Application of Balanced Score card to Development Aid: A System Dynamic approach.

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Master Thesis

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Abstract

For years mechanisms have been implemented in attempt to improve aid effectiveness. The latest of these being the Paris Declaration established in 2005. However, years after the declaration there is little evidence of effective aid performance in Africa. Evidences of ineffective management of foreign aid are spread around Africa (Andrews 2009). Resulting in unintended effects like corruption and dependence on aid. Many of the unintended effects are associated with the way aid is administered from the donors, and therefore some of these negative effects may be minimized if the donors change their policies (Newby 2010).

The Norwegian aid agencies lack an effective management tool to assist decision makers in making effective policies. Following the Paris declaration alone is not enough. The objective of this thesis was to develop a Dynamic Balanced Scorecard (DBSc) model and demonstrate how it can assist decision makers in finding a more effective way of managing aid in order to reduce poverty. DBSc is a useful tool in assisting decision makers in evaluating the consequences of their policies before implementing them by using experimental computer simulation models. DBSc is not yet adopted by the Norwegian agencies. Norad was presented as a case study and Zambia as an example where a DBSc approach was applied. The thesis focused on development aid the Norwegian agencies allocated to Zambia from 1991-2011 for stimulating economic growth, improving both education and health sectors. The policies are about aid allocation per sector and they were evaluated depending on their effectiveness. Today's policies and other policy alternatives were evaluated. The analysis of today's policies suggests that they are not effective, confirming what is already known. The results from other policy alternatives suggest that development aid should be allocated to all the three sectors as they all contribute to a sustainable economic growth. Unequal distribution of development aid is recommended where the economic sector receives the largest share because the expenses involved in creating employment is greater than for building schools and clinics. The education sector should receive more than the health sector because it is assumed that an educated work force earns a higher average salary which leads to more tax revenues. This in turn contributes to economic growth. Aid effectiveness could benefit from better prioritization at the country level. The Zambian government should prioritize their development plan according to the benefits from each sector and this will change the allocation policies in Norway as those policies are influenced by the Zambian development plan.

Keywords: Balanced scorecard, system dynamics and development aid.

1. Introduction

Can development aid be managed more effectively? Evidence of ineffective development aid is widespread in Africa. The debate on how aid can be effective in order to contribute to Africa's development is still going on without any clear way forward (Andrews 2009). Despite the Paris declaration on aid effectiveness in 2005 (more of this is discussed in section1.3), the gap between developing and developed countries is still big. This gap has led to continuous aid inflow from developed countries to developing countries with the goal of stimulating economic growth and thereby reducing the gap. Unfortunately, there is evidence that decades of development aid has done little in changing the economic situation of many African countries (Andrews 2009).

To illustrate this problem, Norad will be used as a case study and Zambia as an example.

1.1 Norad as a case study and Zambia as an example

Norad is a directorate under the Norwegian Ministry of Foreign Affairs (MFA) and part of the Norwegian development cooperation system. This system is composed of four organizational entities and each entity has its own responsibilities;

1) The Norwegian Ministry of Foreign Affairs (MFA) is responsible for policy-making, -decisions and the management of 62 percent of the aid budget (including funding to multilateral organizations),

2) Embassies and delegations are responsible for managing 18 percent of the aid budget at country level,

3) The Norwegian Agency for Development Cooperation (Norad) is responsible for the management of 13 percent of the aid budget (most of which is allocated to the Norwegian NGOs),

4) Norfund, the Peace Corps and the Office of the National Auditor manage 7 percent of the aid budget.

Norad was chosen because it is Norway's foremost body of specialists on development assistance, offering a combination of development aid expertise and sector expertise. The agency provides technical advice to all Norwegian aid agencies on all target areas of development policy. Norad is supposed to assures the quality of Norwegian development aid to all entities, communicate results, conducting independent evaluation of all activities funded by Norwegian development aid, and ensure that statistics on the use of development aid and information on results are available for the general public and to the entire aid sector (Norad 2011).

Zambia was chosen as an example because despite all the quality assurance of development aid Norad is supposed to do, Zambia is the country that has received the largest share of Norwegian development aid through the last years and yet the country is considered to be one of the world's least developed countries (UNDP 2011). Majority of the people suffer from weak purchasing power, homelessness, and insufficient access to basic necessities such as education, health, food, and clean water. Poverty is more prevalent in rural areas compared to the urban areas (83 percent and 56 percent respectively). Poverty is rising faster in urban areas due to failing industries and rising unemployment. 80 percent of the poor people reside in the rural areas and they are small-scale farmers.

Norway has allocated a total of 6 279,753 million NOK in development aid to Zambia to reduce poverty from 1991- 2011, but 64 percent of the population is still below the poverty level, 33 percent of the adult population is considered to be illiterate, people are still dying from curable diseases like malaria, and HIV/ AIDS has affected the country greatly. Zambia's demographic report (UNDP 2011). To demonstrate this problem, reference modes will be constructed to show when the problem started. Zambia receives development not only from Norway but also from other countries. The thesis will not consider aid allocated to Zambia from other countries, but only from Norway and the focus will be on three sectors; economic growth, education and health.

