Investigation on Assessment of the Karnali Employment Program by Using System Dynamics Approach

By

Smriti Joshi

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Department of Geography

University of Bergen

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ABSTRACT

Karnali Employment Program (KEP) is employment led poverty reduction program initiated by the Government of Nepal in 2006 through its budget speech with an initial amount of NRS. 180 million. It aimed to provide safety net to ultra-poor household through short-term employment against seasonality and other shocks. The KEP aimed to providing 100 days of guaranteed wage employment to at least one unemployed family member in every household. The program failed miserably and KEP was only able to achieve 15 to 10 days of employment to the poor household of Karnali Region since its inception. Since, this intervention program impacts the labor market and socio-economic condition of Karnali Zone, it is necessary to evaluate the challenges that lead to the failure of implementing KEP. Therefore, to evaluate the failure of this program, system dynamics approaches was used to analyze the shortcomings of KEP program and to draw lessons for future policies implementation. To analyze the failure of the program five models: the population chain, labor demand, labor supply, government budget and agriculture were modelled explicitly to explain the dynamic problem of the study. The behavior of these models strongly indicated that failure to hire skilled employees and failure to recognize the targeted ultra-poor household led to underperformance of the program. To address this dynamic problem, policies such as hiring skilled employees according to the requirement of project and providing employment to the percentage of people who are identified as ultra-poor are induced in the model. The outcome of this policy showed an improvement in number of employment days provided by KEP. The employment days increased from 15 to 98 days which is quite close to the original target of 100 days. Therefore, to properly implement KEP, Government of Nepal should exert its resources in properly identifying and targeting the ultra-poor employees in order to implement programs like KEP successfully.

Key Words: System dynamics, Social Protection Program, Employment, Ultra-poor, Skilled Employees and Policy

LIST OF ACRONYMS

CLD	Causal Loop Diagram
DFID	Department for International Development
HDI	Human Development Index
HPI	Human Poverty Index
ILO	International Labor Organization
KDRU	Karnali Region Development Unit
KEP	Karnali Employment Program
KEPTA	Karnali Employment Program Technical Assistance
KII	Key Informants Interviewers
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act of India
MOF	Ministry of Finance
MoFALD	Ministry of Federal Affairs and Local Development
NPC	National Planning Commission of Nepal
OPM	Oxford Policy Management Limited
RMP	Rural Maintenance Program
SFD	Stock and Flow Diagram
UNDP	United Nations Development Program

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CHAPTER 1   INTRODUCTION

1.1.   Background and Context of Karnali and Karnali Employment Program (KEP)

The practice of social protection in developing countries have advanced at an astounding pace over the last decade and there is a growing concern around the view that social protection constitute effective response to poverty and vulnerability in developing countries (Barrientos and Hulme 2009). Moreover, social protection has ascended as a widespread arrangement of instruments planned to help individuals, households and communities to better manage risk, shocks and extreme poverty (Suy, Chhay et al. 2017). The National Social Protection Strategy of Karnali Zone gives the particular purpose of coping with the poverty and vulnerability of people living in Karnali region. The poverty, growth inequality, social exclusion, and lack of access to public services and opportunities makes Karnali zone one of the most vulnerable region of the country. The topography, limited cultivate land, mountain climate and remoteness further exacerbate the poverty and vulnerability of the region (Vaidya, Regmi et al. 2010).

The basic Human Development indicators (HDI) show a poor picture in all aspects of Human development components in all the five districts of Karnali zone when it is compared to National Average. The HDI is characterized by low female literacy, chronic malnutrition, and high poverty concentration. Even the status of safe drinking water is way below the national average. The HDI in table 1 shows Karnali district in the bottom of HDI and Highest in Human Poverty Index (HPI) among 75 districts of Nepal. Furthermore, Karnali zone has been one of the conflicted areas with the strong support for the Maoists due to its remoteness and poverty. This strong support for Maoists further aggravate poverty and insecurity in the Karnali region (CrownAgent 2016).

Table 1 Key Indicators of Karnali District

District/ Indicator	Literacy	Female Literacy	Life Expectancy	Chronic Malnutrition	Access to safe drinking water	Human Poverty Index	HDI	Ranking
Humla	19.6	4.8	58.4	90.0	35.5	63.8	0.36	68
Jumla	26.6	9.3	50.8	74.2	26.0	56.8	0.34	70
Mugu	24.1	5.2	44.1	68.8	44.9	61.1	0.30	75
Kalikot	33.2	10.7	46.7	74.2	54.5	58.9	0.32	73
Dolpa	29.0	11.7	52.5	74.2	63.8	61.9	0.37	67
Nepal	48.6	34.9	61.0	50.5	20.5	39.6	0.47	

Source: NPC/UNDP, Nepal Human Development Report, 2004

The government of Nepal, elected as an interim government and operating under an interim constitution since 2007, acknowledged these socioeconomic insecurities when it took office. Building on, but expanding from, the interim development plan, the Nepal fiscal budget 2008/9 introduced social policy interventions to create employment and some additional social protection transfers (Beazley and Vaidya 2015). The existing public works program were complemented by a specific program in the most remote and disadvantaged area in Nepal, the Karnali Zone, called the KEP offering 'One family one job'. The objective of the program is to offer social protection through short-term employment and to create or preserve social and economic assets in five districts of Karnali Zone namely- Jumla, Mugu, Kalikot, Humla and Dolpa. The scheme was introduced in fiscal year 2006/7 in a budget speech with the initial budget of 180 million, and later adopted as a policy in 2010. The KEP is modelled on the Mahatma Gandhi National Rural Employment Guarantee Act of India (MGNREGA) (Beazley and Vaidya 2015).

KEP is financed by the government and managed by the Karnali Region Development Unit (KRDU) under the supervision of the Ministry of Federal Affair and Local Development (MFALD). KEP is also supported by the Department for International Development (DFID) since 2013/2014 through the Karnali Employment Program Technical Assistance (KEPTA) which is managed by Oxford Policy Management Limited (OPM) (CrownAgent 2016).

KEP is designed to provide opportunities to poor households in Karnali region to earn some cash by working on small public works capital projects. The program started with an aspiration to provide 100 days of guaranteed wage employment in a fiscal year to at least one unemployed family member in every household that does not have any employment opportunities or any source of income (CrownAgent 2016). This program aimed to provide safety net to poor Karnali households to help improve their ability to cope with seasonality and other shocks, as well as increase their household livelihood security. Furthermore, KEP aimed to supplement other livelihood options, enabling households to invest in developing their assets and capability to help them move out of poverty and reduce their vulnerability, and develop the stock of productive assets to promote economic development in the region (OPM 2014).

1.2.   Statement of Problem

The KEP program fell short to provide 100 days of targeted employment to poor household. Over seven years of implementing this program, average days of employment per annum was 13 days only (Vaidya, Regmi et al. 2010, NPC 2012, CrownAgent 2016). Even though, the Government's budget for this project have increased for past seven years from 2006 to 2013, the total number of households benefited have not increased significantly which is shown in Table 2. Even though the project was initially designed to help families with the income that is adequate to last for 3 months, every kind of household, irrespective of their financial status, has used these schemes to obtain employment, and in recent years, many people have submitted false documents to obtain jobs for more than one family member (Ghimire 2014). Responsibility to identify needy families and relevant projects for employment falls to local VDCs. The performance of the program has been mixed to date, with limited achievements in terms of employment creation, quality of works and level and regularity of payments for participants (Ghimire 2014)

Table 2 Performance of Karnali Employment Program

Fiscal Year	Total Budget (in millions)	Total number of households benefited	Total projects accomplished	Average days of employment per annum
2006-2007	180,00	60,740	995	15
2007-2008	163, 12	60,539	995	13
2008-2009	161,20	67,999	969	14
2009-2010	214,34	71,005	587	13
2010-2011	220,97	75,006	550	10.20
2011-2012	247,65	73,838	1222	11
2012-2013	259,17	79,913	541	10.50

Source: Ghimire, 2014/ Vaidya et.al., 2010

1.3. Reference Mode

The data for employment provided by KEP program is taken from NPC (2012) report from the year 2003 to 2013 which is the reference mode for this study. The graph in figure 1.1 shows the actual employment given by KEP (in days) to its targeted population. In the graph, KEP only provided 15 days of employment in the year 2006 which later declines to mere 11 days in the year 2013. The figure below clearly illustrate that the targeted group has remained deprived of taking any advantages from KEP.
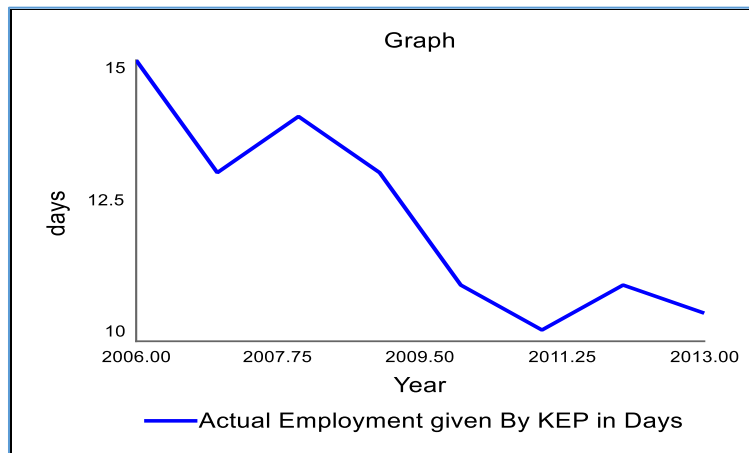
Figure 1 Average Employment Provided by KEP

1.4. Rationality of the Study

KEP is an ambitious program and there are bound to be problems which need attention and this issue is acknowledged by Ministry of Finance (MOF) in its social sector documents (NPC 2012). Since, the intervention program impacts the labor market and socio-economic condition of Karnali Zone, it is necessary to evaluate the challenges that lead to the failure of implementing KEP. Therefore, this study will try to analyze the shortcoming of KEP program to draw lessons for future policies and implementation by using system dynamic approaches.

1.5. Research Objectives

The KEP is supposed to provide "the Big Push" for poor household to move out of poverty since, this program promises to strengthen the local economic development by increasing the livelihood and resilience of beneficiary households beyond the duration of the program. The underperformance and failure to properly initialize the program compromised the overall objectives of the KEP. Therefore, this present study will aim to assess the following objectives by using system dynamic approach:

i.   To assess the employment created through the program and its impacts on the recipient households;
ii. To identify the shortcomings of KEP and its policies;
iii. To draw the future policies and implementation of modality of the program; and
iv. To make recommendations for improving its impact on the recipient household.

CHAPTER 2   LITERATURE REVIEW

2.1.   Why Social Protection

The rapid way in which social protection has gained predominance and political support in the context of the development and poverty reduction discourse over the past few years is almost without precedent (Sepúlveda and Nyst 2013). In welfare economies, social security and protection systems covering universal family benefits, social assistance, and social insurance have been critical in alleviating poverty and enhancing people's living standards (Khanal 2013). Many case studies of developing countries show that the social protection goes a long way in tackling the poverty, supporting economic growth and enhancing the effectiveness of growth strategies (Khanal 2013). Bangladesh, Kenya and Malawi for example have introduced the conditional cash transfer program which contributed to enhancing income security and access to education for the targeted vulnerable households in difficult context where public services and delivery capacities were sometimes too limited even to meet food security emergencies (Cattaert 2016). Although the coverage of some of these program is limited to certain geographic areas or narrowly defined groups of the population, the social protection program helps people from falling into poverty or escape from poverty traps by lessening social tensions, violent conflicts, and uncontrolled migration (Cattaert 2016, ILO 2017). Therefore, Social security needs should be nurtured through adequate investment (Khanal 2013).

2.2.   Presenting the model for the existing system

According to (Garcia Bonilla and Gruet 2003), social protection has three objectives which needs to be achieved in multi-layers. The three dimensions are shown in figure 2 below:

The first dimension: access to essential goods and services

The second dimension: prevention and protection (proactive security)

The third dimension: the promotion of potentials and opportunities
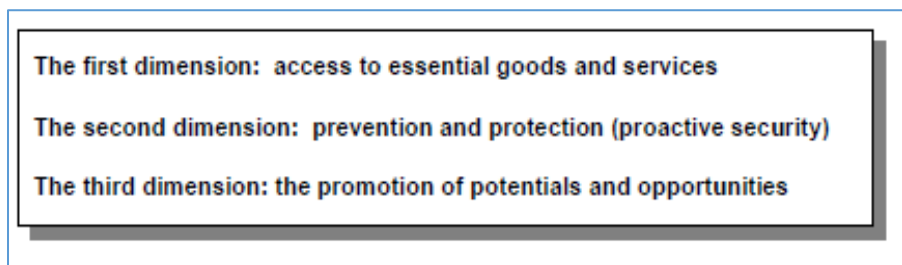
Figure 2 Social Protection in Three Dimensions

Alternatively, the three dimensions could be represented graphically in the following manner:
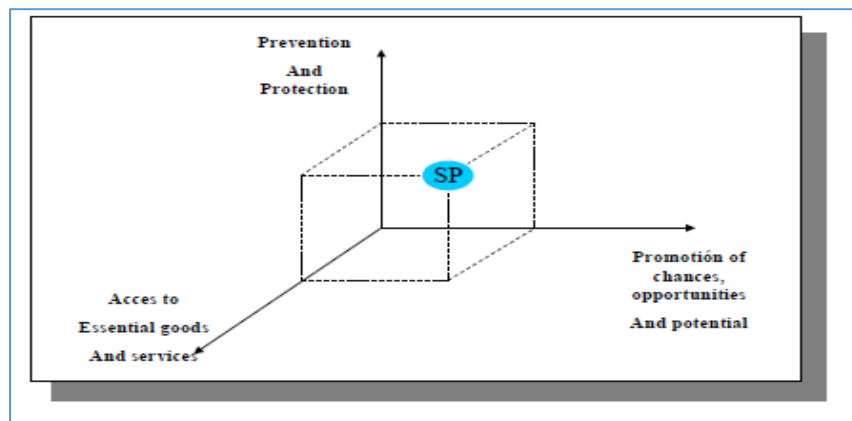
Figure 3 The Three Dimensions of Social Protection

The three dimensions explained by Garcia Bonilla & Gruet (2003), in their study Social Protection: A life cycle continuum investment for social justice, poverty reduction and sustainable development are explained in detail below:

First Dimension: Access to essential goods and services

Access to essential goods and services is a traditional objective of social protection. The achieve of this objective is key prerequisite to attain other social objectives. It is ineffective to advance a social protection scheme when the maximum population do not have access to essential goods and services. In developing countries, even the basic subsistence needs such as food, shelter, and clothing are not being met. Therefore, in order to break the vicious circle of poverty, the floor of essential goods and services should be covered, and social protection is a key to ensure that these essential needs are met.

The Second Dimension: Prevention and Protection (Proactive Security)

The second dimension of social protection scheme include more proactive measures with a function to prevent and protect against life contingencies. According to authors, in most of the developing countries, the poor are vulnerable to economic downturns. The income of population is dependent on the prices of agricultural goods and protects. A decline in the market prices of such agricultural goods and products can throw majority of population into the poverty. Similarly, errors in the implementation of macroeconomic policies or a political crisis can also throw a substantive proportion of the population into poverty if protective measures are not in place.

Hence, a proactive measure when applied can cushion against such shocks. The proactive measures would encourage individuals to undertake economic activities that would bring them greater returns. In developing country, a focus on human capital formation and promotion of opportunities through education and training to address the unemployment issues can be illustrated as proactive security approach. Lastly, the authors in their study conclude that this second dimension of social protection is interdependent with the other two dimensions. A safety-net function that ensures access to essential goods and service is necessary as a coping mechanism if a risk occurs. Similarly, the prevention of risks through proactive security measures helps promote the development of individual and social potentials and opportunities.

