and pre-evaluation mainly focus for sustainability, however have weakness for evaluate impacts incorporate project

external factors. For supporting this weakness, normally prepared financial model compare project cost and economic benefit judge with EIR (Economic Internal Return). This model has similarity with econometric model.

As conclusion of this section, typical score model for project evaluation lack the function of quantitative analysis. For supporting this weakness, statistic model and econometric model was proposed. However, both model lack feedback concept. For considering such weakness of these two quantitative models, author insists ST/SD model and incorporates with PCM methodology. Table-1 shows character of typical models using for project evaluation. Since score model is vaguest but accepted as standard model for evaluation, it is necessary to use support model for cover weakness, specially quantitative evaluation.

4. Approach and methodology

Author insists combine approach of ST/SD modeling with traditional PCM, or more precisely simultaneous approach both PCM and ST/SD Modeling, and supports qualitative and quantitative analysis of ST/SD modeling to analysis of PCM.

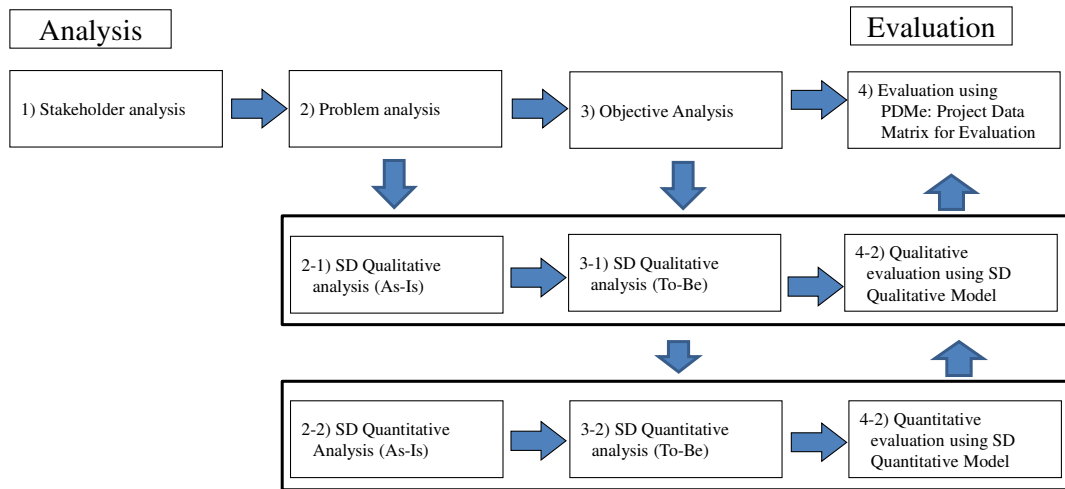


Figure-4: Recommendable Approach

ST/SD modeling itself has sort of methodology, from problem identification to ST modeling, SD modeling, simulation analysis and conclusion. This modeling methodology itself is not violates with PCM methodology. However, analysis model used in PCM are different with ST/SD model in concept and logic. This makes difficult to simply switch ST/SD model with models in PCM.

Figure-4 shows author's recommendable approach merge ST/SD modeling with PCM methodology and supporting analysis with view of ST/SD approach.

PCM methodology starts stakeholder analysis first and then moves to problem analysis and make problem structure model as output of this analysis. In author's approach, also develop SD qualitative model (ST model) and do qualitative analysis. And then moves to develop quantitative model (SD Model), if necessary. These models shows present problematic situation. Quantitative model may provide confirmation of impacts between elements.

On PCM methodology, next step is objective analysis and develop objective structure model as output. In this stage, also develop SD qualitative model and quantitative model incorporate activities of solving problem in target project. These models show idea situation after implementing the project and solve problems. Using quantitative model, evaluator can find impact with what if analysis. What if approach is best suit for SD modeling, as simply change parameter value on the

model and find how the result would differ with, or find the simulation result after remove/add elements relate with the project. Author shows example in case study in later section, but this example shows how project output would be change if the project spends more budget to water supply than construction of drainage and irrigation canal.

This new approach may impress complication and makes misunderstanding evaluator must develop additionally 4 models. But practically, evaluator develops only two additional models, ST model and SD model. Based on problem structure analysis, evaluator develop ST model represent situation before project was implemented. This model would be same with problem structure model (As-Is model), but ST model has feedback structure and could analyze vicious cycle (and virtue cycle). Evaluation mainly concluded from qualitative analysis on feedback structure. Then evaluator added project elements and expected result of project on this model and evolving to To-Be model. This model is similar with objective structure model of PCM, though ST model has solution of solving vicious cycle (or enhancing virtue cycle). Therefore ST model building and qualitative analysis is one step activity. Same for SD model building. Based on ST model, and select area for quantitation, and develop SD model. Therefore, building SD model is also one step activity in practice.

Result of both qualitative analysis and quantitative analysis from SD modeling merge with qualitative analysis using score model prepared in PCM. As mentioned previously, evaluator prepares score model for evaluation based on PDM as output of PCM.

5. Agriculture infrastructure development project in Philippines

Author involves medium term evaluation of agriculture infrastructure development project in Philippines in 2005 and could have experience of suggested SD approach merge with traditional PCM approach, and confirms SD approach is powerful tool for support quantitative evaluation.