1.2 Historical development of aid and its effects

The historical development of aid and its effects will be represented in a graphical form on a two-dimensional block called a reference mode. It is an abstract concept that contains the past as well as inferred future behavior projected from the interrelated past trends. This section will only focus on reference modes featuring past behavior. The modes will be constructed based on the historical data from Norad for the total aid allocated to Zambia for the last 20 years (1991-2011). The intention is to study the problematic patterns. These problematic behaviors are viewed from the manager's perspective, in the sense that what is causing the observed problem is internal within the Norwegian development cooperation system structure. The purpose of viewing the problem this way is to be able to specify the rules of decision making in the system and explore the consequences of those rules. This will lead to an investigation to how the behavior might change if the structure of the rules is changed. The thesis will demonstrate how the system can be changed using a dynamic balanced scorecard approach later.

The focus in the thesis will be on the development aid allocated to Zambia through all the four entities of the Norwegian development cooperation system (MFA, Norad, Norfund and the embassy) for the development of economic, education and health sector. This is because it was difficult to find adequate historical data per entity. The data available for aid allocated through all these four entities is from 1991 to 2011. The time horizon for the reference modes will vary from 1991 to 2011 depending on the data available per sector.

The first reference mode developed will show a general trend of the general total aid verses poverty level, and then three more reference modes will be created based on the aid allocated per sector (economic, education and health sector). The economic sector shows the pattern of the percentage of GDP per capita. The education sector portray the trend of the number students attending both primary and secondary school, and the health sector shows the trend of health expenditures by the government of Zambia.

1.2.1 Reference mode, general total aid verses poverty level

The graph below shows the trend between total development aid and the percentage of population below poverty level in Zambia in the period 1991-2006. Development aid has increased dramatically since 2001, from NOK 187,111 million to NOK 424,762 million, an increase of 227 percent. However, the poverty level has been decreasing at a low rate. As the figure below shows, Zambia reached its highest poverty peak in 1993 at 84 percent and it has been decreasing at a low rate since. There was a modest decline between 2004 and 2006, from 68 percent to 64 percent, a decline of fire percent in poverty at the national level. This decline was mostly in the urban areas. The decline is relatively low compared to the increase in development aid. 64 percent is Zambia's lowest level of poverty in 2006 but, this is still considered very high (Zambia Central Statistcal Office 2006).

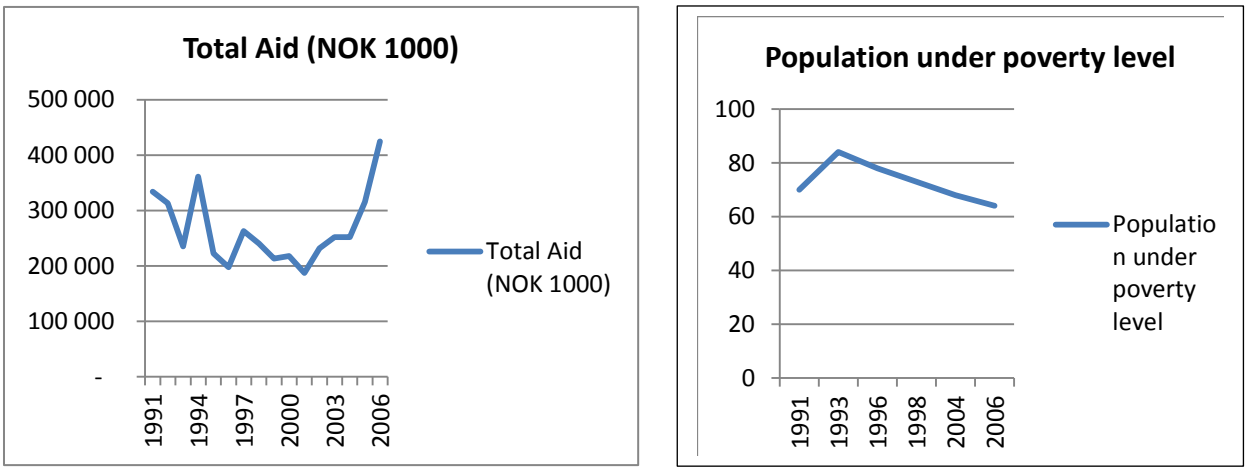


Figure 1.2.1a: Reference mode general total aid verses poverty level, 1991-2006

Poverty trend in Zambia is a product of lack of economic growth and the population increase, the population has been increasing since independence in 1964. According to the 1980, 1990 and 2000 censuses the population of Zambia was estimated at 5.7, 7.8 and 9.9 million respectively. The annual average population growth rate has shown a decline from 4.4 in the 1960 to 3.1 between 1969 -1980, to 2.7 percent between 1980 -1990 and 2.4 percent between 1990 -2000 (UNESCO 2008). The population was mainly concentrated in rural areas at 61 percent compared to 39 percent in urban areas.