The Third Dimension: The Promotion of Potentials and Opportunities

The dimension of social protection includes fostering individual and social potentials and opportunities. This approach not only addresses the risk or adversities, but it also encourages the individual and societal efforts to achieve autonomy and contribute positively to the society. When the more people fulfil their potential, and take advantages of opportunities, they need less assistance to access the essential goods and services and they become less vulnerable to risk. For example, in developing countries women and girls are denied education and they are in greater risk of being exploited in the society. Thus, social protection plays an important role in eliminating all forms of discrimination and it ensures equal treatment and opportunities for all the members of the society. Instruments such as training, active labor policies, micro-credit strategies are some of the tools to promote the third dimension of social protection. This third dimension of social protection provide the real chance to those individuals who could not fulfil benefits from their first opportunity from the society.

2.3.   Social Protection Initiatives in Nepal

In Nepal, social protection is commonly known as welfare-like cash transfers that are implemented by MoFALD, the Department of Education and the Department of Health. The social protection has existed in Nepal for many centuries in the form of informal provision against food protection through Dharma Bhakari, a community-managed grain collection and storage system providing stocks for times of scarcity and also for the support of the most vulnerable community members but formal provision was first established by the Rana regime in 1934 for those serving in the

army; in 1948, this was expanded to cover all civil service employees in the form of a social security program, which is still in operation (Harris, McCord et al. 2013).

The significance of social security has increased immensely, and this is acknowledged by the Government of Nepal elected as an interim government operating under an interim constitution since 2007. The 2007 Interim Constitution clearly states that the Government of Nepal should formulate policy and design program to address the socially excluded population (Adhikari, Thapa et al. 2014). The figure 4 clearly summarizes the social protection provision across the life cycle in Nepal.

Figure 4: Social protection provision across the life cycle in Nepal
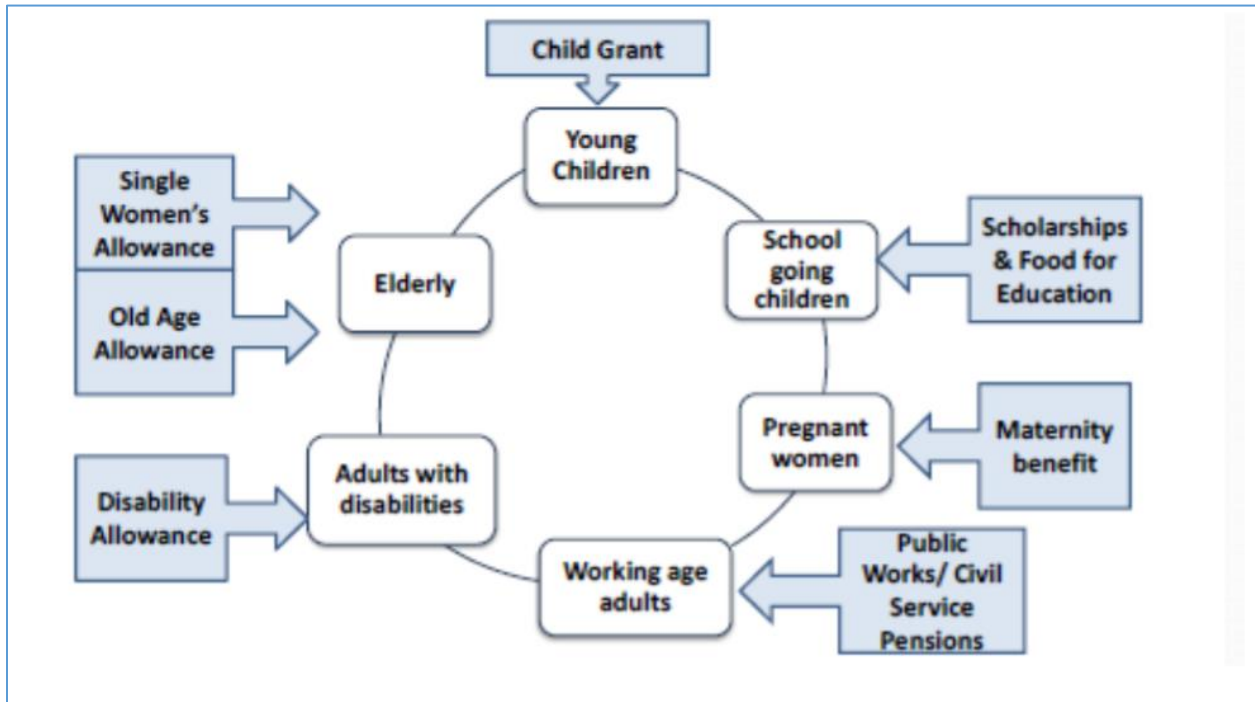
Source: World Bank (2011)

Even though Nepal has adapting social protection policies and its importance has increased significantly, a comprehensive study that focus on poor and deprived sections of the society, particularly those in informal sectors is yet to be carried out by the Government.

CHAPTER 3   METHODOLOGY

3.1.   Research Methodology

The study has been carried out by using secondary sources of the information and reviewing research reports published by Government agencies including, NPC, MoFALD, international agencies such as ILO, World Bank and the United Nations Development Program (UNDP) to identify the dynamic problems related to KEP. Most of the studies carried out by Government agencies and international organization has used purposive selection of KEP employed household to indicate the tracer approach. Random household selection in every identified location was also made by the available literatures. The collection of primary information on those literatures indicate that they have been collected through:

- Direct interviews of the beneficiary households utilizing structured questionnaire,
- Focus group discussion with the stakeholders (local social workers, local community members, political representatives, contractors, and local workers),
- Key Informants Interviewers (KII); and
- Observation of the KEP-created infrastructure.

For, the research methodology of present study secondary data sources is used to analyze the dynamic problem of the study (KEP's failure to provide 100 days employment). To analyze the dynamic problem a system dynamic approach is used to develop a quantitative (simulation) model by using STELLA modelling software.

3.1.1. System Dynamics Approaches

System Dynamics is a method that extends beyond conventional domain of systems approach to large-scale complex engineering problems. System Dynamics deals with interaction of various elements of a system in time and captures the dynamic aspect by incorporating concepts such as stock, flows, feedback, and delays, and thereby provides an insight into the dynamic behavior of system over time (Tang and Vijay 2001). According to (Sterman 2000), "system dynamics is a perspective and set of conceptual tools that enable us to understand the structure and dynamics of complex systems. System Dynamics is also a rigorous modeling method that enables us to build

formal computer simulations of complex systems and use them to design more effective policies and organizations."

According to (JRC 2007) a system dynamics application starts with the identification of a problem. The modelers should then draw in all major patterns of influence that together create the 'system' that produces the problem. A successful model is able to simulate these patterns and produce system behavior. Different values for variables and different policy structures may then be introduced to simulate how the system would respond to different circumstances or initiatives. This method searches for the causes of system behavior that lie within the system, with events 'outside' serving as triggers rather than causes. This method looks for dynamic patterns and describes them in terms of structural relationships between their multiple positive and negative feedback loops and the levels and rates of the primary variables. The design of a system dynamics model begins with a time-frame. The factors that contribute to the problem are listed and their structural relationships sketched with particular attention to characterizing them as levels and rates that feed or drain them. Levels and rates need to alternate in the model; no level can control another without an intervening level. The next step is to quantify these factors and the assumptions behind them. Computer simulations can then be run to test the validity of the model. The model will begin from the initial quantified values for the variables and step through them at discrete time intervals (JRC 2007).

3.2.   Research Strategy

The present study aims to answer the following research questions:

   i.   How will the employment created through KEP impact the recipient households?

  ii.   How the suggested new policy introduced in the model will impact the recipient household and generate more employment?

To answer the above questions following strategies are used:

1. The employment provided by KEP program which is derived from NPC report is used as a reference mode.
2. To address the dynamic problem (underperformance of KEP program i.e. to KEP providing less than 100 days of employment) five multiple modules (Population Chain,

Labor Demand, Labor Supply, Government Budget and Agriculture) were built to simulate patterns to produce system behavior so that different policy structures can be introduced to simulate how the system would respond differently to circumstances.

3. The basic Labor Demand model was extended to introduce the policy intervention to observe how the policy induced will affect the overall behavior of the model.

4. To answer the above-mentioned research questions, the models will be run along with the intervention policies and it will be compared with the reference mode. The different patterns and behavior will help to analyze the impact the KEP will have on household recipients.

5. After analyzing the system behavior, suggestions about possible policies and recommendation for future research will be provided through this study.

CHAPTER 4   THE MODEL STRUCTURE

This chapter gives the overview of model structure of KEP. The five modules: Population Chain, Labor Supply, Labor Demand, Government Budget, and Agriculture will be briefly defined in this section. The model of policy structure with and without policy will also be discussed in this section. This section is structed in following way:

 i. The list of models is presented.

 ii. Each of the five sectors is described in detail to understand the KEP dynamics.

 iii. The causal loop diagram of the model is briefed.

4.1.   Simulation Settings:

The time measurement for this project is conducted in years and the entire simulation is run from the year 2006 to 2013 in case of replicating the reference mode. However, to represent the policy implementation, the impact of the policy has been shown from the year 2014 to 2020. The time units for the model has been defined at 1 year and time step for the model is set at 0.25. Standard Euler method has been used for integration.

4.2.   Assumption of the Model:

The underlying assumptions over which the model has been developed are briefly explained below:

1. The Delay time in the model are assumed figures.
2. It is assumed that the policy will be implemented from the year 2014 to observe the changes in model behavior after the policy is implemented.
3. It is assumed that the project completion of KEP would lead to asset creation that leads to access to more land in Karnali area. This assumption has been made due to lack of proper data. However, some qualitative studies have shown evidence of benefits in the sector of agriculture (NPC 2012).
4. It is assumed that the Government budget for KEP is spent on the labor wages and skilled employee's salary.
5. It is assumed that KEP in its initial project identified one individual from every household as a potential beneficiary of the KEP project.

6. While introducing the policy it is assumed that KEP can easily hire the skilled employee from the market.

4.3.   The Models

The KEP model is divided into five sectors. They are:

1. Population Chain

2. Labor Supply

3. Labor Demand

4. Government Budget; and

5. Agriculture

The System Dynamics model built for addressing the problem has five modules as shown in the figure 5 below:
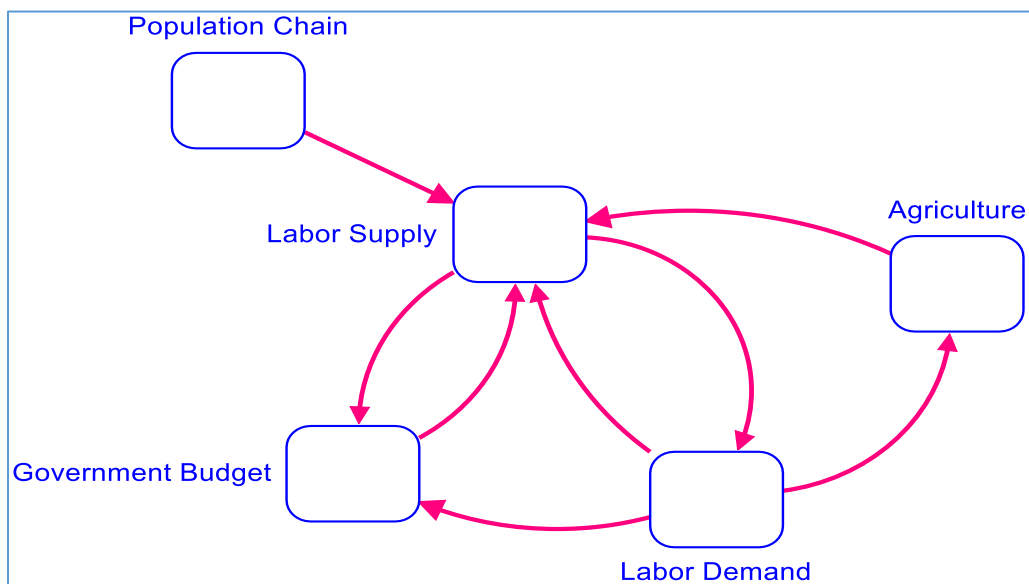

Figure 5 Five Modules and overview of the System Dynamics model for the KEP

A systematic description of each of the components of this model will be provided below where each module is explained in detail along with its sub-components:

4.3.1. Population

The population module depicts the development of the population dynamics of the area under the study (Karnali zone). The population module consists of three stocks namely:

i.   Young Population

Young population consists of people within the age group of 0-14 years. Birth rate is the inflow to the young population stock which has been calculated using the following equation:

$$Birth\ Rate = Total\ Population * CrudeBirthRate \qquad\qquad (1)$$

Young Population Death Rate and Young Population Maturation Rate are the two outflows associated with the young population stock where the first is the outflow caused due to the death of the people in the given age group while the other represents the number of people who have grown older than the age of 14 due to which they are transferred to the older age group. The calculation are as follows:

$$Young\ Population\ Death\ Rate = Young\ Population\ Fractional\ Death\ Rate *$$
$$Young\ Population\ (0-14) \quad (2)$$

$$Young\ Population\ Maturation\ Rate = \frac{Young\ Popuation(0-14)}{Time\ to\ become\ Adult} \qquad (3)$$

ii.   Adult Population

Adult Population consists of people within the age group 15-59 years. They are considered as the active population group that contributes to the society by joining the workforce. Young population maturation rate is the inflow to the Adult Population (15-59) Stock and it is the same as the outflow for Young population stock and can be referred to equation ***Young Population Maturation Rate = Young Popuation*(0 − 14)⁄*Time to become Adult***

(3). Similarly, there are two outflows namely adult population maturation rate and adult population death rate which can be computed using the following equations:

$$Adult\ Population\ Maturation\ Rate = (Adult\ Population)/(Time\ to\ Become\ Old) \qquad (4)$$

$$Adult\ Population\ Death\ Rate = Adult\ Population * Adult\ Death\ Fraction \qquad (5)$$

iii.   Old Population

Old Population consists of people within the age group of 60 and above. Adult Population Maturation rate which is the outflow for the Adult Population stock is considered as the inflow for

Old Population stock and therefore the same equation **Adult Population Maturation Rate = (Adult Population)/(Time to Become Old)**

(4) can be referred for the inflow to the old population stock. Death Rate is the outflow for the Old Population Stock which has been computed using the following equation:

Old Population Death Rate = Old Population Death Fraction ∗ Old Population (6)

iv. Total Population

Total Population can be considered as the summation of the three stocks i.e. Young Population, Adult Population, and Old Population which gives the total population of people in Karnali zone at any given point of time and it has been computed in the following manner:

Total Population = Young Population + Adult Population + Old Population (7)

From this module, the workforce population as well as total population can be estimated which is used as an input for the labor supply module.