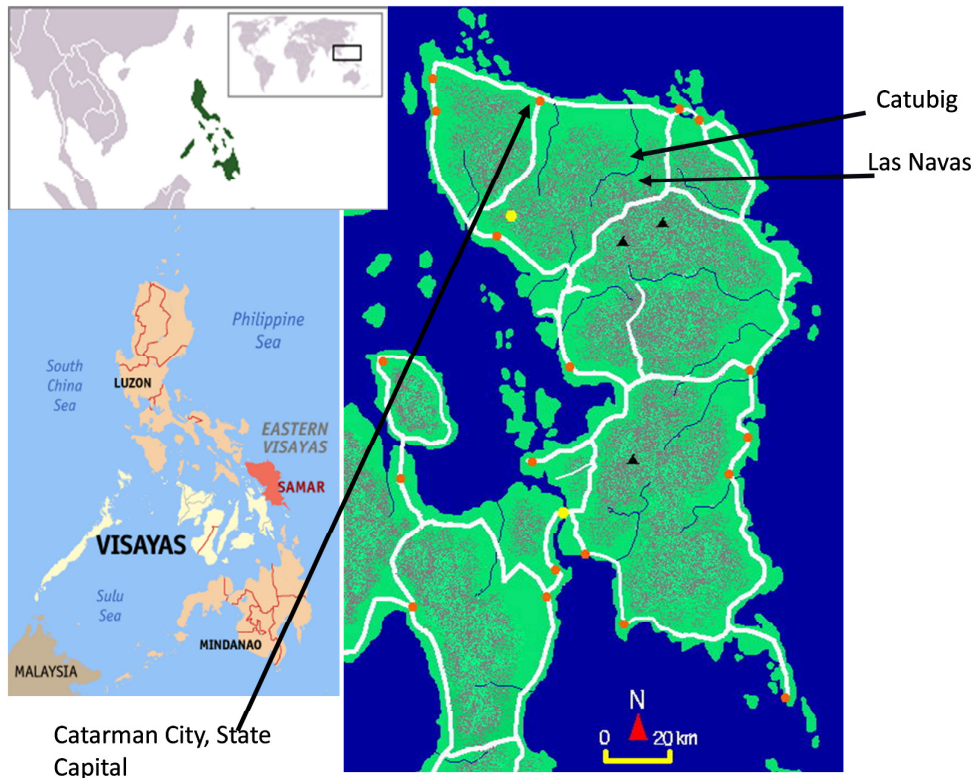


Figure-5: project location map

(1) Project background

Socio economic development of northern Samar of Visayas Area, Philippines is far behind from other area in the country. Income per capita of the area is less than half of national average. Agriculture is main industry in this area, however, could not produce enough rich and even import from neighbor area including Leyte. Secondly, poor health condition and spread of local diseases including Schistosomiasis hampers further development. Spread of Schistosomiasis caused mainly from poor drainage and irrigation system.

Basically this area has rich potential for agriculture as enough rainfalls and good soil. Government expected high agriculture production like Central Luzon and Mindanao, and requests foreign assistance for realize the expectation. In 1970s, World Bank and the Government of Australia supported F/S: Feasibility Study of comprehensive development including construction of road, landing places, water supply and sanitation, agriculture infrastructure development and anti Schistosomiasis. Unfortunately, anti-government activities and poor security stop implementation of this development plan. The Government splits the development plan and implementing component for Southern Samar where anti-government activity is less serious. However, development of Northern Samar leaves behind.

- Socio economic development is far behind other area and stay in low income
- Modernization of agriculture is behind and rice production is not enough for support people
- Rainfall is sufficient for rice cropping, however, poor irrigation and drainage system cause flood and draught frequently.
- Development plan was prepared in 1970s, however, anti-government activity stop the development, and development shifting to southern Samar
- Still local diseases including Schistosomiasis widely infected. Other area success to reduce water born diseases with development of water supply system and hygiene education.
- Health infrastructure is also behind and life standard is lowest in philippines.

Anti-government activity is stop in the area in later 1990s and the Government of Philippines request supporting for develop this region. In 2001, assistant starts and construction of agriculture infrastructure including irrigation canal is going on for enhance rice production, and revenue enhancement of farmer. Also, construction of facilities for improving living standards is going on to target year of 2010.

Author joins middle term project evaluation as evaluation team leader/coordinator/facilitator in October 2006 and submits report in December [12], [13] and [14].

(2) Project Component

The project has 5 components, namely 1) construction of irrigation and drainage network system, 2) improving road and transportation infrastructure, 3) improving water supply system, 3) anti Schistosomiasis, 4) construction of facility for agriculture modernization and 5) training for organize farmer and dissemination of agriculture modernizing technology.

Main issue is under developed agriculture infrastructure including irrigation canal and drainage, as well as access road to market. 1st component focus for improving irrigation and drainage canal network to control water for improve flood and draught. For improving irrigation canal network, 4,550 ha of rice field would be irrigated and would expected enhancing rice products from 4,475 tons per annual (once a year harvest) to 11,148 tons per annual in 2010 (twice a year harvest), and then enhance to 39,813 tons in 2017.

Second issue is poor transportation facility, specially access road to market. People use mainly river transportation in project area for very limited land transportation and access road. Second component focus to construct access road to market and improving national road connect with city and town for transport products to market and earn cash. Since still mainly transportation relay on

boat, construction including rehabilitation of two landing places. Accompany with increases of rice production, project expects improving income of farmer from 4,000 Pesos per households per year to 27,000 Pesos in 2010 and 52,500 Pesos in 2017.

Third issue is healthcare situation specially water born diseases including Schistosomiasis. Third component focus on construction of water supply system and reduce water born diseases with provide safe water. However, Schistosomiasis also affect to human by freshwater snail lives in muddy water and 4th component focus to construct drainage system to change environment of freshwater snails as well as training and disseminating anti Schustosomiasis behavior, partly including good hygiene practices. In this component including construction of bamboo bridges for passenger can avoid to step in river stream.

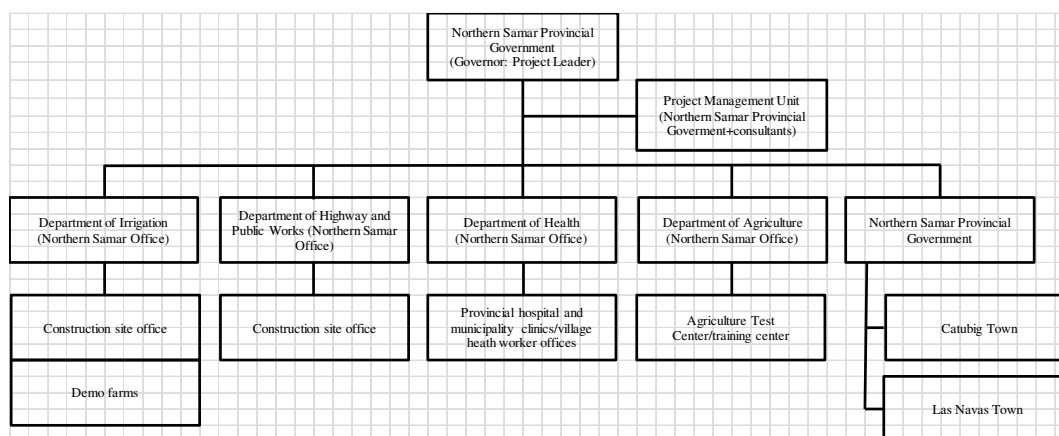


Figure-6: project organization

Table-2: Project component and targets of each component

Components	Items	Quantity	Implementing Agency
1. Irrigation and drainage system	Construction of irrigation and drainage system	Irrigation target area	4,550ha
		Dam	3 dams
		Irrigation canal	130km
		Drainage	144km
		Maintenance road	123km
	Enhance irrigated area	4,374ha	
	Enhance rice field area	910ha	
	Construct model farms for demonstration	2 farms	
Provide maintenance facilities and equipment	1set		
2. Transportation infrastructure	Rehabilitation of national road, bridge and landing places	National road	29.5km
		Las Navas Bridge	1
		Landing place	2
	Construct access road to agriculture fields	9.04km	
	Provide maintenance equipment	1 set	
	Construct water supply systems	20	
3. Anti-Schistosomiasis	Construct drainage for anti-Schistosomiasis	64km	
	Construct toilets	Public Toilet	76
		Share Toilet	589
	Construct access bridge over muddy river	51	
	Hygiene training/education	1set	
	Provide tool for anti-Schistosomiasis	1set	
4. Technical Transfer of modern agriculture	Rehabilitation of agriculture test center	1	
	Training for dissemination of modern agriculture	1session	
	Provide training material and equipment	1set	
5. Organizing farmer	Assist to organize water user committee	12	
	Training	1set *1)	
	Provide equipment and material for organize farmer	1set	

*1) Cooperation of Department of Irrigation, Department of Health and Department of Agriculture

Forth component focus to construct dissemination center of agriculture modernization technology (demo farm) and plans rehabilitation of agriculture test center and conducts series of training to farmer for technology transfer for modernizing agriculture.