A reference mode is developed to show the population development trend from the 2000 - 2011. As the figure shows, the population continues to increase even though the average population rate is falling. In 2000 the population was increasing at an average rate of 2.01. The average annual percent change in the population fluctuated a lot, the lowest being 1.52 percent in 2003 and the highest of 3.06 percent in 2011(Index mundi 2013). Comparing the population growth rate for the last two decades, the average growth rate has decreased by 0.49 percent between the periods 1990 -2000 and 2000 -2010.

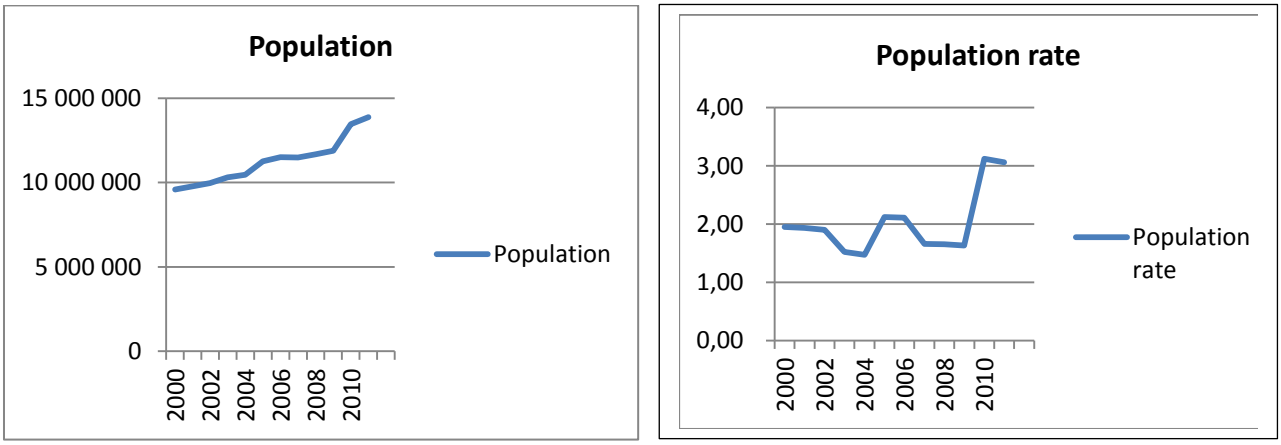


Figure 1.2.1b: Population growth

The population continues to increase because the average birth rate is higher than the average death rate, 0.045 and 0.018 respectively. The data for birth and death rate for the last decade is shown in the table below.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Birth rate	0.045	0.044	0.044	0.044	0.044	0.044	0.044	0.045	0.045	0.045	0.046
Death rate	0.020	0.020	0.020	0.019	0.019	0.018	0.018	0.017	0.017	0.016	0.016

Table 1.2.1c: Birth and death rate (Index mundi 2013).

A high birth rate with a slow economic growth contributes to the persistence of poverty in Zambia. Majority of the population are children under the age of 14 years of age. The age structure of the population is described in the table below.

Age	Percent	Male	Female
0-14	46.3	3 210 553	3 183 169
15-24	20	1 382 475	1 384 868
25-54	28.5	2 042 023	2 009 511
55-64	2.9	188 412	205 783
65 and over	2.4	144 145	191 129

Table 1.2.1d: Age structure (CIA 2013)

Life expectancy of the total population in Zambia is only 52.57 years; male live until there are 51.34 while female live 2.48 years longer. HIV/AIDs have contributed to this low life expectancy. The estimated number of children aged 0-14 living with HIV in 2009 was 120 000. These children were born with HIV, mother-to-child transmissions could be prevented with proper treatment. HIV is more dominant among the population aged 15-49, this group represents 13.5 percent of the population living with HIV/AIDs in Zambia (Unicef 2013).