The population chain model is one of the basic and most prominent structures that provides inputs to the labor supply module. The Stock Flow Diagram (SFD) in figure 6 of the population chain model will help us further understand and visualize the population chain model:
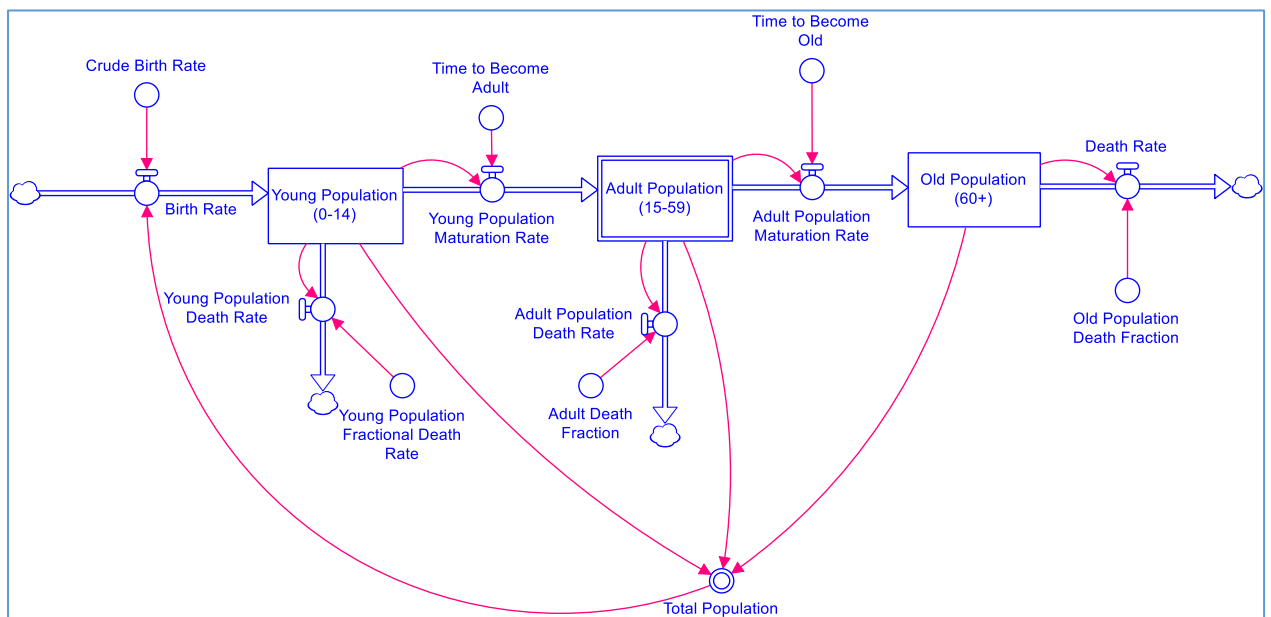

Figure 6 The Population Chain Model of Karnali Region

4.3.2. Labor Supply

The labor supply module computes the total number of people that are available for active participation in the labor market who are willing to offer their time in exchange of monetary incentives. However, since the KEP targets ultra-poor people looking for employment, the labor supply in that context will be a bit modified to match the condition of people who are both unemployed as well as ultra-poor. We have used the following structure to reflect how KEP has designed to identify the ultra-poor people that seeks employment:
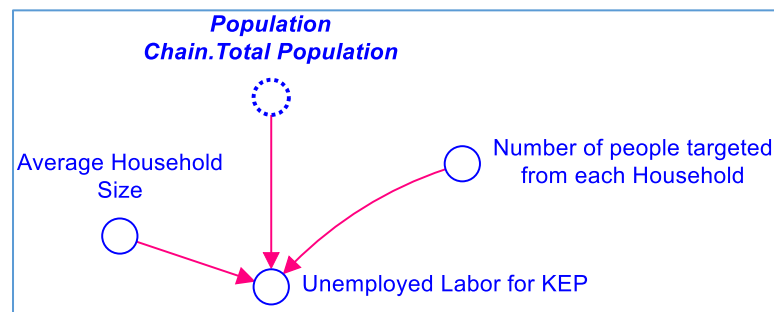
Figure 7 Structure that helps to explain Labor Supply for KEP program

As we can see in the above **Error! Reference source not found.**, KEP targets certain number of people (1 person) from each household and this number is used to calculate the total number of unemployed labor for KEP. Following equation helps to understand further the calculation of Unemployed Labor for KEP:

$$Unemployed\ Labor\ for\ KEP = \frac{Total\ Population}{Average\ Household\ Size} * Number\ of\ people\ targeted\ from\ each\ household \quad (\ 8)$$

Furthermore, Labor Supply module consists of two important stocks which can be further elaborated in the section below:

i. Unemployed

Unemployed which consists of the total number of unemployed people that are targeted by the KEP. This stock has one inflow namely – (Pool of Unemployed from Household per year) which explains the yearly increase in the number of unemployed people from the sources that were explained earlier. It has been computed using the following equation:

Pool_of_Unemployed_from_household_per_year = (MAX((Labor_Supply_for_KEP_Program-Unemployed-Employed-Employed_in_Agriculture)/Time_to_Adjust, 0))+Layoff_Rate (9)

Similarly, this stock has two outflows namely – (Net Labor Demand for Agriculture) which consists of total employment created for unemployed people through increase in agricultural activities which has been considered as the positive benefit of the project completed by KEP which is directed mostly towards infrastructure development in the field of agriculture and roads. Since, this outflow is an input from another module namely Agriculture sector, its equation will be duly explained in that respective section.

The other outflow consists of the hiring rate which means that the unemployed people are no longer unemployed as they have been hired through the projects introduced by KEP. Following equation explains how hiring rate has been determined:

Hiring Rate = IF (Government_Budget.Total_Government_Budget>0) THEN (MIN((Unemployed/Time_to_Hire), Labor_Demand.Labor_Demand)) ELSE 0   *(10)*

ii. Employed

Employed consists of those people who have been provided employment through the projects introduced by KEP. This stock consists of one inflow i.e. hiring rate which is explained earlier in equation (10) and one outflow namely layoff rate. Layoff rate is the labor that can only be employed as long as the project is in operation after which they have to be laid off. The following equation puts it into perspective:

Layoff rate = Employed/Labor_Demand.Project_Completion_Time   *(11)*

Both the stocks Unemployed as well as Employed are used as inputs to the other modules.

The following SFD in figure 8 can be used to summarize the entire Labor Supply Module:
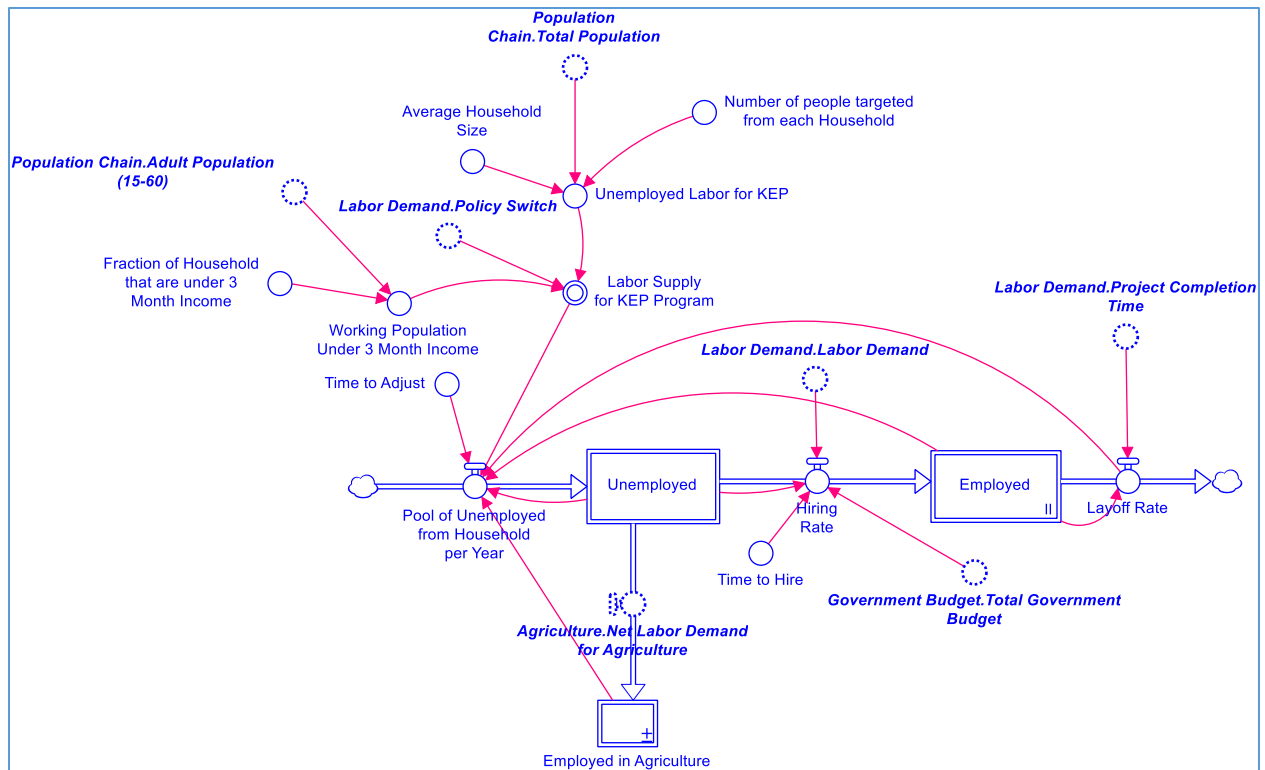
Figure 8 SFD of the Labor Supply Module

4.3.3. Labor Demand

The labor demand produces the number of labor required by the KEP based on the expected number of projects in operation which depends on the number of skilled employee hired by KEP. So, labor demand module has two major stocks i.e. Skilled Employee and Number of Projects in operation and one another stock called Project completed which only stores total number of project completed by KEP. Brief elaboration of each of these stocks and the flows associated with it are as follows:

i. Skilled Employee

Skilled Employee consists of the total number of skilled employee that KEP has hired to run various projects which in turn requires labor to work. This stock consists of one inflow and one outflow. The hiring rate of skilled employee is the inflow and layoff rate of skilled employee is the outflow:

Hiring rate for KEP currently is to maintain the current number of skilled employees and therefore following simple equation can help us understand its structure:

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Hiring rate of Skilled Employee = Layoff Rate of Skilled Employee (12)

Layoff rate for KEP depends on the average amount of time that each skilled employee is willing to work at KEP and it can be better understood with the following simple equation:

Layoff rate = Skilled_Employee/Average_Time_of_Work (13)

ii. Number of Projects in Operation

Number of projects in operation consists of the total number of projects in operation which is calculated based on the number of skilled employee and their productivity. This stock has one inflow and one outflow. They are project started rate which is the inflow and the project completion rate is the outflow of the number of projects in operation.

The project started rate shows how many projects are started each and the equation that defines this is:

Project Started Rate = Project_Initiated/delay_time (14)

Where,

*Project Initiated = Productivity * Skilled Employee* (15)

*Productivity = Learning_Curve_Effect*Initial_Productivity* (16)

Learning Curve Effect = 1+(EXP(min(1,Projects_Completed/250))) (17)

The above equations 15-17 show that the productivity is dependent on the initial productivity as well as the learning curve effect which grows as the skilled employee complete more projects. The learning curve effect has a saturation level at 500 projects beyond which the learning curve effect will not have any incremental impact on the productivity of an employee.

Similarly, Project completion rate is the outflow from the stock Number of Projects in Operation which shows the rate at which the number of projects in operation are completed. The equation that defines the outflow is:

Project Completion Rate = No_of_Projects_in_Operation/Project_Completion_Time (18)

iii. Projects Completed

This is an additional stock in the module which only stores the total number of projects completed by the KEP. The outflow for the stock Number of Projects in Operation i.e. Project completion rate is the inflow for Project completed stock and its equation can be referred from equation (18).

A simple SFD of the Labor Demand module can be seen in the figure 9 below which helps us to visualize and relate to the equations that have been provided with respect to the labor demand module.
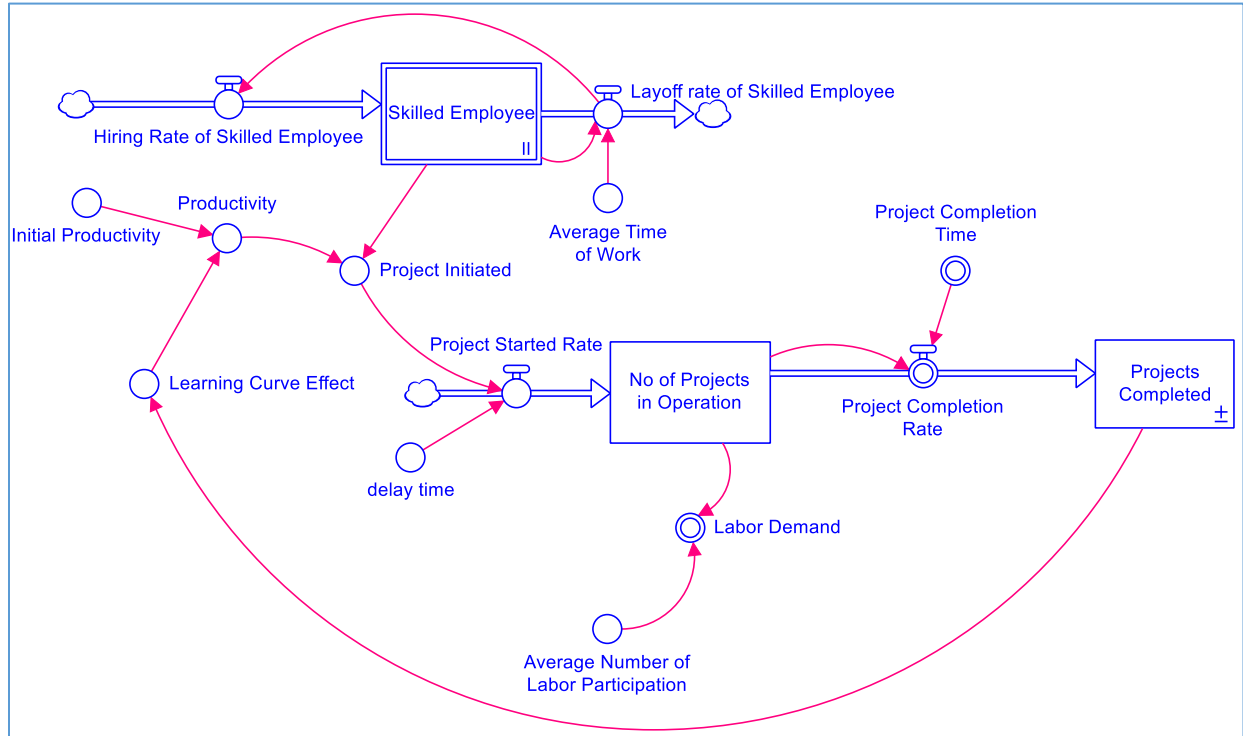
Figure 9 Labor Demand Module for KEP

4.3.4. Agriculture

The agriculture module shows the total amount of land available for agriculture and the impact of the KEP projects on the generation of additional units of land for agriculture. This generation of land relates to the amount of new land that can be accessed to for agricultural purposes which is the result of development of road and irrigation infrastructure. The remote land terrain of Mid-Western Region of Nepal has caused many problems for the households to be able to access the land for productive purposes. The projects initiated by KEP are mainly focused towards development of infrastructure that aid in agriculture. Therefore, the direct relationship between the number of KEP projects completed and access to / generation of arable land can be formed.

In terms of the model, agriculture sector has mainly two stocks "Asset Creation" and "Arable Land". This module accepts one input from Labor Demand module i.e. Project Completion Rate

Equation (18) and it provides one output in the form of Net Labor Demand for agriculture to the Labor Supply module.

i. Asset Creation

The asset creation stock shows the total amount of asset created in terms of its monetary value (expressed in NPR). The asset creation stock has one inflow and one outflow which is asset creation rate and asset depreciation rate respectively.

Asset Creation Rate is the rate at which new assets are created and that causes the stock of asset creation to increase. The equation for asset creation rate is given as follows:

Asset Creation Rate = (Average_Value_per_Project*Labor_Demand.Project_Completion_Rate)   *(19)*

Asset Depreciation Rate is the rate at which the existing assets get depreciated and for this purpose we have taken an arbitrary fixed depreciation rate. The corresponding equation that explains the Asset Depreciation Rate is as follows:

Asset Depreciation Rate = Asset_Creation/Depreciation_Time   *(20)*

ii. Arable Land

The Arable Land stock shows the total amount of arable land that is available in the Mid-Western region of Nepal. This stock has one inflow and one outflow as well which are Generation of arable land and Depletion of Arable Land respectively.