Last component focus on organization of farmer and enhance organizational capability for manage and maintaining agriculture infrastructure system and community based healthcare system by farmers.

Figure-6 shows project organization. Governor of Northern Samar Province himself roles project leader for forwarding this project. Under his control assisted with PMU: Project Management Unit, 4 central government agencies, Department of National Irrigation, Department of Highway and Public Works, Department of Health and Department of Agriculture, as well as two municipal governments (Catubig Town and Las Navas Town) work for implementing this project. Table 2 shows detail of component and target of each construction (outputs).

(3) Targets

Project targets shows as Table-3. With increase rice crops, project aims to enhancing house income of farmers. This target would be achieved by two components, increasing production of rice crop by irrigation and dissemination of modern agriculture technology, and improving accessibility to market and enhance chance to sell products in market. Also, improving health situation may help to increasing labor efficiency and farmer can concentrating to cultivating. Reduction of medical cost may contribute improvement of net profit of farmer.

When author starts study for the evaluation, there is no project design document by PCM. That is common for project designed before middle of 1990, as Japanese donor agency starts request PCM workshop after middle of 1990s. Even PDM and PO are provides to evaluator, however, quite seldom to provide other project design documents including program structure model and objective structure model.

Table-3: Project targets

Performance indicators	Basis (2005)	Target	
		2010 *1)	2017 *2)
1. Increase of irrigated area (ha)	rainy season:80, dry season:60	4,550	4,550
2. Increase rice crops (ton/ha)	0.9	2.45	5
3. increase rice production (ton/year)	4,475	11,148 *3)	39,813 *4)
4. Increase house income of rice farmer (Pesos/year/household)	4,000	27,000	52,500
5. Increasing national road possible to access in rainy season (km)	6.0	21.7	
		(Possible to access to Las Navas)	
6. Improving agriculture road access to market (hour)			
1) Between Quezon - Las Navas	2 hours by foot	20 min. (reduce 85%)	30 min. (reduce 85%)
2) Between Bulao -Las Navas	3 hours by foot	30 min. (reduce 85%)	30 min. (reduce 85%)
3) Between Sta. F - Catubig/Las Navas	2 hours by foot + 1 hour by boat	30 min. (reduce 85%)	25min. (reduce 60%)
4) Between San Isidro -Las Navas	1 hours by boat	25 min. (reduce 60%)	20 min. (reduce 85%)
7. Reduce infection rate of Schistosomiasis (%)			
1) Catubig	3.0	2.40 (reduce 20%)	1.50 (reduce 50%)
2) Las Navas	3.9	3.12 (reduce 20%)	1.95 (reduce 50%)
8. Increasing recipient household of water supply (household)			
1) Catubig	2,999 *5)	3,444	3,444
2) Las Navas	1,303 *5)	2,988	2,988
9. Increasing number of farmer unions	10	12	12
*1) Year when this project accomplished			
*2) 7 year after completion of this project and accomplish dissemination			
*3) Assumes total 175% land usage efficiency of two crops (100% in rainy season and 75% in dry seson)			
*4) Assumes total 200% land usage efficiency of two crops (100% in rainy season and dry season)			
*5) Original plan is provide water supply to 58 communities, but reduce to 44 after remove difficult community by detail filed survey in 2004			
Refer with this change, recipient household reduce and changed from original target.			

First step is organize evaluation team with stakeholders including local consultant and selected members from project units. Three project members selected from project management unit, and one or two from each units. Position of author is coordinator/facilitator/team leader of this participatory evaluation team. For assist author's activity and also work as interpreter, one female local consultant expert of healthcare sector joins to this team.

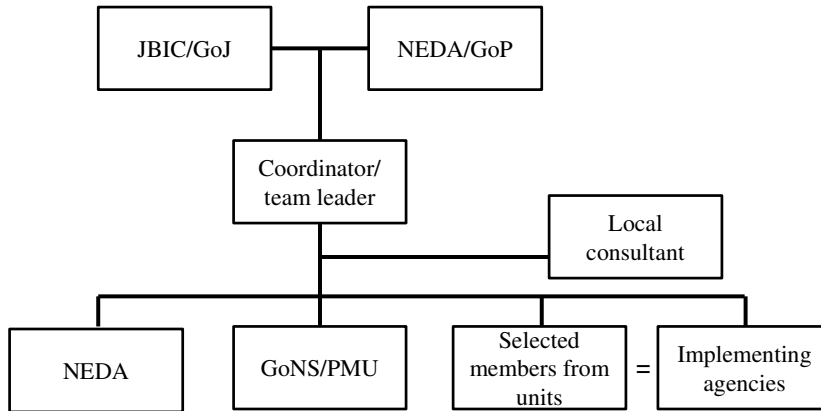


Figure-6: evaluation team

Medium term evaluation starts presentation for explain what is monitoring and evaluation, objectives, schedule and expected outputs to participants in PCM workshop. In this PCM workshop, author explains some hypothesis and focus area for study and survey. However, author does not develop ST/SD model in this stage. ST model is prepared during filed survey and interview to stakeholders with evaluation team. SD model is prepared after author comes back to Manila where author can use computer easier and could have time for concentrating. Accordingly with schedule, then author and the team visit site and conduct series of interview survey. During filed survey, author discusses with team member and develops ST model. Author use this ST model for mainly discussion and find structure of problems.