1.2.2 Reference mode, effect of aid on the education sector

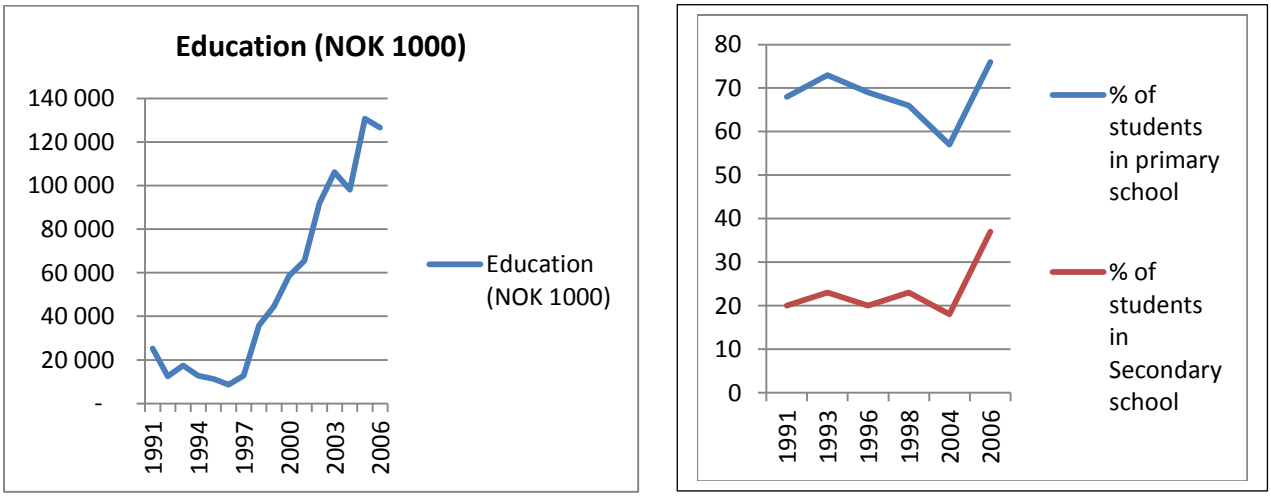


Figure 1.2.2: Reference mode education sector, 1991-2006

Development aid allocated to education has increased at an increasing rate since 1997 as the reference mode shows. On the contrary, the percentage of students attending both primary and secondary school did not increase as expected. The increase in the number of students in both levels is attained between 2004– 2006. According to Living Condition Monitoring Survey (LCMS), the highest percentage of attending primary school was 79 percent in 2006, and the

lowest of 57 percent in 2004. Secondary school had the highest attending rate of 37 percent in 2006, and the lowest of 18 percent in 2004 (Zambia Central Statistcal Office 2006). The development aid from Norway for the education sector has some effect on the children attending primary school but more need to be done as still 21 percent of the of the children have no primary education. Secondary on the other hand, aid has little impact as 63 percent of the population has no secondary school education.

The demand for education reduced greatly after the introduction of education fees in the 1990s especially for middle and lower income population (UNDP 2011). One of Norad's main goals is to provide free education to all children in Zambia, this goal is not achieved yet.

The government of Zambia has not used a lot of resources on education in the last 20 years. The table below shows the expenditure budget for education by the Zambian government according to the data attained from the World Bank search. The resources are not enough to improve the education sector in terms of increasing the number of schools and ensuring the quality of education.

Year	% of government expenditure on education
1998	17,6
1999	6,9
2000	6,4
2004	14,8

Table 1.2.2a: Government expenditure on education (The World Bank 2013)

The education sector public expenditure review of 2006 concluded that Zambia has a low-cost, low-quality education system especially at the primary school level. Other African countries spend on average as much as 30 percent of domestic revenues on education, compared to only 11.4 percent in Zambia. This low spending is a major setback for the education sector (UNDP 2011).
The formal education is based on three-level system as viewed in the table below;

Level	Grades	Age
Primary school	1-7	7- 13
Junior secondary	8 and 9	14- 15
Senior secondary	10- 12	16- 18

Table 1.2.2b: Education system (UNDP 2011)

Upon completion of secondary school, one may choose to continue with the education by attending a university, college, or a technical institute. This thesis focuses on education at primary and secondary level.

Even though there have been some improvements in the number of students attending primary and secondary school the median years of completed schooling for the adult population is only six years which means that many Zambians have not achieved the required seven years of primary school (UNDP 2011).

Efficiency indicators for schools.

Indicator	**Rate**
Transition rate grades 7-8	55,6
Transition rate grades 9-10	38.2
Completion rate grade 9	51.2
Completion rate grades 1-12	21.9
Dropout rate grades 1-9	2.2
Dropout rate grades 10-12	1.1
Repetition rate grades 10-12	1.5

Table 1.2.2c: Indicators (UNDP 2011)

As the table shows, generally the completion rate of 21.9 at both primary and secondary schools is very low. The explanation for the bad results is poor quality of teaching and poor classroom structure. The recommended pupils per classroom per teacher are a maximum of 40 pupils, but this recommendation is not followed. A classroom has normally more than 40 pupils per teacher, thereby reducing pupil-teacher contact.

Another reason for poor performance is that learning achievements for pupils traveling long distances to school is reduced the longer the distance. Some of the development aid could be allocated for building more schools such that the students don’t have to travel long distance to school.

The dropout rates are due to financial constraints of the lower income population, disabilities, and language and cultural barriers.