Generation of arable land is the amount of land that is generated as a result of the asset created by the KEP program. The following equation explains the calculation of generation of arable land:

Generation of arable land = (IF Arable_Land <Maximum_Value_for_Arable_Land THEN Access_to_more_Land_per_Agriculture ELSE 0)   *(21)*

Similarly, there is some natural rate at which the fertility rate of land gets deteriorated and thus depletion of arable land and this value has been calculated in the following manner:

Depletion of arable land = Arable_Land*Deprection_Rate (22)

The following SFD summarizes the entire Agriculture Module:
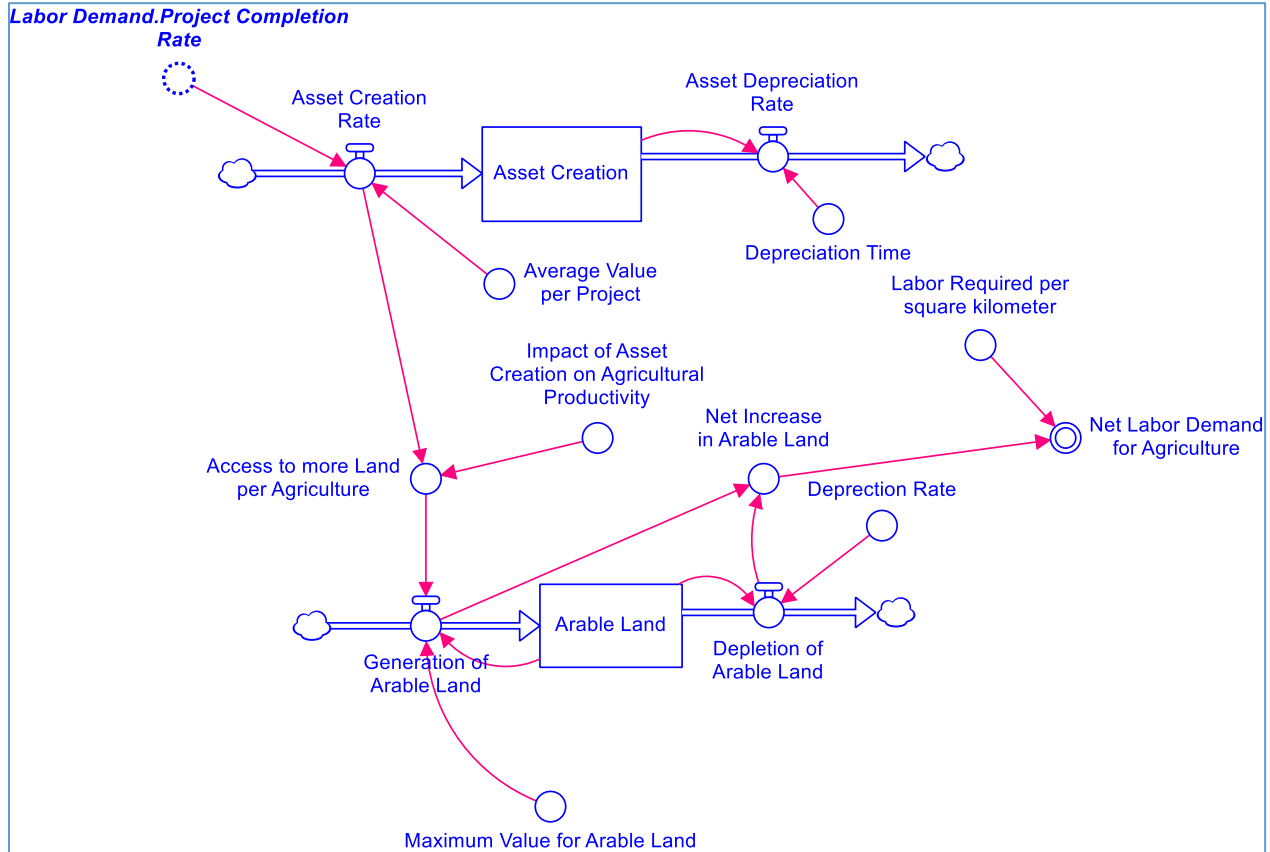
Figure 10 Agriculture Module of KEP

4.3.5. Government Budget

The Government budget module tries to calculate the inflow and outflow of funds to the KEP program. The bank account of KEP which has been named as the total Government budget contains the total amount of money for KEP project. This module consists of one stock namely Total Government Budget which can be considered as the bank account of KEP which holds the total funds that are available for spending. This stock further has one inflow called approved funding and two outflows namely Spending on Labor Wages Spending on Administrative Wages respectively.

i. Approved Funding

Approved Funding is the approved budget that has been allocated to the KEP by the government. This funding can be considered as a yearly inflow. A graphical function has been used to fill in the exact yearly data that this program has received from the year 2006 to 2013.

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Figure 11 The Data for approved budget for KEP

ii. Spending on Administrative Wages

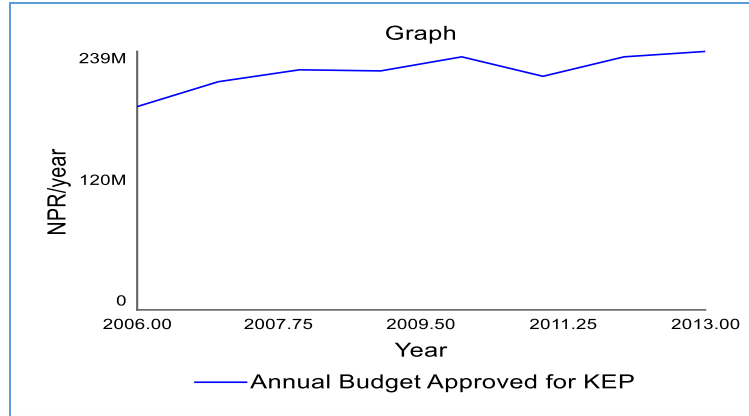Spending on Administrative Wages is the total amount spent by the KEP on administrative staffs and other miscellaneous expenses. The equation for this calculation is:

Spending on Administrative Wages= Labor_Demand.Skilled_Employee*Avg_Salary_per_skilled_employee (23)

iii. Spending on Labor Wages

Spending on Labor Wages is the total amount spent by the KEP on the wages of the labor hired during a given period. The equation for labor hired is as follows:

Spending on Labor Wages = MIN((Total_Government_Budget/delay_time),
Labor_Supply.Employed*Labor's_Yearly_Wage)　　　　　　　　　　　　　　　　*(24)*

The main variable of the model which is a rough estimation of the reference mode i.e. Employment given by KEP in days is calculated in the Government budget module and the equation for this variable is:

Employment given by KEP in days =
(((Spending_on_Labor_Wages/(Labor_Supply.Labor_Supply_for_KEP_Program-
Labor_Supply.Employed_in_Agriculture))/avg_wage_per_day))*year　　　　　　*(25)*

The following SFD in figure 12 summarizes the entire Government Module:
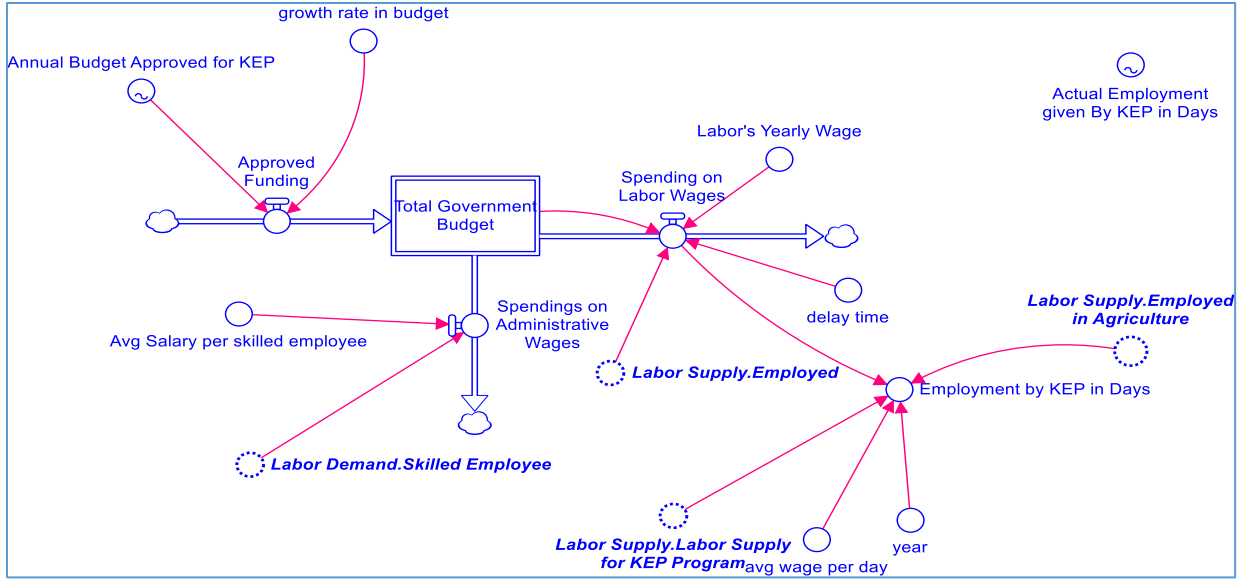
Figure 12 Government Module of KEP

4.4. CLD Representation of the model

A Causal Loop Diagram (CLD) of the above STELLA model helps us to understand the bird's eye view of the entire model. The CLD helps to simplify the system and understanding the feedback mechanism. The basic model is summarized by using CLD in figure 13:
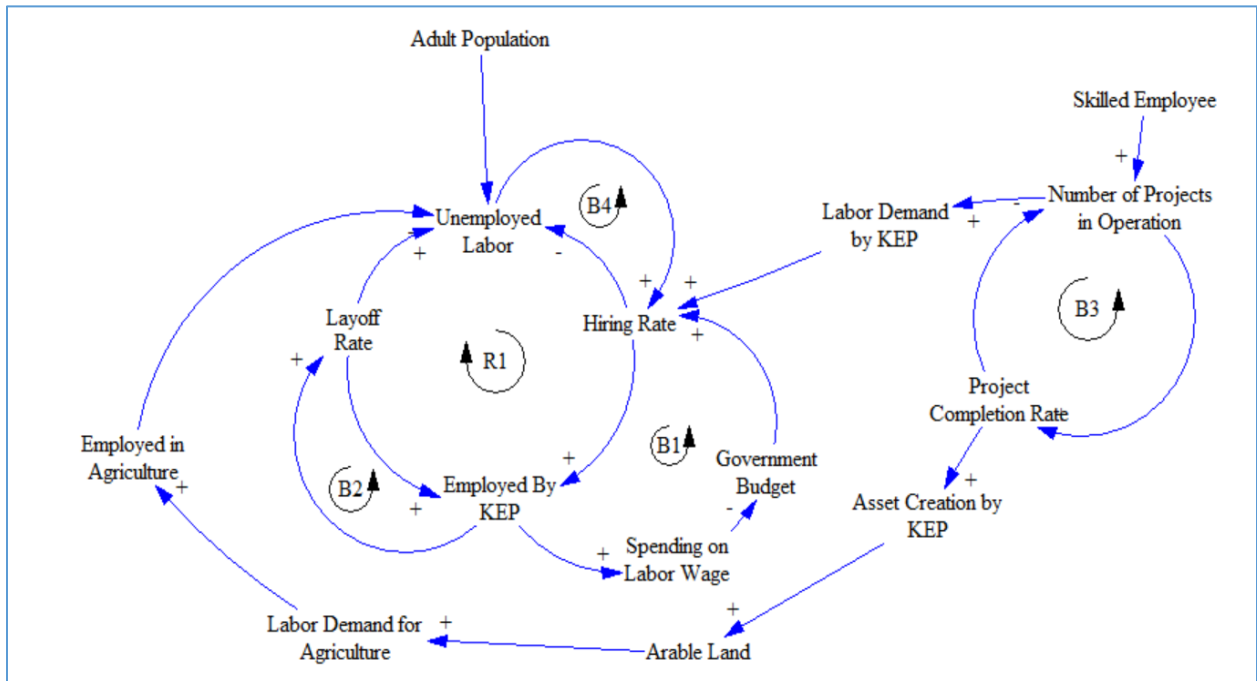

Figure 13 Basic CLD Model of KEP without Policy

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In the figure 13 there are 4 balancing feedback loops and 1 Reinforcing loop. All the feedbacks loops are numbered and a brief explanation for each loop is presented below:

4.4.1. Balancing Feedback Loop

B1: Loop B1 show the balancing feedback relationship between hiring rate of labor, labor employed by KEP, spending on labor wage and Government Budget. Hiring rate has a positive relationship with number of labor employed by KEP. The number of labor employed by KEP also has positive relationship with spending on the labor wage. To illustrate this relationship, higher number of labor employed by KEP would mean higher wage that needs to be paid by KEP and vice-versa. This spending on labor wage has negative relationship with the Government budget available for KEP and this Government budget available has positive relationship with hiring rate which closes the loop.

B2: This is a minor balancing feedback loop. This loop shows the relationship between layoff rate and labor employed by KEP. There is a positive relationship between labor employed by KEP and layoff rate. However, this relationship with layoff rate and labor employed by KEP will change as the layoff rate rises or declines and there is going to be inverse relationship between these two variables.

B3: This is a minor feedback loop where number of projects in operation has a positive relation with the projection completion rate. However, completion of project will lead to lower number of project in operation.

B4: This is a minor balancing feedback loop which signifies the negative relationship between unemployed labor and hiring rate.

4.4.2. Reinforcing Loop:

R1: The reinforcing loop R1 shows the positive relationship between unemployed people, hiring rate and number of people employed by KEP. The loop shows that higher number of unemployed labor leads to higher hiring rate and this would lead to higher number of labor employed by KEP. Again, higher number of labor employed by KEP would lead to higher layoff rate and this in turn would lead to higher unemployed labor.

In the policy implementation and recommendation section, the impact of policy will be represented as an added structure in the CLD to understand the mechanism in simple terms visually.

CHAPTER 5   MODEL BEHAVIOR

5.1.   Reference Mode vs the Model Behavior

The main concern of the underlying study was to understand why KEP was unable to provide the 100 days employment to the ultra-poor people in Karnali. The model developed for this purpose as explained in Chapter 4 helps us replicate the behavior of actual employment given by KEP in days. As shown in the figure below, line 1 represents the actual employment provided by KEP and it can be seen from the graph that KEP has been short of its targeted employment of 100 days i.e. it has reached a maximum of around 15 days in the year 2006 and for most part of the period 2006-2013 it has provided employment of roughly 12-13 days per year. Line 2 is the behavior generated by the model and it seems that it has been able to quite closely replicate the reference mode and has similar shape which means that the model developed has been able to explain the actual event in some extent.
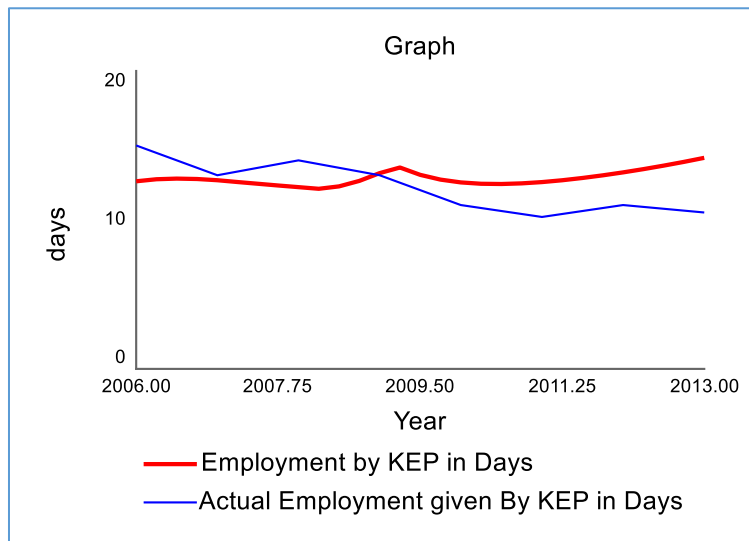
Figure 14 Reference Mode vs the model behavior

Similarly, there are other essential aspects of the model whose behavior over time can help us to understand the underlying problem with the KEP project. Some key variables of the model are therefore, presented in this section:

5.2.   Unemployed

The unemployed people of Karnali that KEP project has tried to provide employment is included in this model and its behavior over time can be seen in the figure 15 below. It is seen that there are

some issues with the project as the number of unemployed people gradually rises from its initial figure of 67,700 unemployed people and settles at a figure of around 95,700 unemployed people. Instead of the project being able to provide jobs and reduce the number of unemployed people, the opposite can be seen in the figure.