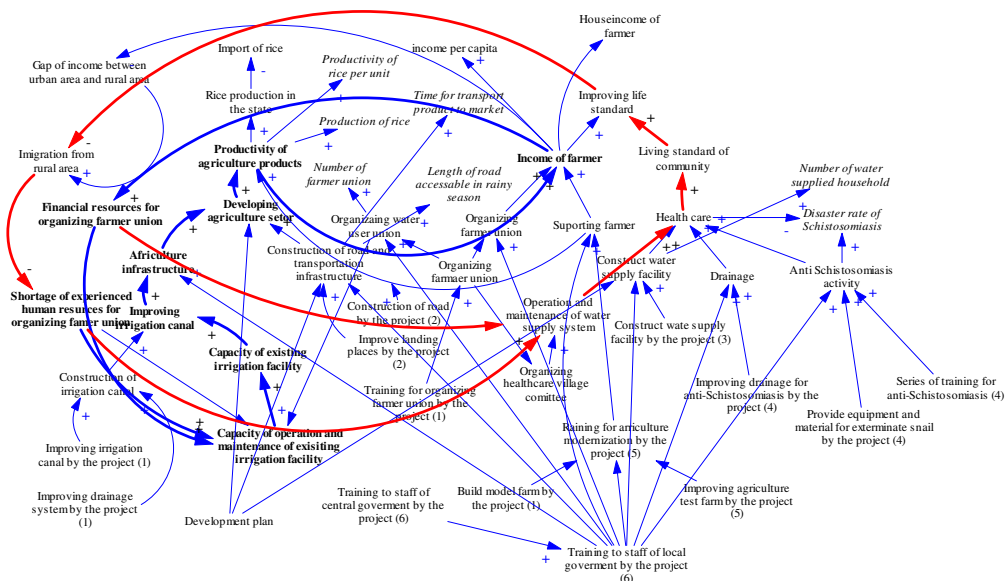
6. Model and simulation

(1) Qualitative analysis

Figure 7 is original qualitative model developed while author and the team conducting filed survey and use for start line of discussion. First author develop the model and modifying on team members during discussion meeting after field survey, mainly confirm observation and understanding of author with team members.

Soon after staring filed survey and discussion with stakeholders, author immediately noticed language barrier of two groups, participants from unit of infrastructure development and participants from unit of healthcare and sanitation development. They share project objective and outputs, however, participants from infrastructure development focus and concerns progress of construction and participants from healthcare and sanitation units concerns more on improvement of healthcare system and living standard. Without considering their concerns and interest, discussion sometimes loses direction.

For adjusting difference of concerning, author first change color of arrows, as red for healthcare and sanitation, and thick blue for construction of agriculture infrastructure and improving income of farmer. But soon, author noticed this is not enough and model of Figure-7 is too much complicates for difficult to explain as well as difficult to make understand to stakeholder. They are not familiar with such diagram as well as it is their first time to see. For this reason, author decides to separate into two models. Basically these two models (Figure 8 and 9) come from original model of Figure-7.



Figur-7: ST model of the project

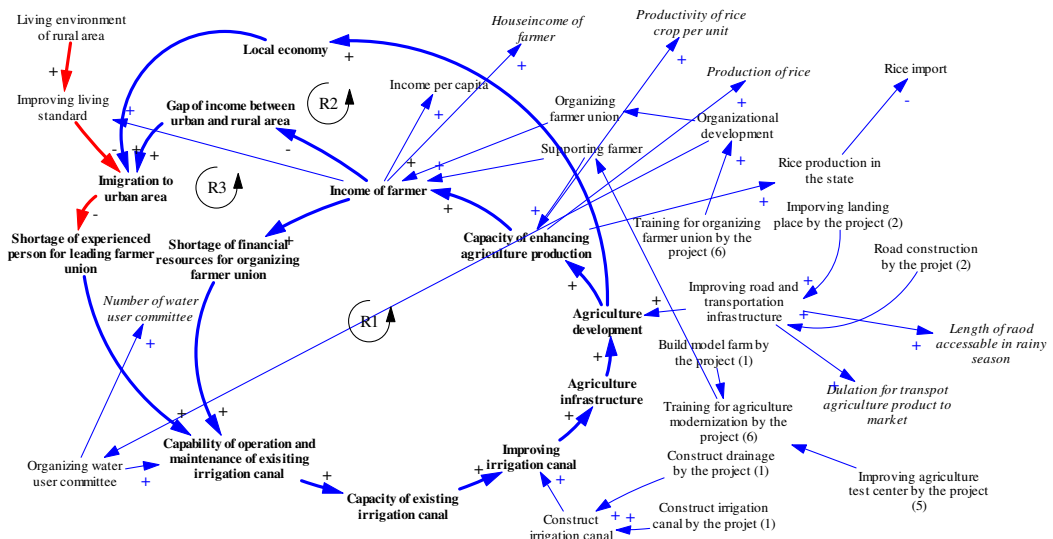


Figure-8: Model modify for stakeholders of agriculture infrastructure development units

Model of Figure-8 focus relation of agriculture infrastructure development and enhancing house income of farmer, and eliminate elements of healthcare and sanitation. For drop topics of healthcare and sanitation, author and stakeholder can focus the discussion on relation of infrastructure development and revenue enhancement. Using this model, evaluation team discuss mainly with implementing agencies (Department of Irrigation, Department of Highway and Public Works, Department of Agriculture, leaders of farmer union, municipal governments of Catibig, Las Navas and Northern Samar, and managers of demonstration farms).

This multi circle feedback looping share same core circle is typical vicious cycle structure commonly appears on socio-economic development issues and problems in developing countries and this complicated structure makes difficult to improving situation. Anyway, discussion with stakeholders agrees on relation with agriculture infrastructure development and related issues with

this infrastructure development. Author rather wishes to focus on direct impacts with infrastructure development and house income of farmer (R1), however, stakeholder rather interest with development of local economy (R2) and improving gap of income, or improvement of poverty (R3).

Author use Figure-9 for discussion with stakeholders involving healthcare and sanitation. Again, with drop topics of agriculture infrastructure development, author and stakeholder can focus to the discussion on improving sanitation and living environment. These simplified models improving communication with stakeholders. This time, discussion is easier than other group. Using this model, the evaluation team discuss with Department of Health, hospitals, clinics, village healthcare volunteers, village sanitation volunteers and discussion focus on mainly relation of infrastructure development for healthcare and anti-Schistosomiasis activity. However, participants rather interest with improving life standards and development of community.