1.2.3 Reference mode; effect of aid to the health sector

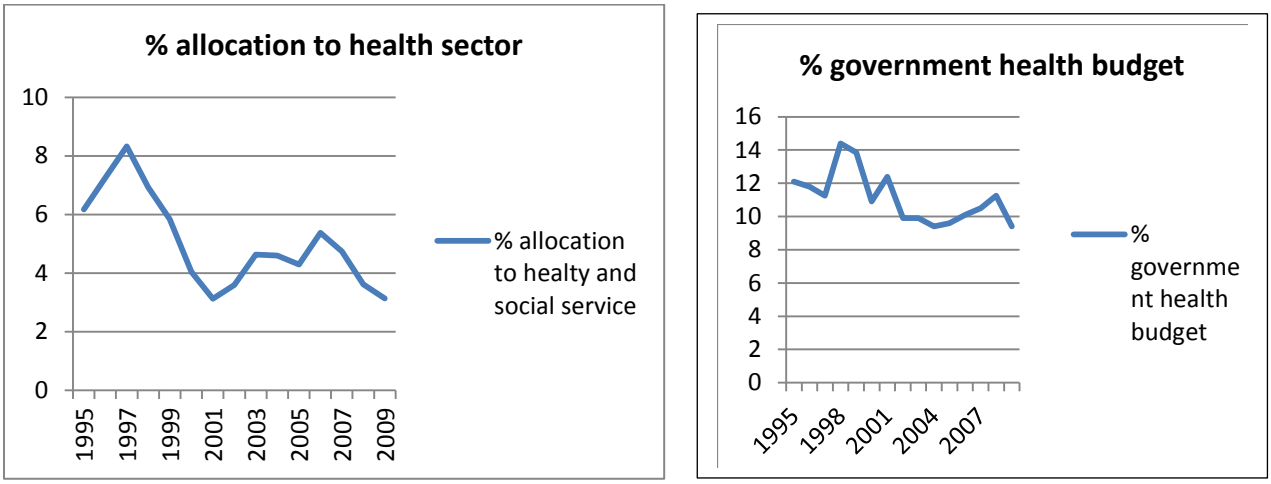


Figure1.2.3: Reference mode health sector, 1995-2009

The reference mode shows an oscillation pattern for both percentage of aid allocated to the health sector and the percentage of government health budget between 1995- 2009. The aid allocated was on average 5.07 percent. The government of Zambia health budget was on average 11.17 percent of the national budget even though the Abija Declaration target requires the governments to spend 15 percent of the nation budget on health. Comparing the trend of development aid to government health expenditure, the highest aid of 8.33 percent was allocated in in 1997 and a year later, the Zambian government allocated its highest budget expenditure of 14.4 percent attained in 1998. Further, Norway allocated its lowest aid in 2001 and 2009 of 3.13 and 3.14 respectively and that's the same period the government of Zambia also had the lowest budget expenditure, 9.4 percent in 2004 and 2009. It seems like there is a correlation between the amount of aid allocated for the health sector and the amount of funds the government allocated to the sector. Comparing Zambia to other countries, Zambia's budget expenditure is ranked as number 142 out of 189 on world ranking scale (CIA 2013).

The development of health budget is unfortunate because the budget influences a number of health facilities available in the country. The government of Zambia had a total of 1124 health facilities in 2000s (Picazo & Zhao 2009). There are 53 government hospitals. These hospitals are divided into levels (first, second and third) according to number of people they serve. The first-level hospital serves a population between 80.000 and 200.000. Second-level serves between 200.000 and 800.000, and third-level 800.000 and over. According to CIA, there are 1,9 hospital beds per 1000 people (CIA 2013). This serves as a general measure of inpatient service available. There is no global target for the number of hospital beds per country,

because the inpatient services depend on several factors such as demographic and the seriousness of the disease.

Total number of health centers was1052. These health centers are divided into two categories, urban and rural. Urban Health Centers (UHC) are intended to serve 30 000-50 000 people in the urban areas while Rural Health Centers (RHC) are to cater for 10 000 people within 29-km radius. The target was 1 385, but only 1 052 where established.

Number of health posts, 19. These posts were established with a five-km radius for sparsely populated area and the purpose was to cater for 3 500 people in the rural areas and 7 000 in the Urban area. The goal was to establish 3 000 health posts, but only 19 exist.

It is not surprise that the government didn't achieve its target goal of more health facilities since the health budget expenditure was lower than 15 percent which is recommended. Health services are important factors determining the level of human development. Prevention of diseases, timely and quality treatment are vital for sustainable healthy lives. A healthy population is generally more productive and employable (UNDP 2011). In 2009, 980 000 people were living with HIV/AIDs. With proper treatment, these people would be productive members of the society by contributing positively to the work force. The country is also affected by other major infectious diseases which could be cured with proper treatment like; diarrhea, hepatitis A, typhoid fever, malaria and plague and rabies (CIA 2013).