Figure 15 Unemployed people in Karnali region eligible for KEP

5.3. Employed

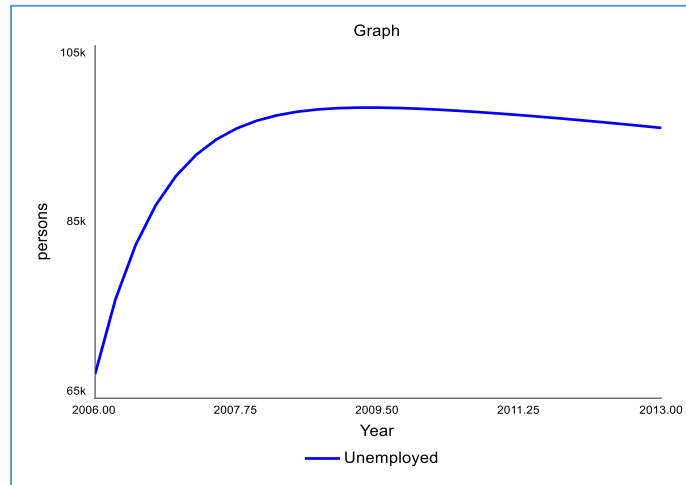The graph shows that KEP has been able to provide employment to a mere 3,630 people per year and this can also be seen in the figure 16 below. This number of employment has been way less compared to the employment goal of KEP.
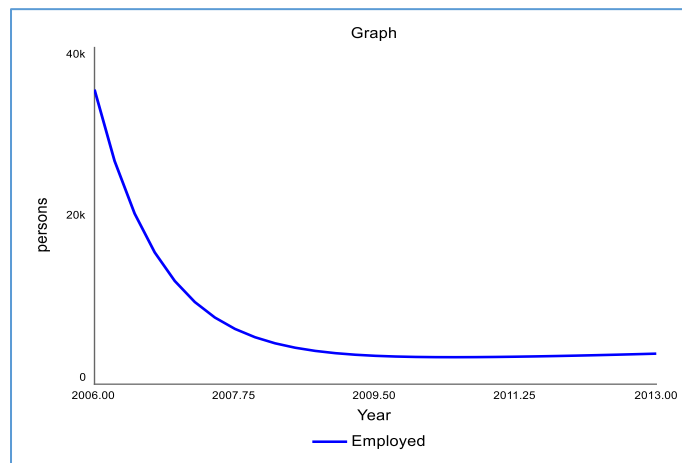
Figure 16 Number of Employed People by KEP

5.4. Skilled Employees

Skilled Employees are the backbone of the KEP. The productivity of skilled employee determines the total number of project that are in operation. The total number of project in operation in turn determines the number of people i.e. labor that are employed by KEP. However, as per the KEP policy, fixed number of skilled employee have been hired for the entirety of the simulation i.e. from 2006 to 2013. In figure 17, it is seen that a total of 5 skilled employee were hired by the KEP to run the project.
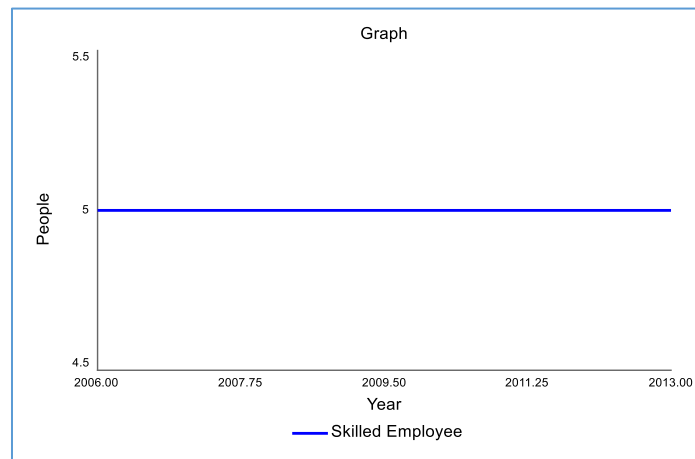
Figure 17 Number of skilled employee at KEP

5.5. Number of project in operation

The skilled employee with passage of time will have some learning curve/ experience effect as a result of which their productivity will gradually grow as they complete more projects. Figure 18 below shows the behavior of the total number of project in operation. It is seen that the number of projects in operation grows from the initial value of 10 projects to 35 projects by the end of 2013.
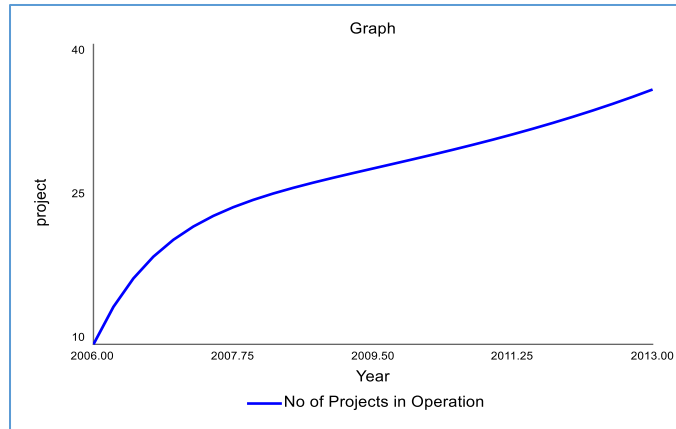
Figure 18 Number of projects in operation for KEP

5.6. Projects completed

This is the total number of projects completed by KEP from 2006 to 2013. By the end of 2013 KEP had completed 184 projects in total which can be seen in the below Figure 19.
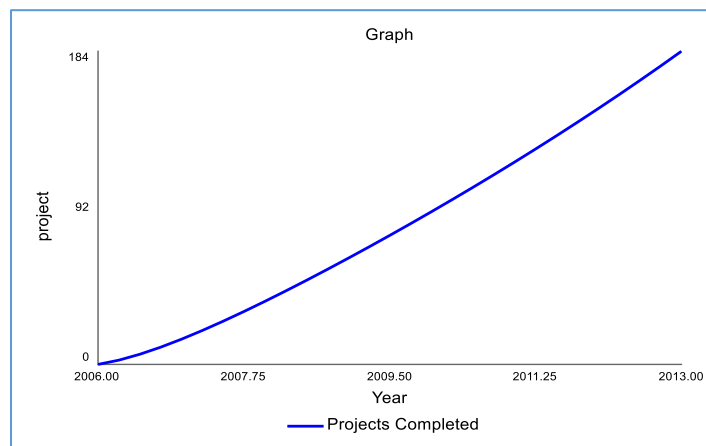
Figure 19 Projects completed by KEP

5.7. Asset Creation

Most projects conducted by KEP were related to building roads and developing irrigation channels for agriculture. Since, Karnali is highly remote place, these projects once completed result in some indirect benefits i.e. it helps in access to more arable lands. However, these values have not been verified with data, but some average values have been used in order to compute the average amount of asset created as the projects get completed. Figure 20 shows that KEP accumulates a total of

15.9 million worth of assets by the end of 2013. These assets created in turn would help in increasing access to more land for cultivation.
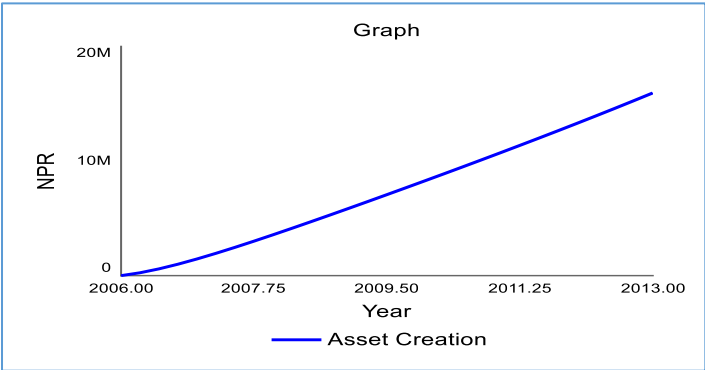
Figure 20 Asset Creation by KEP

5.8. Arable Land

Due to the of asset creation by KEP arable land has to certain extent increased during the given time frame of 2006 to 2013. It can be seen that in the figure 20, arable land in Karnali region has increased from the initial value of 3.3 sq.km. to 3.33 sq.km.

Figure 21 Arable Land in the Karnali region

CHAPTER 6   MODEL VALIDATION

6.1.   Test of Model Validation

This chapter will try to validate the KEP model which is described in Chapter 4. The reason for checking the validation of the model is to build the soundness and usefulness of a model (Barlas 1996). The set of validation test is performed in this chapter to check the soundness and usefulness of the model. The soundness of the mod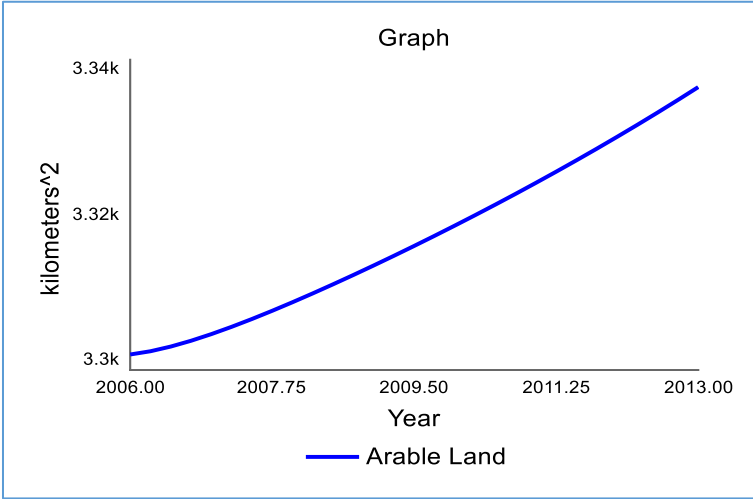el mean that the model will make correct prediction, explain causes of important problem, and provide a basis for designing policies that can improve behavior in future (Senge and Forrester 1980). The authors Senge and Forrester (1980) although has mentioned that there is no formal definition for validation, the system dynamists should present the many tests available for assessing the realism of model assumptions and behavior to generate insights into the cause of observed phenomena. Similarly, (Sterman 2000) also suggest for continuous testing throughout the modelling process in order to detect modelling errors or flaws in the model design. Therefore, taking the suggestion of Senge and Forrester (1980) and Sterman (2000) the test was continuously performed throughout the modelling process. For, the validation of model, the suggested test by Sterman (2000) is taken into the consideration for the present study. Each of the test suggested by Sterman (2000) are explained individually below:

6.1.1. Structure Assessment Test

Structure confirmation test can be done by carrying out theoretical structure test by comparing the model equations with generalized knowledge in the literature. The main purpose of carrying out structure assessment test is to observe if the model structure is consistent with relevant descriptive knowledge of the system (Sterman 2000). To observe the model structure consistency various literature, previous research findings and statistical sources were used. The knowledge obtained from those resources were used to build the model structure such as stock and flow diagram, causal loop diagram and equation formulation in the model.

6.1.2. Boundary Adequacy Test

Boundary test can be considered as the scope of the study where some key variables are treated endogenously while other variables are treated as exogenously (given to the model). These exogenous variables (often obtained from reports/ previous research studies) are used to explain the endogenous variables which is key to the current study. In the current study, the unemployed

people that are considered as ultra-poor by KEP are treated endogenously. The model will try to explain how these initially targeted ultra-poor unemployed people will benefit through the implementation of KEP projects. However, this model will not try to model the entire labor demand or labor supply in Karnali region. Labor market in general are treated as exogenous factor. This model will try to explain the interaction between labor demand and supply within the KEP project. The variable such as skilled employee, arable land, projects in operation all are treated as endogenous variables and these variables contribute to explaining the labor demand and labor supply for the KEP market. Furthermore, variables such as household size, Government budget are also treated exogenously. Although for instance, Government budget can be treated as endogenous variable in order to see the relationship between successful implementation of the project that would lead to better allocation of Government budget in future and vice-versa, this plan was not implemented due to lack of time constraints.

6.1.3. Parameter Assessment Test

According to Sterman (2000) parameter assessment test is done to see if the equations are dimensionally consistent and has clear real world meaning. To confirm this test, most of the parameters numerical values are taken from literature, Government statistical sources and previous research studies. However, some of the parameter values are adjusted due to the lack of data and study in the concern field. For example, Agriculture module is a general indication of benefits that KEP can provide for agriculture sector in Karnali region. However, the benefits cannot provide conclusive result since, due to lack data resources and information proper field work has not been done and this could be one of the field for future studies. Hence, in the model where there is lack of data and information, the values provided by previous studies and resources are used as a benchmark values.

6.1.4. Dimensional Consistency Test

The dimensional consistency test was considered from the very beginning of the building model. This test confirms that all the units of parameter values are consistent. To ensure the dimensional consistency test, Stella Architect is used. The iseesystem, suggest the following steps to check the consistency for the entire model:

   i.   To check unit consistency for entire model all the equations in the model must be entered. Once this happens, the message on the Run toolbar will change from providing the

number of errors to providing the number of variables for which units have not been defined, or for which there are unit inconsistencies.

Note: The list of model errors and unit warnings is only available in Model x^2 mode, not in Map 🌐 mode.

ii.   If no problems are found, the Run toolbar won't display any message.

iii.   For each units' issue, the dropdown listing the number of warning errors displays the name of the variable with the problem.

iv.   To troubleshoot the inconsistencies, each variable should be seleted, and then its units must be checked. Using the Check Units entry in the menu next to the units will provide additional information on the nature of the inconsistency.