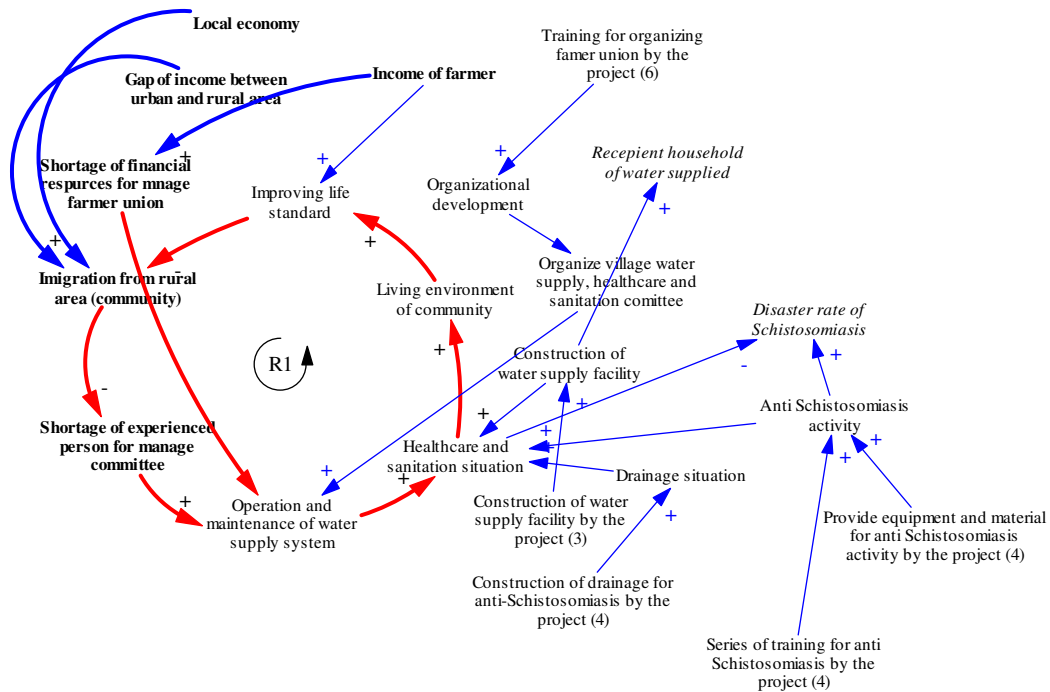


Figure-9: Model modify for stakeholders of health and sanitation development units

Number attached on parameter shows component of the project. This makes clear the influence and impact of component to the project and outputs. For distinguish construction (hardware) and training (software), model parameter added (6) to training component of the project.

Author was not ensured to develop ST model with participatory approach first time. However, participants are familiar with PCM approach and building ST model in front of participants is not much difficult. Since already problems and objectives are list upped during PCM workshop conducted in beginning of the activities (during developing problem structure model and objective structure model), author just use factors (problem or problem solved situation) already identified during PCM workshop. Since description of model elements on problem structure model and objective structure model are short sentence, but not key words, author simplified these factors into key words, and demonstrate building ST model during discussing. But some are not completely simplified into key words, rather leaves problem description.

Feedback loop is new concept for all participants in this evaluation, and hard to accept for some of them. Some confusion emerged, however, with already prepared tree type model in PCM workshop,

they accept to using two different type models for evaluation.

Using these two models, the team prepares qualitative evaluation and fulfils score model author prepare based on PDM:

Efficiency: evaluation with PCM is simply compare inputs and outputs of the project. Since evaluation based on score model is simply confirms inputs of resources is on schedule and outputs is also on schedule, assumes efficient. But if inputs or outputs are behind the implementing schedule, evaluator doubts efficiency. ST model analysis shows efficiency depend on how infrastructure contributing income enhancement, and income enhancement stops depopulation of community with improvement of living standard.

Impact: impact of this project depends on how the project realizes virtue cycle of revenue enhancement and stop depopulation of rural community. Observation identifies change attitudes of farmer with the project and they gradually eager to learning modern agriculture technology and start to borrowing equipment from demonstration farms. Also, some farmer notices growing vegetable and carry to market get more money than simply growing rice in irrigated field.

Relevance: evaluation with PCM is simply confirm target project has relation with other development projects and harmonize, or supporting each in main stream of national development plan. Target project is counted on Philippines 5 year national development plan and also governor of Northern Samar himself identifies critical development plan and takes initiatives [15], [16] and [17]. ST model analysis rather wonders how central government agencies identify and allocate budget and resources after completion of the project.

Efficiency: ST model analysis wonders key factor may human resources development in community and efficiency may depend on how develop such person leading community. Observation impressed Filipino is politic loving people, but community leader is expected leading and manage farmer organization and forwarding socio-economic development of community with other farmers. Expected character is not politician, but leader and manager.

Sustainability: sustainability also depends on human resources development as project could provide facility and equipment, though recipient (farmer) should operate and maintaining facility and equipment after transfer from the project.

(2) Quantitative analysis

There could be sort of system archetypes for model building of evaluation on socio-economic development project, mainly focus on construction of infrastructure, especially typical infrastructure development project like this case study. Figure-10 shows sort of archetype of such project for adapt to develop quantitative model.

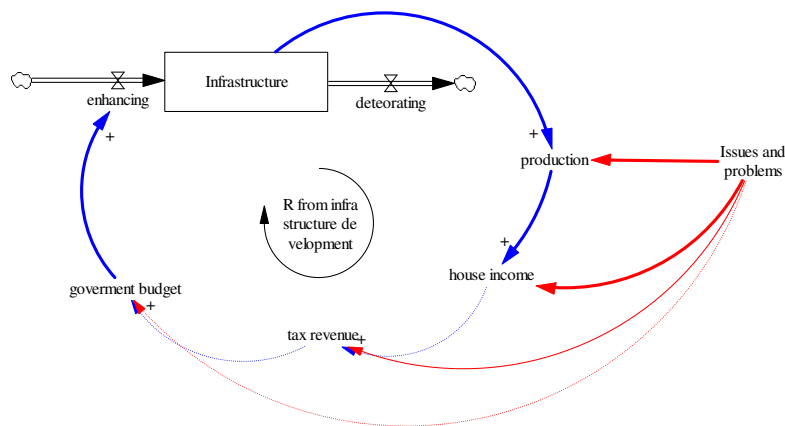


Figure-10: Basic concept of the Quantitative Model

Concept is very simple for development of infrastructure may enhance production, leads to enhancement of house income and link to growth of tax income, and tax income may possible to allocate more budget for infrastructure, though reality may not come in short time in developing countries. Anyway, based on this logic, further add related elements with infrastructure development.

In this case study, there is two kinds of infrastructure development, infrastructure for agriculture modernization and healthcare, and must consider relation on two infrastructures development cycles shows on Figure-11. This Figure-11 shows simplified model of Figure-12, final SD model for evaluation of the project. Project budget enhance two capacities, 1) agriculture infrastructure including irrigation canal, drainage and access road, and 2) healthcare infrastructure including drainage in community area, healthcare facility, water supply and sanitation facility. Also consider enhance capacity of resource input for production by leadership of farmer (using fertilizer, chemical and modern agriculture technology), as well as improvement of labor efficiency by improvement of healthcare environment (with training and promotion). Infrastructure construction module represent with enhancing “capacity of agriculture infrastructure” in Figure-11 simply consider how capacity improving production. Based on this concept, author further divide infrastructure more precisely to irrigation, drainage, access road and land irrigated. Same for development of health care infrastructure, and further divides to hospital, clinics, water supply, anti-Schistosomiasis and community based healthcare system.