1.2.4 Reference mode, effect of aid on the economic sector

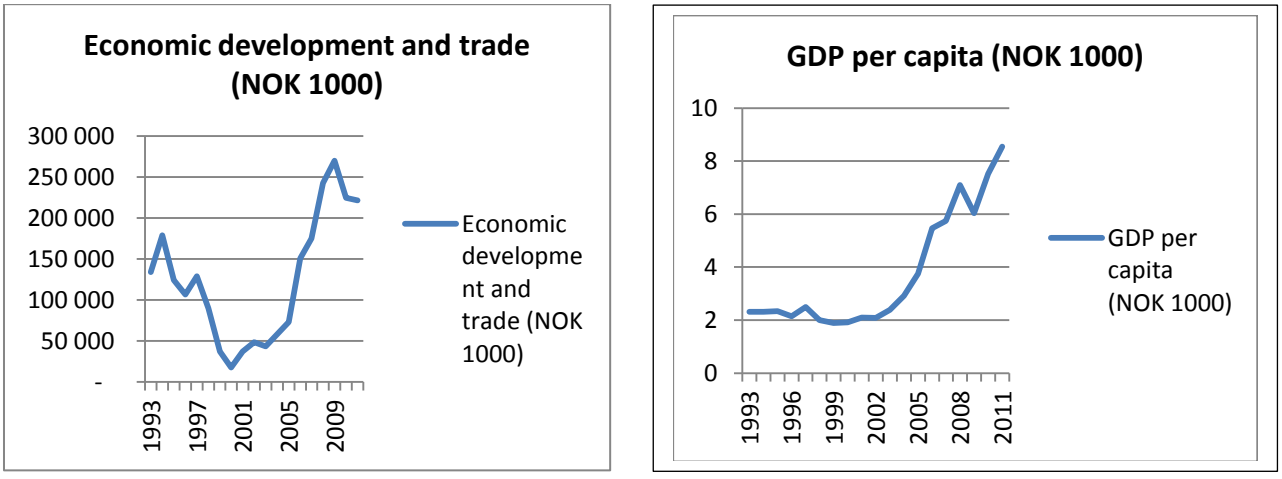


Figure 1.2.4: Reference mode economic sector, 1993-2011.

The figures for GDP per capita in Zambia were in US$, but were converted to NOK to get consistence in the units. The currency rate used to convert is six US$ per NOK. GDP per

capita has increased exponentially, but at a very low rate compared to development aid. The lowest GDP was NOK 188.94 in 1999 and the highest of NOK 855.18 in 2011.

The slight increase in GDP per capita is mainly in the urban areas. GDP per capita for the majority of rural households in Zambia is relatively low because the majority of people depend on agriculture with low income levels (Zambia Central Statistcal Office 2006).

The low growth of Zambia's economy over the past thirty years is caused by the failing industries in the country. Mining, the driving force in the Zambian economy, declined for a long time, pulling down other sectors that depend on it. There is no major substitute for the mining industry in Zambia. This has resulted in unemployment and reduced ability of government to provide basic services like education and health. On top of that, HIV/AIDS pandemic and other diseases have worsened the poverty situation from the 1990s. This has a huge impact on the family's economy, the health system and the general work force. The work force population (in 1000s) for the last decade is portrayed in the table below.

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Work force	4290	3400	3400	4590	4630	4800	4903	4989	5235	5416	5524
%	0.448	0.348	0.341	0.445	0.443	0.426	0.426	0.435	0.449	0.456	0.410

Table 1.2.4: Working population (Index mundi 2013)

On average 42 percent of the Zambian population are working. Unemployment rate has been high. The data available show unemployment rate of 25 percent in 1998 and a staggering 50 percent in 2000, but it has reduced to 14 percent by 2006. 85 percent of the working population works with agriculture, 6 percent in the mining industry and 9 percent in the service sector (CIA 2013).

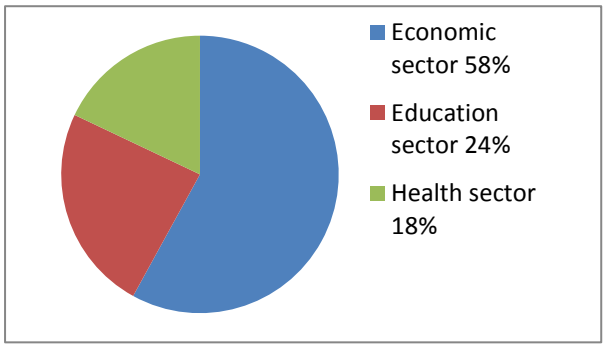
The reference modes described above show patterns of when the resistance to the policy intervention started in the different sectors. The policies that lead to the observed behaviors are discussed below.

1.2.5 Today's goals and policies

Poverty reduction is an overall goal of development aid. The Norwegian development cooperation follows the Millennium Development Goals (MDGs) discussed in details in section 1.3. The intension of adopting these MDGs is to reduce poverty in developing countries. The thesis will be focusing on three of those MDGs;

- Provide education. Millions of children do not have access to basic education in Zambia and millions adults are illiterate because they have never got any education. They are all being deprived their basic human right: The right to education (Norad 2011). In order to ensure that many children receive education, Norway offer development aid in terms of budget support to the government of Zambia for the education sector.
- Promote economic development in order to reduce poverty and hunger. In order to achieve economic growth in Zambia, Norway provides support to the economic sector in terms general budget support to the government of Zambia and through different NGOs. The main focus of Norway is supporting good financial management in Zambia, such as building capacity in the Zambia Revenue Authority to enable them collect taxes from the mining industry.
- Combat diseases. Millions of people in Zambia battle daily with diseases associated with poverty. Norway assist by allocating aid to the health sector through budget support to the government and via international organizations for improving health facilities, other social infrastructures and services, and water and sanitation.

Development aid allocated per sector from 1991-2011 to achieve the above goals is as shown in the figure. The economic sector has received the largest share followed by the education sector. As discussed under the reference modes, these are not the most effective policies as they have little impact on reducing poverty in Zambia. The decisions behind these policies according to the Norwegian ambassador in Zambia Arve Ofstad are as follows;



It is the Parliament that decides the allocation of the national budget and how much aid that is allocated to the various budget lines of development aid like health, education and economic development via the four entities of the Norwegian development cooperation system. Then the entities allocate aid to Zambia according to Zambia's development plan. These policies are summarized in the table below.