All the steps suggested by the iseesystem is followed by using STELLA software. The software show that all the units are consistent. This can be seen in figure 22 after using Run toolbar, no message was displayed. Hence, it ensures that the model is dimensionally consistent.
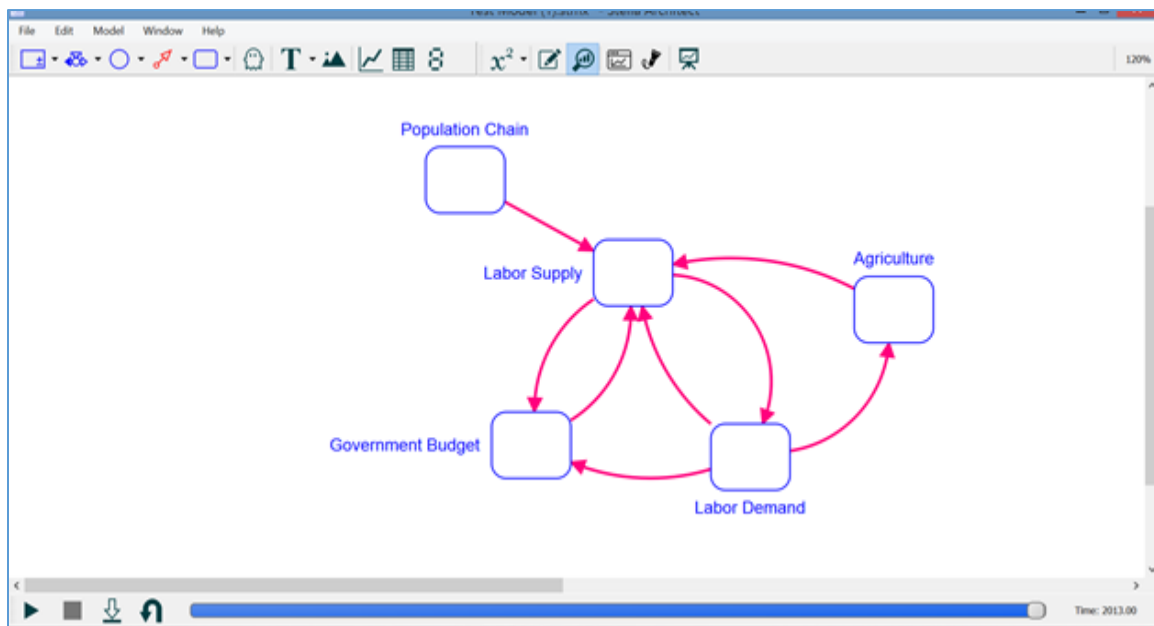

Figure 22 Dimensional Consistency Test of the Model

6.1.5. Extreme Condition Test

To perform the extreme condition test, the parameters were assigned with extreme values to see if the model behavior make sense even when its inputs take on extreme values. For this process, several constants were tested like average household size, impact of asset creation on agriculture

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productivity, Average number of labor participation and so on. For, now two variables are taken into consideration for extreme condition test and they are average household size from Labor Supply module and impact of Average number of Labor Participation from Labor Demand Module. The results are shown below:

i. Average Household Size

In the model, the average household size plays a key role in determining how many people targets to provide employment. The more average the household size is the more employment the people should get under KEP program. In the model, the average household size was 5.3 and with this household size KEP was able to provide in average 13 days of employment. Now for the extreme condition test, the value for the average household size is kept at 1, 5, 10 and 15 which is represented in the graph as Run 1, Run 2, Run 3, and Run 4 respectively. The graph shows that when the average household size is decreased to 1 the employment days also decreases accordingly. Similarly, when the average household size is increased to 15 the employment days provided by KEP is also increases and reaches around 30 days.
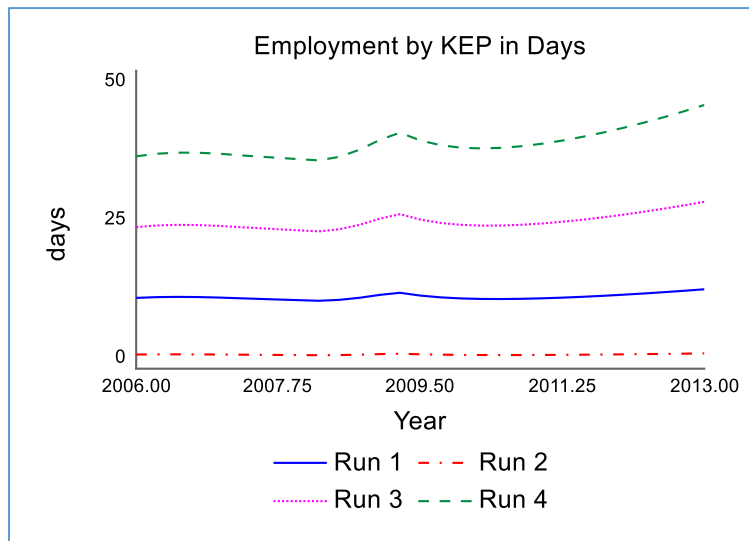

Figure 23 Extreme Condition Test, Average Household Size

ii. Average Number of Labor Participation

Average number of labor participation show how many people will work in a project. This variable was tested to how it will impact on Employment generated by KEP in days. For the extreme condition test the value in average number of labor participants were kept as 50, 110 and 500 for

Run 1, Run 2, and Run 3 respectively. As expected, when the number of average employee of Labor participation is increased then the days of employment would increase which is represented by Run 3 in graph below. Similarly, when the number was decreased to 50 the employment by KEP days felt to 6.48 days.
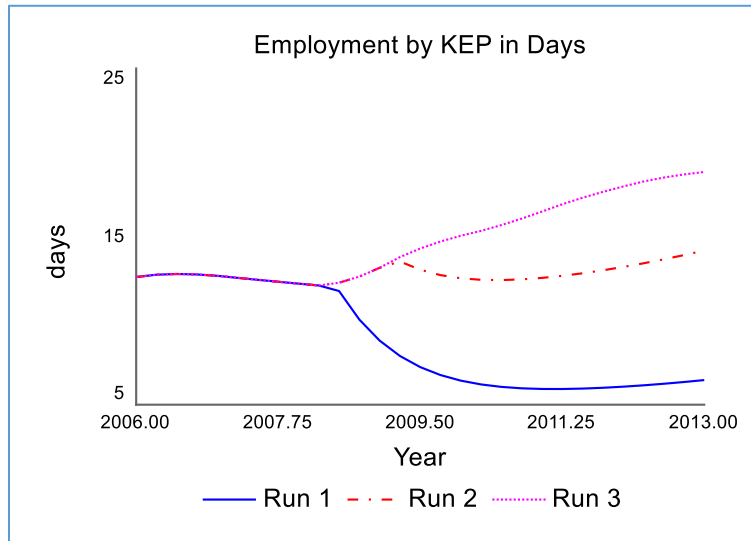

Figure 24 Extreme Condition Test, Average Number of Labor Participants

6.1.6. Integration Error Test

The model was tested to see if the model is sensitive to the choice of time step or integration method. For this, the integration methods available in Stella Architect such as Euler, Cycle Time, RK2, and RK4 were tested and the results show that the model behavior is consistent regardless of whichever method was used. For time step 0.25 was used for the convenience.

6.1.7. Equilibrium Test

Equilibrium test is done to ensure that the inflows and outflows are consistent given that the inflows and outflows are equal. To ensure inflows and outflows are consistent the stock should be in equilibrium. In case, the equilibrium is not obtained after setting all the inflows and outflows equal then there is some problem in the structure. To ensure that there is no problem in structure this equilibrium test was performed and this test show that the structure do not have any problem. The test is performed in following manner.

Setting the Model into Equilibrium

The parameters and stock values need to be set to certain specific values in order for the model to run in equilibrium. The values of each of the variables in the respective modules have been outlined below:

- Government Budget Module -
    - Annual Budget Approved for KEP = 232,500,000
    - Total Government Budget (Initial Value) = 232,500,000
- Population Chain Module -
    - Young Population (0-14) = 100,000
    - Adult Population (15-59) = 100,000
    - Old Population = 100,000
    - Crude Birth Rate = 0.1
    - Young Population Fractional Death Rate = 0.20
    - Time to Become Adult = 10
    - Adult Death Fraction = 0.05
    - Time to Become Old = 20
    - Old Population Death Fraction = 0.05
- Labor Supply
    - Average household size = 3
    - Unemployed (Initial Value) = 50,000
    - Employed (Initial Value) = 50,000
- Labor Demand
    - Productivity = Initial Productivity
    - Avg. number of labor participation = 4,000
- Agriculture
    - Asset Creation (Initial Value) = 1,250,000
    - Depreciation Time = 1
    - Arable Land (Initial Value) = 1,000
    - Depreciation Rate = 0.0025

After setting the model to these values in the respective modules, we can see that the model runs in equilibrium state. Below are some of the graphs of the stocks of the model which provide further evidence of equilibrium.

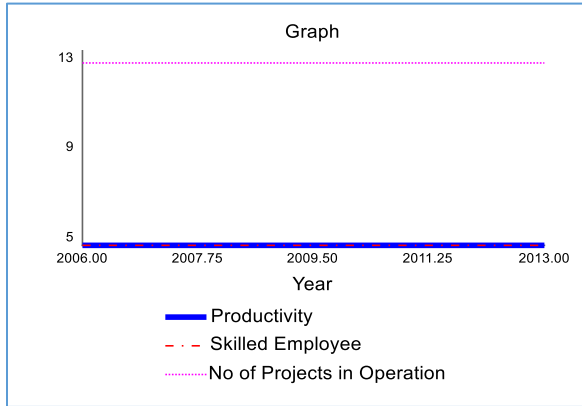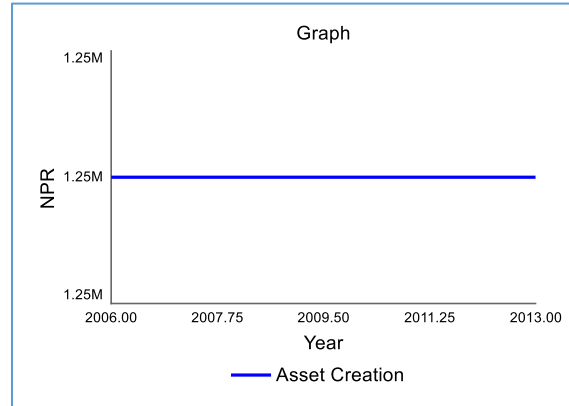*Figure 25 Equilibrium Test, Productivity, Skilled Employee, and No. of Projects in Operation*
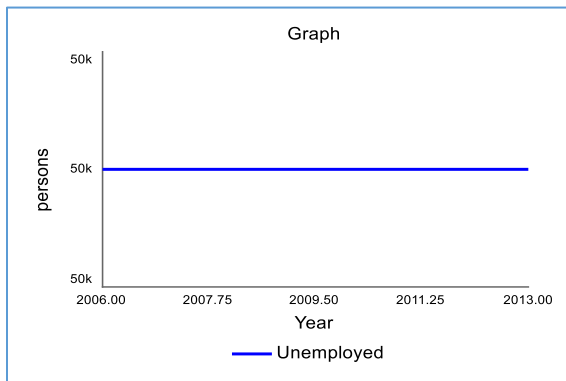

Figure 26 Equilibrium Test, Asset Creation
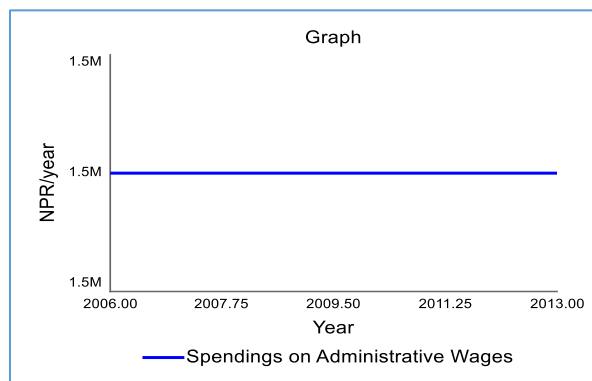

Figure 27 Equilibrium Test Unemployed

Figure 28 Equilibrium Test Spending on Administrative Wages

CHAPTER 7   POLICY RECOMMENDATION AND IMPLEMENTATION

7.1.   Introduction to the Policy

The model presented in chapter – 4 and the simulation results of the model shown in Chapter 5 provides us with some idea regarding the possible shortcomings of the KEP project. The policy introduced can be explained in the following manner:

7.1.1. Clear definition of the Ultra Poor Working Population

In the labor supply module, it can be seen that the definition of ultra-poor has been made bit unclear i.e. KEP considers at least 1 person from every household to be considered for the employment program. However, this isn't the case as all the households do not fall in the ultra-poor category. The data provides evidence that 18% of total working population earn less than 3 months income and therefore, are considered as the ultra-poor population that KEP should be targeting. Following figure 29 shows the snapshot of the SFD which now considers the truly ultra-poor working population.
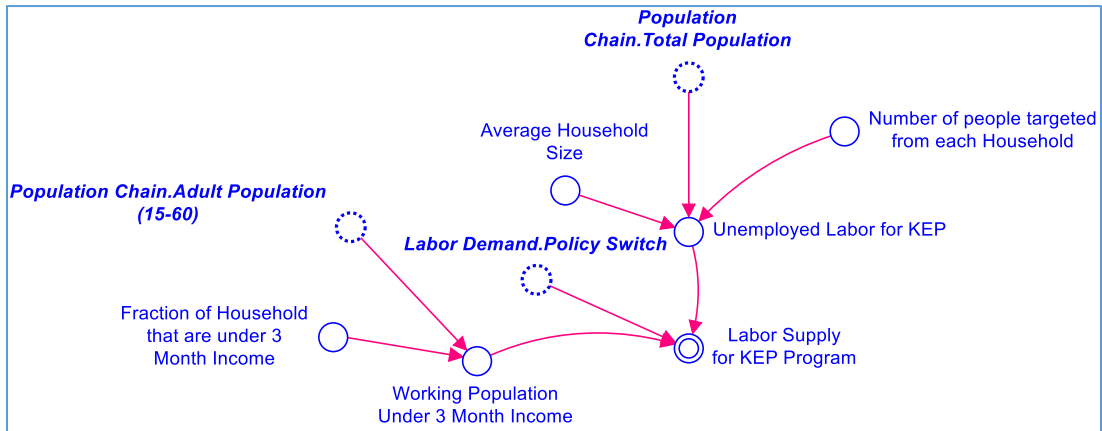

Figure 29 Considering ultra-poor working population for KEP

The new equation that has been introduced to incorporate this issue is listed below:

Labor Supply for KEP program = IF (Labor_Demand.Policy_Switch=1) THEN MIN(Unemployed_Labor_for_KEP, Working_Population_Under_3_Month_Income) ELSE Unemployed_Labor_for_KEP (26)

By doing so, KEP can truly target the ultra – poor population and deliver the performance that is needed. Therefore, KEP should try to identify the true ultra-poor population and the above equation 26 addresses that situation.

7.1.2. Bridging the Skilled Employee Gap

The model unraveled in Chapter 4 has clearly shown that the number of projects in operation are determined by the number of skilled employee hired by KEP. This total number of projects in operation in turn determine the total number of labor that are demanded by KEP to complete it. The following snapshot of a part of the SFD diagram that has been added as a policy to the labor demand module is presented below:

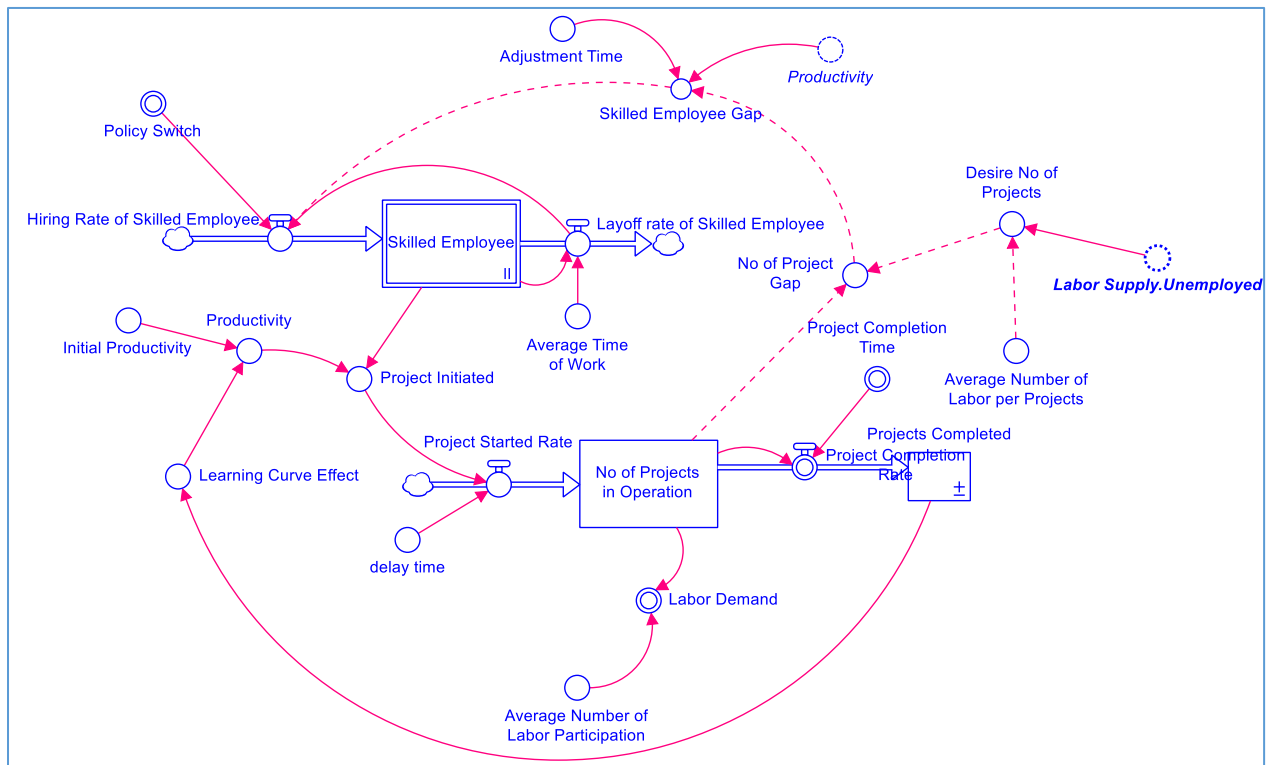*Figure 30 SFD of the Labor Demand module including the policy*

As can be seen in the above figure 30, the dotted lines represent the added structure to the initial model which works a policy program to hire more skilled employees based on the number of unemployed people that KEP is looking to provide employment. Following are the equations that were used to explain the new variables included in the policy:

Desired number of projects = MAX (0, labor_Supply.Unemployed / Average_Number_of_Labor_per_Projects) (27)

No of Project gap = MAX(0, Desire_No_of_Projects-No_of_Projects_in_Operation) (28)

Skilled Employee Gap = (No_of_Project_Gap/Productivity)/Adjustment_Time (29)

Policy Switch = (IF TIME<2014 THEN 0 ELSE 1) (30)

*Hiring Rate of Skilled Employee = Layoff_rate_of_Skilled_Employee + (Policy_Switch*Skilled_Employee_Gap) (31)*

7.2. Key Assumptions Behind the Policy

- Adjustment Time for the skilled employee gap to reach the desired level is 3 years.
- The government budget for KEP has been assumed to grow at a healthy rate of 10% per annum.
- The policy is assumed to be applied from the year 2014 and an attempt is made to see in backdate the impact of the policy until the year 2020.