Figure-12 is SD model for simulation based on ST model of Figure-7. Since the team discuss and concluding qualitative evaluation based on two qualitative model on Figure-8 and 9, as well as traditional tree type objective structure model from PCM, however, Figure 8 and 9 are basically same and originated from qualitative model of Figure-7.

This model has 4 modules, infrastructure construction, economic, healthcare, and budget allocation. Model looks complicated, but basically very simple. Basic feedback component is population in the economic module, and influence comes as mortal rate from healthcare module. Population and rice production of infrastructure construction module calculate income. Healthcare module influences to labor efficiency on rice production in infrastructure module. Budget module simply allocate budget to infrastructure construction module and the healthcare module. Budget module itself has no feedback structure.

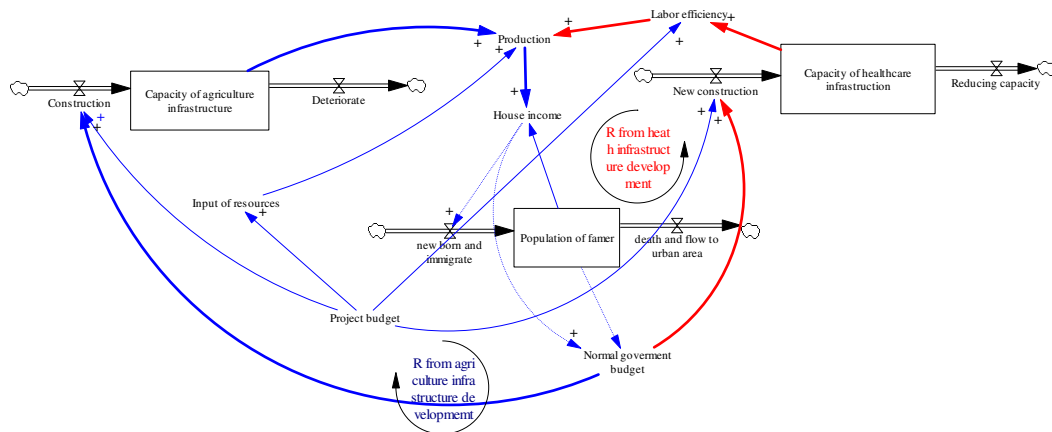


Figure-11: Simplified Quantitative Model

Therefore, budget allocation from project control infrastructure development in initial stage (project period), and consider how normal government budget can maintain capability of infrastructure. Then try to confirm outputs can achievable based on this structure.

Healthcare module represent with “capacity of healthcare infrastructure” composed with hospital,

clinic, healthcare center, village healthcare volunteers, village sanitation volunteers, water supply and sanitation facilities. But this module simply focus to enhance “capacity of healthcare infrastructure” and improving labor efficiency.