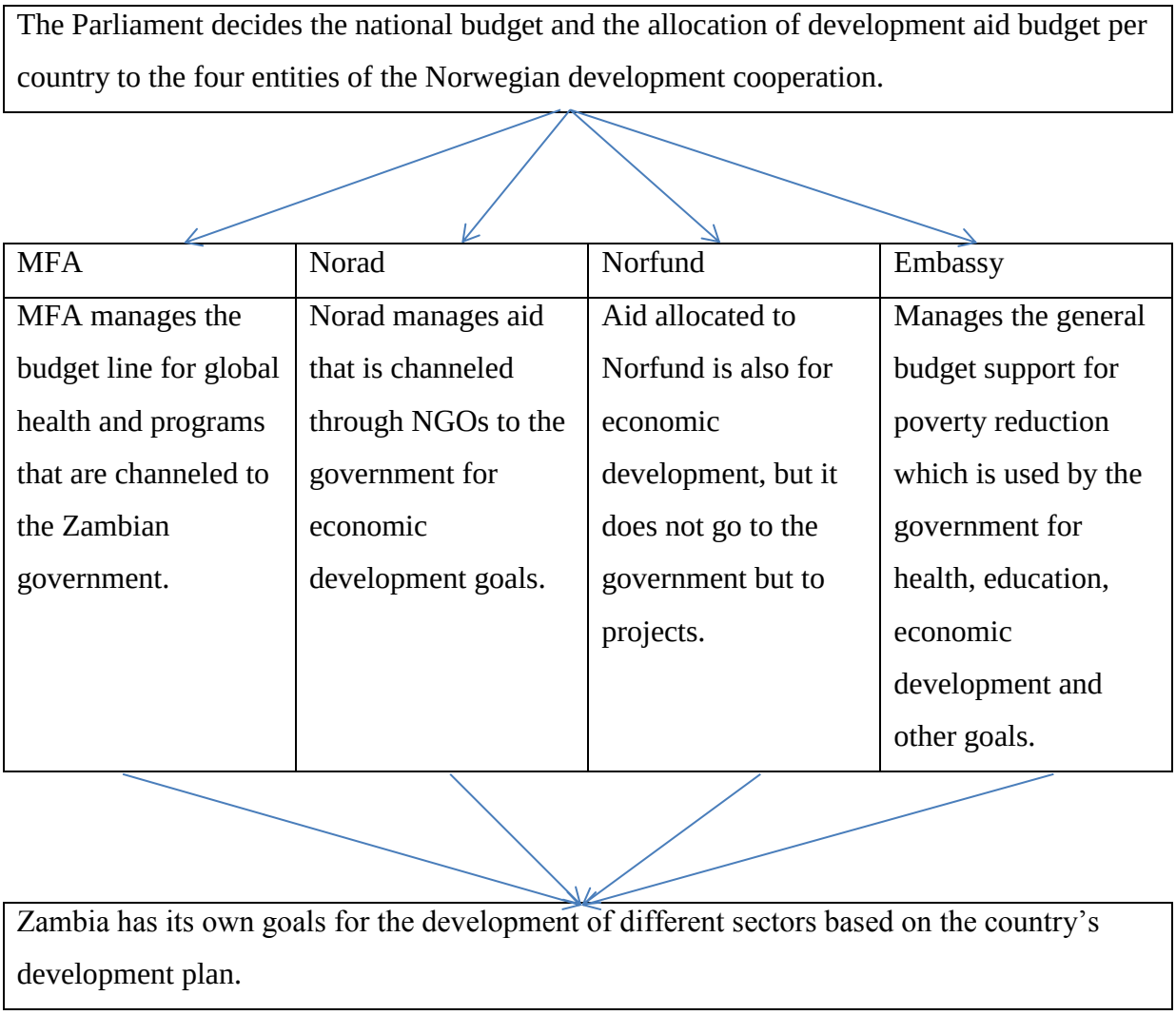


Figure 1.2.5a: Policies in the Norwegian development cooperation

The figure shows the decision structure of the Norwegian development cooperation system, showing how development aid is allocated today. The policies consist of both long-term and short-term projects/programs. The short-term policies are those where aid is channeled through NGOs and other organizations. Each entity focuses on its own goal and projects/programs separately. According to my research, there is no coordination among the entities. The policies aim at reducing poverty by promoting economic growth. These policies have been implemented over the years to address the poverty problem, but poverty continued to persist. This is because the policy makers have no clear understanding of what causes the problem, and they don't acknowledge that there are other actors in the system that has different motives that offsets the intended goal of the policies. These policies attribute poverty to outside factors as if they came to be as acts of fate. They also assumed that the system in which poverty appeared is static. This is why the decision makers expected that directly

attacking the symptoms would help alleviate poverty. Policies implemented with such a perspective produce unexpected results (Saeed 2003).
How the decision makers in the Norwegian development cooperation think about the poverty problem is explained by their policies to improve the problem. They go through problem solving without considering the relationships between contributing factors, and they have no knowledge or opportunity of testing policies before implementing them. This leads to implementing ineffective policies.