7.3. CLD Representation of the Policy Model

Introduction of policy leads to inclusion of two additional feedback loop B5 and B6 which are explained below in detail:
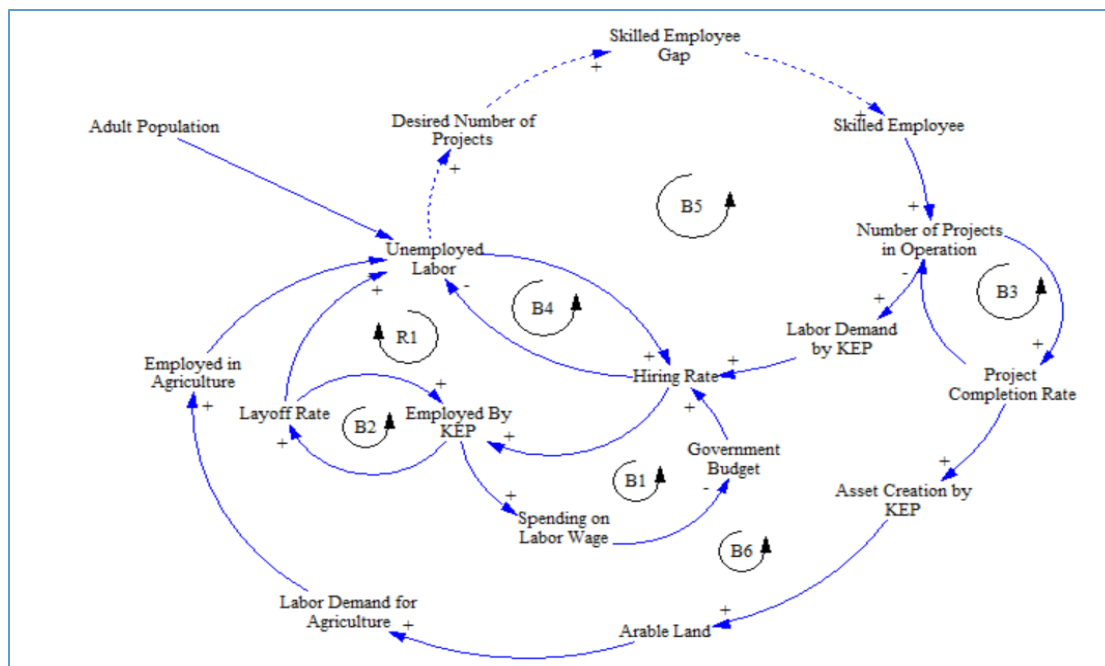

Figure 31 CLD model including the policy

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The two-additional feedback loop attempts to reduce the number of unemployment labor. These loops B5 and B6 show the impact of direct and indirect benefits of policy implementation in the model. The loop B5 is a major feedback loop which show how the stock of unemployed labor is used as a reference point to create desired goal of number of projects required to create jobs to unemployed people which in turn would lead to hiring of skilled employee. The hiring of skilled employee will increase the project in operation resulting in increment of labor demand which will ultimately reduce the unemployment in Karnali Region. Similarly, B6 loop show how the completion of KEP projects would lead to asset creation that will aid to generation of new arable lands. This new generation of arable land will again create labor demand for agriculture which will reduce the unemployed labor.

7.4.   Presentation of Results After Implementing the Policy

7.4.1. Employment by KEP in Days

It has been explained earlier in the introduction section of this thesis that KEP had targeted to provide 100 days employment to the ultra-poor people of Karnali. However, the figure 32 below shows that up until the year 2013, KEP was able to barely provide 15-20 days of employment to its targeted ultra- poor people. However, after the implementation of the policy, KEP will be able to provide almost 98 days of employment to the ultra-poor people which is quite close to the targeted amount of 100 days of employment.
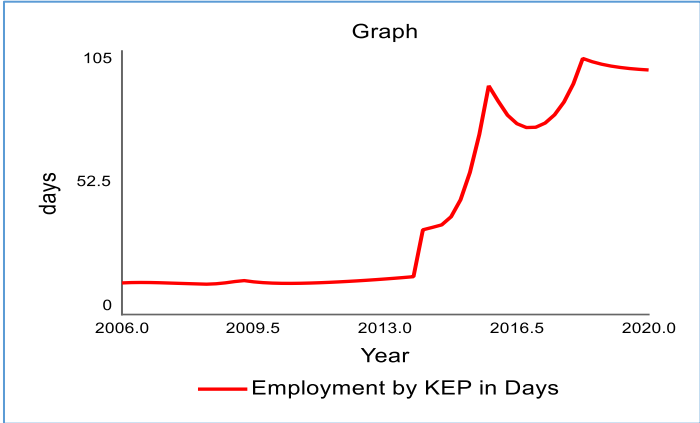
Figure 32 Employment by KEP in days with implementation of the policy

7.4.2. Unemployed

As can be seen in the below Figure 33, after the implementation of the suggested policy in the year 2014, KEP would be able to decrease the number of the unemployed people. In fact, the policy helps to reduce the number of unemployed people from the initial number of 93,600 people in the year 2013 to 41,200 in the year 2020 which would be a great achievement.
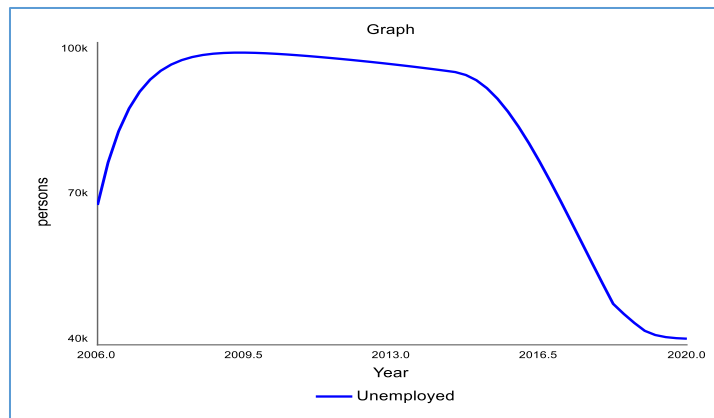
Figure 33 Unemployed people in Karnali region eligible for KEP with the policy implementation

7.4.3. Employed

The figure 34 below shows that KEP has been able to provide employment to a mere 3,630 people per year until the end of year 2013, however, this number has risen sharply after the implementation of the policy. As per the simulation results, KEP would be able to hire an amazing 41,000 people by the end of the year 2020. Being able to do so would be a great achievement for KEP.
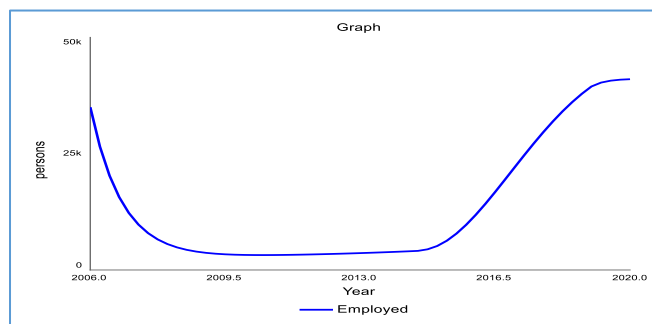
Figure 34 Number of Employed People by KEP with the policy implementation

7.4.4. Skilled Employee

As Skilled Employee has been explained earlier in the policy introduction. Skilled employee is an integral aspect for the success of KEP program. The policy suggests that skilled employee should be hired at a higher number for KEP to be able to operate more projects and employ higher number of people. As can be seen in the figure 35, KEP had hired a fixed number of skilled employee until the end of 2013 i.e. only 5 skilled employees irrespective of the targeted number of labor employment. However, after the introduction of the policy program, KEP would end up hiring 46 skilled employees by the end of year 2020 in order to introduce higher number of projects to provide employment to larger number of people.
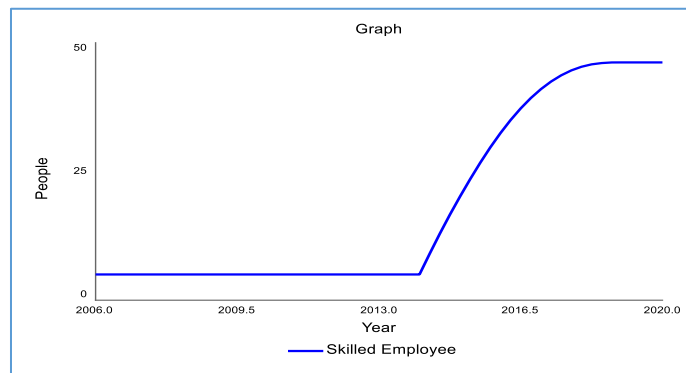
Figure 35 Number of skilled employee at KEP with policy implementation

7.4.5. Number of Project in Operation

With the increase of skilled employees after the year 2013, number of projects in operation has also grown. From an initial number of 40 projects in the year 2013, total number of projects in operation by the end of year 2020 reaches to 423. The figure 36, below show the clear increase in the total number of projects in operation after the year 2013.
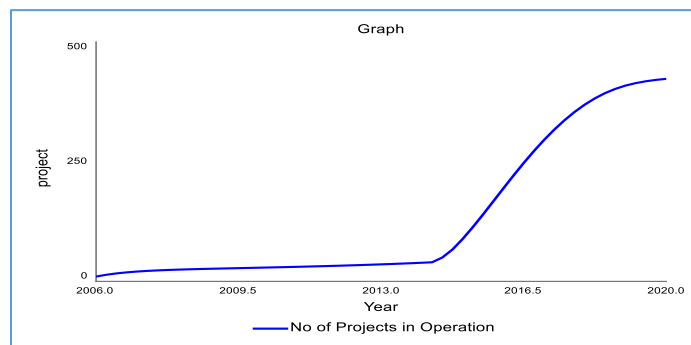
Figure 36 Number of projects in operation for KEP with the policy implementation

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7.4.6. Projects Completed

Figure 37 below show the total number of projects completed by KEP from year 2006 to 2020. As can be seen by the end of 2013 KEP had completed a total of 184 projects. However, after the introduction of policy in the year 2014, KEP would be able to complete a total 1,760 projects by the end of 2020.
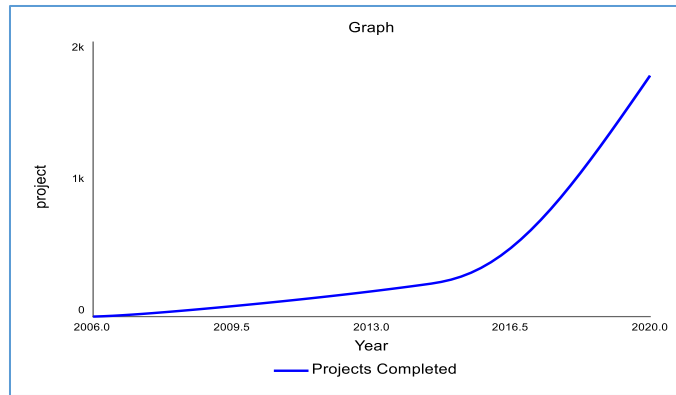
Figure 37 Projects completed by KEP with policy implementation

7.4.7. Asset Creation

Figure 38 show the tentative value of asset created by the KEP project. NPR 15.9 million worth of asset were created by KEP by the end of 2013. However, by the end of 2020 with the help of the proposed policy suggestion, KEP would be able to create asset worth NPR 153 million. This amount of asset in the Karnali zone it is assumed that Karnali zone would be able to create a lot of road access which will increase the area of arable land as well.
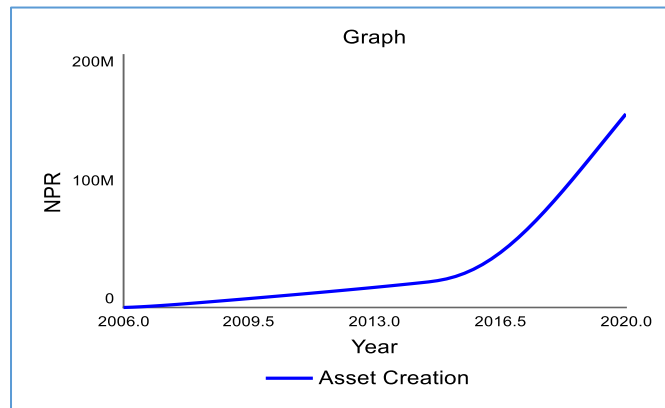
Figure 38 Asset Creation by KEP with policy implementation

7.4.8. Arable Land

Due to increase in the asset creation, there is higher access to new lands and greater possibility of irrigation in this land and thus would increase arable land. As per the simulation results, arable land increases from its initial value of 3,297 sq. km. to the maximum possible arable land in Karnali region of 3,500 sq. km. The rationale behind maximum possible arable land is that no matter the amount of asset creation, the fertile land can only be increased up to a given amount.
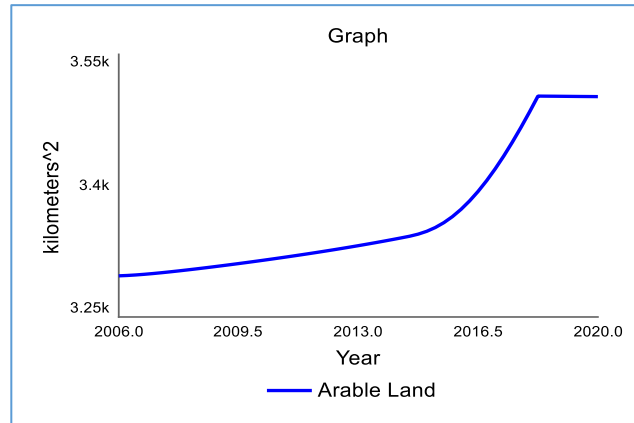
Figure 39 Arable Land in the Karnali region with policy implementation

CHAPTER 8   OVERVIEW, RECOMMENDATIONS, AND CONCLUSIONS

8.1.   Overview and Conclusions

KEP was initiated to provide social protection and support in one of the poorest and rural parts of Nepal- the Karnali Zone. It aimed to provide safety net to poor household against seasonality and other shocks, as well as increase the livelihood of the household through short term employment by providing 100 days of employment. However, several assessments indicated that the program failed to provide 100 days of employment to poor household miserably. The assessment such as average days of employment showed that KEP was able to provide 15 to 10 days of employment instead of 100 days. To evaluate the reason for a failure of KEP project the system dynamics methods were used to model the areas which has major influence on stated problem so that various policy structures may be introduced in a system to see how the system would respond to different situation and circumstances. The five sectors namely the population chain, labor demand, labor supply, government budget and agriculture were modelled to explain the dynamic problem of the study. The behavior of these models strongly indicated that KEP's inefficiency lied in the hiring of skilled employees and identifying the targeted household beneficiaries. KEP focused more on outcome but the failure to hire skilled employees and target ultra-poor household jeopardize the overall objective of the project.