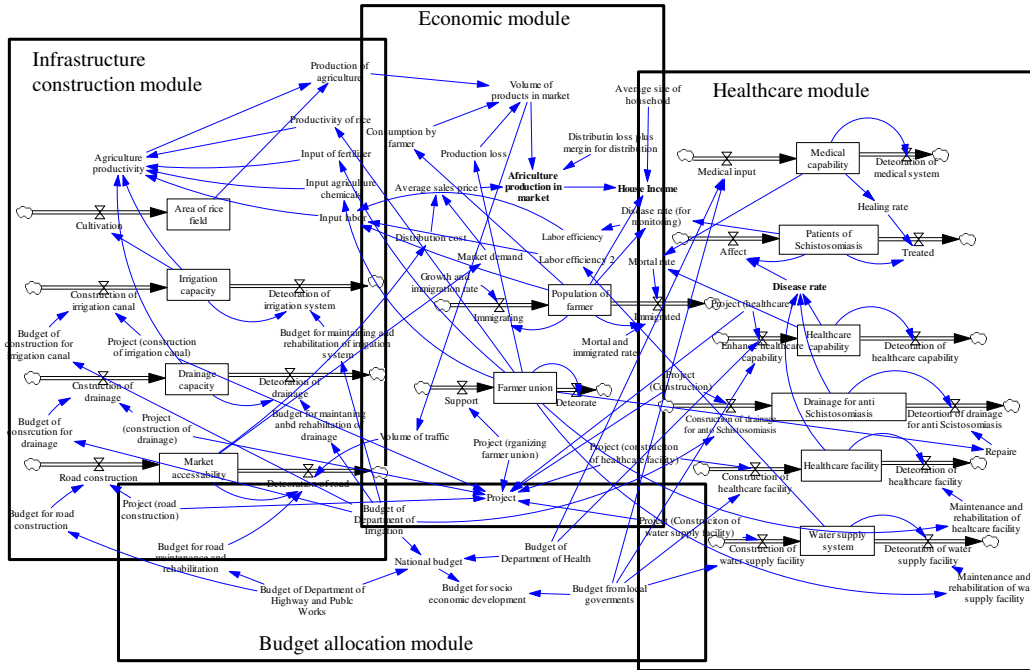


Figure-12: Quantitative Model

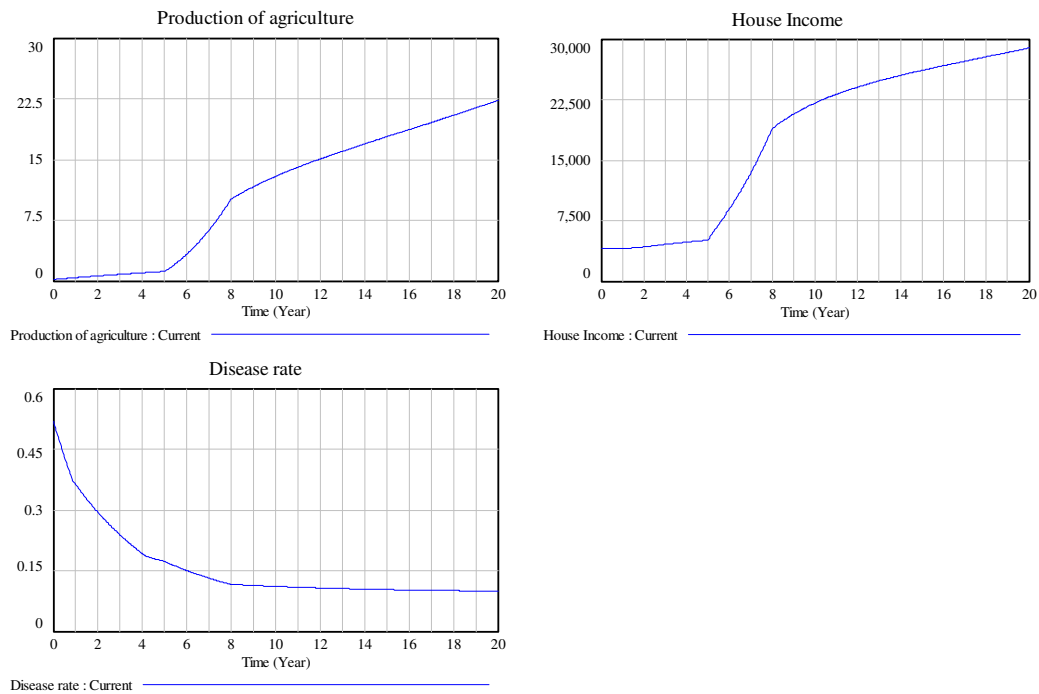


Figure-13: Simulation result

Economic module is also simplified as population and house income. In this module, house income calculated with production and population. May be author can show this simplified model and demonstrating primitive simulation, however, author still does not ensure to develop SD model with participatory approach.

Figure-13 shows simulation result with the SD model. "Production of Agriculture" represents rice production before distribute to market. This parameter does not consider any other agriculture crops including vegetable and fruits. Unit is 1,000 ton. Target of rice production is 11 thousands ton in 2010. SD simulation shows 13 thousands ton, a bit overshoot from the target. However, target of 39.8 thousands ton in 2017 is quite doubtful and simulation shows 19.5 thousands ton. Although this SD model may be too much simplified, however, it still suggests necessity of further consideration on the target set.

Target house income in 2010 is 27 thousands Pesos, and simulation shows a bit undershooting, 22 thousands Pesos, though target of 52.5 thousands Pesos in 2017 may still difficult. Simulation result shows achievement is 27 thousands Pesos. However, this value of "House Income" excludes not only inflation but also other revenue from sales of vegetable and fruits, or side revenue. Even though, target house income of 52.5 thousand Pesos in 2017 may too much optimistic. This simulation results suggests necessity of further consideration on this target set. Disease rate of Schistosomiasis keep dropping, however, still need time for extermination. These are major finding by quantitative analysis. No necessary to say to SD experts, only quantitative model can show such result.

Participatory approach is useful for develop ST model, however, not much effective for develop SD model. Author develops this SD model alone and only shows simulation results to team members. Author could not yet find effective way of participatory SD model building.

(3) Argument on impact of sub component

There arises question and discussion on impact of water supply. One of external stakeholder who concerns with this project argues construction of water supply system may reduce labor of water carrying by female and child. Unfortunately, planned water supply facility by this project is not house supply, but user must come to public water faucet. Presently, people mainly use river water and average distance to river is 200 to 300 meters. New water supply facility will reduce distance to public faucet to average 50 meter, however, this type of water supply system may not much reduce labor of female and children for carry water. Impact of water supply system is more on providing safe water and reducing medical cost, or enhancing labor efficiency.

For this argument, author point outs:

Reduce female and child labor for carry water: water supply system planed in this project is so called common water supply system and water supply to public faucet, but not household. This type of system does not reduce female and child labor for water carry rapidly, because user must come to public faucet for getting water. For reduce the labor rapidly, it is necessary to change design of water supply facility to house connection supply. However, cost jumps more than triple.

Reducing water born diseases: It may not much big difference of impact between public faucet water supply system and house connection supply until facility provide safe water and user use water sufficiently in good hygiene practice and sufficient sanitation facility.

Reducing patients of Schistosomiasis: impact comes mainly from construction of drainage system and reduce snail living environment. Water supply system is not much contributing for reduce Schistosomiasis, except people can avoid to drink cercariaeegg contaminated water. *3)

Secure of budget: budget of this project is limited and could not change total amount. Changing allocation is possible in certain portion, but also difficult to change allocation rapidly. In this situation, change allocation of budget to water supply facility construction means reduce allocation of budget to other components. Suppose allocation of budget to construction of water supply facility increase double, rice production and house income would be drops around 5% by reduction of budget for construction of irrigation canal and drainage.

Which should be main objective: main objective is construction of agriculture infrastructure facility, but not construction of healthcare infrastructure including water supply system. Construction of healthcare facility is sub objective. If change of budget allocation does not influence rapidly to main target (rice production and house income enhancement), change the allocation may possible, however, most stakeholder may not hope to reduce targets of main objectives.

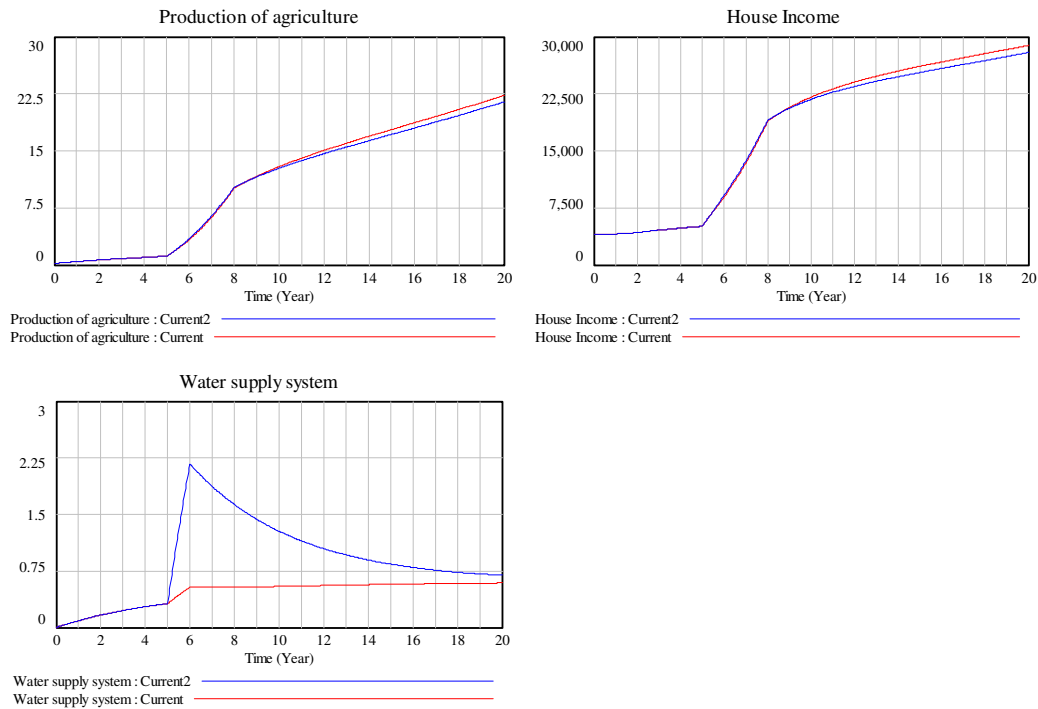


Figure-13: Simulation result

For showing impact of changing budget allocation to water supply system, author show simulation result after increase budget allocation to construction of water supply facility and reduce budget allocate to construction of irrigation and drainage. Number of water supply system per year is increasing rapidly, though agriculture production is drop and house income also drops. Added more, number of increasing water supply system would be stagnant after completion of this project.

(4) Observation and lesson learned

This case study is actually second time trial for author’s attempt on merge ST/SD model building approach and PCM, and finds some difficulties:

- Building SD model with participatory approach
- Difficulty of explain quantitative analysis and quantitative evaluation
- Gap of understanding feedback thinking and straight forward thinking

as well as

- Difficult to explain why new approach is necessary

1) Building SD model with participatory approach

Building ST model with participatory approach is not so difficult. Model builder can use material for PCM including cards for building problem analysis and objective analysis as well as two models on PCM (problem structure model and objective structure model) itself. Building ST model with participatory approach may makes fruitful discussion for find and confirm impacts relation among factors on model. However, building SD model with participatory approach is still difficult even prepare some pattern for shorten time for model building.

- 2) What is quantitative analysis and quantitative evaluation
Most stakeholders in donor agencies and implementation agencies easily jump to conclusion of compare quantitative target and quantitative results and concluding this is quantitative evaluation. Some of them insists Figur-2 model is sufficient enough for quantitative model for quantitative evaluation, because of exist (sort of) logic and numeric data on model. Author insists quantitative evaluation is judgment to result from quantitative model, however, still not all of them accept.
- 3) Gap of understanding between feedback thinking and straight forward thinking
Some of stakeholders in donor agencies and implementation agencies does not much agree to accept feedback thinking and insists straight forward thinking shows as sample in Figure-2. Since PCM adapts straight forward thinking model, typical shows as Figure-2, and they are very familiar with this concept or way of thinking. Some of them know SSM: Soft Systems Methodology and some tools such as rich pictures are also very familiar for them, however, these are not means feedback thinking is acceptable for them.
- 4) Resist to new concept
This may always emerged issues when someone insists new approach, and always some of them are not accept or agree. Author hopes increasing evaluation experts who use this approach and ST/SD for project evaluation.

7. Conclusion

As case shows, participatory ST/SD modeling approach supports and provides rich insights to evaluation with traditional score model and tree model. Since PCM is quasi-official methodology for evaluation of project and evaluator could not resist to using score model and tree models on PCM even these have weakness, author rather recommend combination approach with ST/SD modeling and PCM. However, SD modeling approach may need further consideration for participatory project evaluation. Also, author feels necessity of material explain concept of feedback loop and qualitative analysis for beginner with relation of traditional approach.

Notes:

- 1) Government and/or assisting agency is required two things:
 - a) audit for guarantee financial report and their financial system are sufficient and accurate, as well as
 - b) guarantee of assistant project is
 - efficiently conducted,
 - effectively conducted,
 - has relevance with other project and assistances, and
 - achieve planned impacts to socio economic development of target countries and beneficially as well as
 - achievement of the project would be sustainable.
 Auditing mainly guarantees item a) while project evaluation tries to guarantee item b).
- 2) Author wants to determine terminology in this paper, because terminology used in experts among socio-economic development is a bit different with terminology commonly used in business administration.

As-Is model/problem structure model: represents situation before implementing project and problem is not solved. In PCM methodology, “problem structure model” from program analysis represents this situation and use “problem structure model” for As-Is model. PCM is methodology covers project cycle management and “problem structure model” developed in project design stage is not rigorously covers situation before implementing project, but rather cover all over problems. However, in project evaluation phase, the model is modified for focus on issues and problems structure related with the target project.

To-Be model/objective structure model: represents ideal situation after implementing project

and solve problems. In PCM methodology, “objective structure model” from objective analysis represents this situation and use “objective structure model” for To-Be model. Since PCM is methodology covers project cycle management and “objective structure model” developed in project design stage is not rigorously covers situation after implementing project, but rather cover all over issues for achieve project purpose. However, in project evaluation phase, the model is modified for focus on issues structure related with the target project.

PDM/project summary: is sort of project design summary and including information of purpose, outputs, inputs, activities and immeasurable indicators as target. In business administration, this word may replaces with “project summary table” or simply “summary”. However, PDM has sort of logic for concluding project purpose and outputs from activity and inputs, and called “logical framework” by USAID, before completed to PCM.

PO/action plan: Plan of operation is just simply action plan including information of schedule per activity and expected results and outputs. This PO use for monitoring implementation of the project. In business administration, this is simply called “action plan”.

Logical tree model: is simply model elements related with cause and results. “Problem structure model” and “objective structure model” build in PCM are logical tree models. In business administration, this type of model called simply “logical model”. Logical relation between elements of this model can determined with mathematical equation, though normally relation I not determined with such gigolos relation and normally categorized as qualitative model. Sample of this type model shows as Figure-2.

Qualitative model: means model itself lacks rigorous logical relation between components or elements of model. Rigorous logical relation could represent with mathematical equation. In this determination, ST model categorize to qualitative model. Since statistic model, econometric model and SD model are represented by series of equation, these categorize to quantitative model.

Score model: is simple matrix model for fulfill reasons of evaluation result and points.

Monitoring: is activity of compare target and achievement for comment to gap. Monitoring is activity for compare target and achievement of outputs, but not outcomes. Output is results directly produced by the target project. Outcome is result combine with output produced by other projects. For example, water born disease infection rate may reduced by construction of water supply facility and supply clean and safe water to user. Thought, it is not enough and may need construction of sanitation facility and improving hygiene practice of user. Together with water supply project and sanitation project, patient of water born diseases would be reduced.

Evaluation; is activity to judge or comment to achievement of the target project including outputs and outcomes. In this term, evaluation sometimes criticize to output of the project even target project achieves target, when evaluator judges target project could achieves more performance.

- 3) Parasite eggs of Schistosiasis in faces and/or urine released from human body to muddy snail living fresh water swamp. Eggs hatching on contact with fresh water and metamorphoses to free-swimming miracidium. Miracidia infect freshwater snails. After infection with snail, the miracidium transforms into a primary (mother) sporocyst. Germ cells within the primary sporocyst dividing to secondary (daughter) sporocysts, and migrate as hepatopancreas of snail. In hepatopancreas, germ cells producing thousands of new parasites, known as cercariae. These cercarias capable of infecting mammals. While person wading or swimming in lake, pond or river, cercarias comes into human body with touch of skin or drinking water. Cercarias in human body transforms into a migrating schistosomulum stage and produce eggs.

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