To address this dynamic problem, a balancing feedback loop was created where skilled employees were hired based on numbers of projects required to provide employment to potential unemployed ultra-poor people who are identified as potential beneficiaries by KEP. The introduction of this policy in the model showed that there is improvement in number of employment days provided by KEP. The number of employment days raised from 15 days to 98 days which is quite close to the original target of providing 100 days of employment. The effect of other indicative benefit from this KEP project may be on Agriculture where an asset mostly in infrastructure development are created which is directly linked with providing benefits to agriculture sector.

To conclude, the Government of Nepal should try to improve its performance by hiring more skilled employees and properly identifying and targeting the ultra-poor employees in order to

implement programs like KEP successfully. Other specific recommendations for success of this KEP program are explained in detailed below.

8.2. Recommendations:

8.2.1. KEP Should Follow Prototype of Social Protection Program

The research studies like NPC (2012) has stated that KEP is not well-designed program since, it does not follow a prototype of any kind of cash transfer social protection program which are run in countries like India, or Bangladesh. To illustrate this, KEP is based on MGNREGA program of India. MGNREGA program also provides 100 days of guaranteed employment to every household in rural part of India who volunteered to do unskilled manual job. One of the attraction of MGNREGA program is that an applicant is entitled to apply for unemployment benefit if work is not provided within 15 days of applying (Khera and Nayak 2009). Such kind of monetary benefits are not available in KEP projects. Similarly, Rural Maintenance Program (RMP) which is operated in Bangladesh provides four-year cycle of employment to destitute women (divorced, separated, widowed or outcast). This group is generally landless, has no assets, is poorly educated, and has little or no means of livelihood. Such women are provided skills and training related to road maintenance, human rights and gender equality, health and nutrition, numeracy, and business management. The women receive a regular salary. 20% of their regular wage is withheld as savings to facilitate their ability to start Income Generating Activities (IGAs) from their own resources upon completion of their four-year tenure with RMP (Ashraf Uddin Chowdhury, Abul Barkat et al. 2006). This shows that even though KEP project was started with a reference from the projects like MGNREGA or RMP, KEP was unable to replicate their success because unlike its predecessor, neither was KEP able to properly identify the proper target group of ultra-poor people or provide employment opportunities and other monetary incentives, nor was KEP able to provide trainings or other valuable skills to the ultra-poor people which could be used to generate wealth in the future.

8.2.2. Lessons Learnt from the Simulation

The simulation run from the suggested model in the thesis shows that the targeted objectives (one of the major objectives) of KEP can be fulfilled by hiring more skilled employees. The idea behind hiring more skilled employees is to ensure that more projects are initiated so that the labor get opportunity to work. One of the major challenges behind this policy is to find the qualified skilled

manpower who are willing to work in such remote, harsh conditions. Designing highly lucrative remuneration for potential employees should be done to attract the required skilled employee to work for KEP.

8.2.3. Identification of Poor and Non-Poor Population.

One of the failure of this program is caused because the program failed to identify poor and non-poor population. The previous research studies indicate that many people have submitted false documents to obtain jobs for more than one family member (Ghimire 2014). Due to this reason, KEP has not been able to include all the target beneficiaries in the program. Therefore, detailed study of each district with a focus on the identification of the poor and non-poor should be one of the priorities of the program which will help to ensure the better livelihood development of poor people.

8.2.4. Importance of Training Program on the Success of KEP

With reference to the similar projects conducted in Bangladesh, focus need to be placed not only to provide employment opportunities but also to provide training to the ultra-poor people. The training could be provided in agriculture related activities, vocational trainings such as social entrepreneurship would help the ultra-poor to deal with risk and adversities and it would also encourage the individuals to achieve financial autonomy.

8.3.   Limitations and Further Studies

8.3.1. Model Boundaries

The unemployed people that are considered as ultra-poor by KEP are treated endogenously. This model will not try to model the entire labor demand or labor supply in Karnali region. Labor market in general are treated as exogenous factor. The variable such as skilled employee, arable land, projects in operation all are treated as endogenous variables which will contribute in explaining the labor demand and labor supply for the KEP market. Furthermore, variables such as household size, Government budget are also treated exogenously which can be treated endogenous but due to time and resource constraints this has been considered as exogenous variable. Therefore, in future studies, the entire labor supply and demand can be modeled, and government budget can also be modeled endogenously to do the detailed study.

8.3.2. Data Insufficiency

There is insufficient literature or data in social policy making in developing countries like Nepal. Most of the literature on Nepal's social protection programs are evaluated based on the way that end recipients use or access their cash transfers, but it does not explain why cash transfer and other forms of protection exist in low-income, post-conflict, exclusive stake like Nepal (DRUCZA 2015). Hence, because of data insufficiency in terms of literature and secondary data our study can be considered as an indicative study not conclusive. Therefore, in the future there is still a scope for doing field work and collecting quality data to make this study more relevant.

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Top-Level Model:

Agriculture:
Arable_Land(t) = Arable_Land(t - dt) + (Generation_of_Arable_Land - Depletion_of_Arable_Land) * dt
INIT Arable_Land = 3297
INFLOWS:
Generation_of_Arable_Land = IF Arable_Land <Maximum_Value_for_Arable_Land THEN Access_to_more_Land_per_Agriculture
ELSE 0
OUTFLOWS:
Depletion_of_Arable_Land = Arable_Land*Deprection_Rate
Asset_Creation(t) = Asset_Creation(t - dt) + (Asset_Creation_Rate - Asset_Depreciation_Rate) * dt
INIT Asset_Creation = 0
INFLOWS:
Asset_Creation_Rate = (Average_Value_per_Project*Labor_Demand.Project_Completion_Rate)
OUTFLOWS:
Asset_Depreciation_Rate = Asset_Creation/Depreciation_Time
Access_to_more_Land_per_Agriculture = Asset_Creation_Rate/Impact_of_Asset_Creation_on_Agricultural_Productivity
Average_Value_per_Project = 100000
Depreciation_Time = 20
Deprection_Rate = 0.0001
Impact_of_Asset_Creation_on_Agricultural_Productivity = 500000
Labor_Required_per_square_kilometer = 100
Maximum_Value_for_Arable_Land = 3500
Net_Increase_in_Arable_Land = Generation_of_Arable_Land-Depletion_of_Arable_Land
Net_Labor_Demand_for_Agriculture = MAX(0, (Net_Increase_in_Arable_Land*Labor_Required_per_square_kilometer))

Government_Budget:
Total_Government_Budget(t) = Total_Government_Budget(t - dt) + (Approved_Funding - Spending_on_Labor_Wages -
Spendings_on_Administrative_Wages) * dt
INIT Total_Government_Budget = 170000000

INFLOWS:

Approved_Funding = IF TIME<2014 THEN Annual_Budget_Approved_for_KEP ELSE Annual_Budget_Approved_for_KEP *(1+growth_rate_in_budget)

OUTFLOWS:

Spending_on_Labor_Wages = MIN((Total_Government_Budget/delay_time), Labor_Supply.Employed*Labor's_Yearly_Wage)

Spendings_on_Administrative_Wages = Labor_Demand.Skilled_Employee*Avg_Salary_per_skilled_employee

Actual_Employment_given_By_KEP_in_Days = GRAPH(TIME)

(2006.000, 15.00), (2007.000, 13.00), (2008.000, 14.00), (2009.000, 13.00), (2010.000, 11.00), (2011.000, 10.20), (2012.000, 11.00), (2013.000, 10.50)

Annual_Budget_Approved_for_KEP = GRAPH(TIME)

(2006.000, 1.8e+08), (2007.000, 1.67e+08), (2008.000, 161200000), (2009.000, 214340000), (2010.000, 220970000), (2011.000, 247650000), (2012.000, 259170000), (2013.000, 2.6e+08)

Avg_Salary_per_skilled_employee = 300000

avg_wage_per_day = 200

delay_time = 1

Employment_by_KEP_in_Days = (((Spending_on_Labor_Wages/(Labor_Supply.Labor_Supply_for_KEP_Program-Labor_Supply.Employed_in_Agriculture))/avg_wage_per_day))*year

growth_rate_in_budget = 0.10

Labor's_Yearly_Wage = 52461

year = 1

Labor_Demand:

No_of_Projects_in_Operation(t) = No_of_Projects_in_Operation(t - dt) + (Project_Started_Rate - Project_Completion_Rate) * dt

INIT No_of_Projects_in_Operation = 10

INFLOWS:

Project_Started_Rate = Project_Initiated/delay_time

OUTFLOWS:

Project_Completion_Rate = No_of_Projects_in_Operation/Project_Completion_Time

Projects_Completed(t) = Projects_Completed(t - dt) + (Project_Completion_Rate) * dt

INIT Projects_Completed = 0

INFLOWS:

Project_Completion_Rate = No_of_Projects_in_Operation/Project_Completion_Time

Skilled_Employee(t) = Skilled_Employee(t - dt) + (Hiring_Rate_of_Skilled_Employee - Layoff_rate_of_Skilled_Employee) * dt

INIT Skilled_Employee = 5
INFLOWS:
Hiring_Rate_of_Skilled_Employee = Layoff_rate_of_Skilled_Employee + (Policy_Switch*Skilled_Employee_Gap)
OUTFLOWS:
Layoff_rate_of_Skilled_Employee = Skilled_Employee/Average_Time_of_Work
Adjustment_Time = 3
Average_Number_of_Labor_Participation = 110
Average_Number_of_Labor_per_Projects = 110
Average_Time_of_Work = 5
delay_time = 2
Desire_No_of_Projects = MAX (0, Labor_Supply.Unemployed/Average_Number_of_Labor_per_Projects)
Initial_Productivity = 5
Labor_Demand = Average_Number_of_Labor_Participation*No_of_Projects_in_Operation
Learning_Curve_Effect = 1+ ((EXP(MIN(1, Projects_Completed/250))))
No_of_Project_Gap = MAX(0, Desire_No_of_Projects-No_of_Projects_in_Operation)
Policy_Switch = IF TIME<2014 THEN 0 ELSE 1
Productivity = Learning_Curve_Effect*Initial_Productivity
Project_Completion_Time = 1
Project_Initiated = Skilled_Employee*Productivity
Skilled_Employee_Gap = (No_of_Project_Gap/Productivity)/Adjustment_Time

Labor_Supply:
Employed(t) = Employed(t - dt) + (Hiring_Rate - Layoff_Rate) * dt
INIT Employed = Initial_Employed
INFLOWS:
Hiring_Rate = IF (Government_Budget.Total_Government_Budget>0) THEN (MIN((Unemployed/Time_to_Hire),
Labor_Demand.Labor_Demand)) ELSE 0
OUTFLOWS:
Layoff_Rate = Employed/Labor_Demand.Project_Completion_Time
Employed_in_Agriculture(t) = Employed_in_Agriculture(t - dt) + (Agriculture.Net_Labor_Demand_for_Agriculture) * dt
INIT Employed_in_Agriculture = 0
INFLOWS:
Flow_1 =

Unemployed(t) = Unemployed(t - dt) + (Pool_of_Unemployed_from_Household_per_Year - Hiring_Rate - Agriculture.Net_Labor_Demand_for_Agriculture) * dt

INIT Unemployed = Initial_Unemployed

INFLOWS:

Pool_of_Unemployed_from_Household_per_Year = (MAX((Labor_Supply_for_KEP_Program-Unemployed-Employed-Employed_in_Agriculture)/Time_to_Adjust, 0))+Layoff_Rate

OUTFLOWS:

Hiring_Rate = IF (Government_Budget.Total_Government_Budget>0) THEN (MIN((Unemployed/Time_to_Hire), Labor_Demand.Labor_Demand)) ELSE 0

Flow_1 =

Average_Household_Size = 5.3

Fraction_of_Household_that_are_under_3_Month_Income = 0.18

Initial_Employed = 35000

Initial_Unemployed = 67761

Labor_Supply_for_KEP_Program = IF (Labor_Demand.Policy_Switch=1) THEN MIN(Unemployed_Labor_for_KEP, Working_Population_Under_3_Month_Income) ELSE Unemployed_Labor_for_KEP

Number_of_people_targeted_from_each_Household = 1

Time_to_Adjust = 1

Time_to_Hire = 1

Unemployed_Labor_for_KEP = (Population_Chain.Total_Population/Average_Household_Size)*Number_of_people_targeted_from_each_Household

Working_Population_Under_3_Month_Income = Population_Chain."Adult_Population_(15-60)"*Fraction_of_Household_that_are_under_3_Month_Income

Population_Chain:

"Adult_Population_(15-60)"(t) = "Adult_Population_(15-60)"(t - dt) + (Young_Population_Maturation_Rate - Adult_Population_Maturation_Rate - Adult_Population_Death_Rate) * dt

INIT "Adult_Population_(15-60)" = Initial_Adult_Population

INFLOWS:

Young_Population_Maturation_Rate = "Young_Population_(0-14)"/Time_to_Become_Adult

OUTFLOWS:

Adult_Population_Maturation_Rate = "Adult_Population_(15-60)"/Time_to_Become_Old

Adult_Population_Death_Rate = "Adult_Population_(15-60)"*Adult_Death_Fraction

"Old_Population_(60+)"(t) = "Old_Population_(60+)"(t - dt) + (Adult_Population_Maturation_Rate - Death_Rate) * dt
INIT "Old_Population_(60+)" = Initial_Old_Population
INFLOWS:
Adult_Population_Maturation_Rate = "Adult_Population_(15-60)"/Time_to_Become_Old
OUTFLOWS:
Death_Rate = Old_Population_Death_Fraction*"Old_Population_(60+)"
"Young_Population_(0-14)"(t) = "Young_Population_(0-14)"(t - dt) + (Birth_Rate - Young_Population_Death_Rate - Young_Population_Maturation_Rate) * dt
INIT "Young_Population_(0-14)" = Initial_Young_Population
INFLOWS:
Birth_Rate = Total_Population*Crude_Birth_Rate
OUTFLOWS:
Young_Population_Death_Rate = Young_Population_Fractional_Death_Rate*"Young_Population_(0-14)"
Young_Population_Maturation_Rate = "Young_Population_(0-14)"/Time_to_Become_Adult
Adult_Death_Fraction = 32/1000
Crude_Birth_Rate = 32.5/1000
Initial_Adult_Population = 193553
Initial_Old_Population = 11538
Initial_Young_Population = 152615
Old_Population_Death_Fraction = 129.07/1000
Time_to_Become_Adult = 15
Time_to_Become_Old = 45
Total_Population = "Young_Population_(0-14)"+"Adult_Population_(15-60)"+"Old_Population_(60+)"
Young_Population_Fractional_Death_Rate = 6.13/1000
{ The model has 98 (98) variables (array expansion in parens).
In root model and 5 additional modules with 0 sectors.
Stocks: 12 (12) Flows: 20 (20) Converters: 66 (66)
Constants: 35 (35) Equations: 51 (51) Graphicals: 2 (2)

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