Another approach of viewing the way development aid is managed today is by using system archetype (generic structure) called "Shifting the burden". This approach facilitates rapid understanding and diagramming of the Norwegian development cooperation system. Poverty persists despite repeated efforts to reduce it. This is because the underlying causes of poverty is either difficult to identify or impossible to address. The poverty problem seems to require more and more of development aid. This is because the Zambian government has shifted the burden to aid agencies in Norway. Fighting poverty should be the Zambian government's responsibility, but it is instead the aid agency's responsibility. Since poverty is visible, the Norwegian development cooperation system is being pressured to improve the poverty situation in Zambia. To alleviate the pressure, Norwegian aid agencies to a certain extent focuses on the short-term goals which are easily measured like projects through different NGOs and other organizations as shown in the figure 1.2.5a above. This approach has its side effects; people became dependent on development aid, assuming it will always be available and reliable, and it promotes corruption (these side effects are discussed in details in selection 2.4.1). Because of focusing on short-term policies, the attention is not given to the underlying sources of the problem and therefore the implementation of more fundamental policies is postponed or ignored. This discussion is illustrated in the figure below.

The figure consists of two balancing loops and one reinforcing loop. Determination of the polarities of these loops is explained in details in section 2.2.1. The upper balancing loop represents the short-term policies as discussed above. Short-term policies reduce the symptoms of the problem.

The lower balancing loop shows the dynamic of the correcting process of the poverty problem through long-term policies which improve the fundamental problems of poverty which are illiteracy, diseases and low economic growth in Zambia. The long- term policies are investing

in building more school, health facilities like clinics and promote economic growth through tax revenues. These policies can reduce the poverty problem, but they usually contain a delay, indicating that it take longer time from when the policy is implemented to have an impact or see the results of the policy.

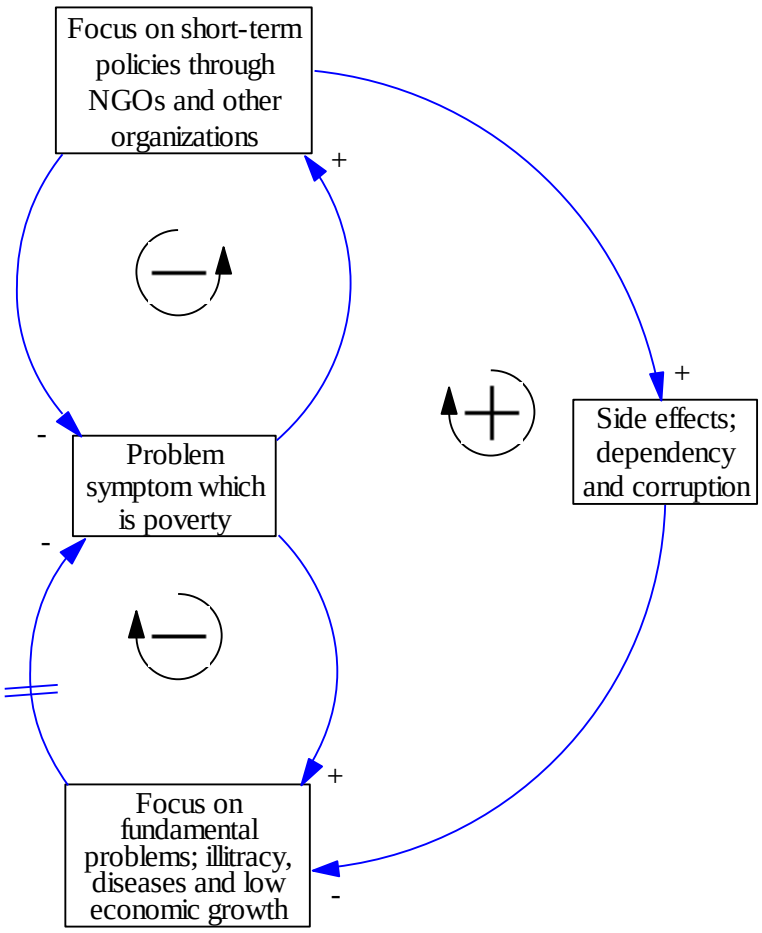


Figure 1.2.5b: Shifting the Burden (isee systems 2006)

The third loop which is a reinforcing loop represents the unintended effects of development aid like dependency and corruption. This loop is linked to the long-term loop, the one that focuses on the fundamental problems, to show the dynamics generated by the short-term policies on the fundamental policies. Short-term policy lead to increased corruption and dependence and these unintended effects reduce the implementation of the fundamental policies.

Systems thinking can improve policy making and inspire organizational learning. Applying the Balanced Scorecard approach to the complex poverty problems will inspire collective learning and improvement in Norwegian agencies policy making. System dynamics will be a

useful tool to help decision maker acknowledge that everything is connected to something else and therefore, one cannot make changes in one area without affecting all the others. Policies made for one sector influences the other sectors. The three sectors are interconnected and influence each other as discussed in more detail in section 2. The economic sector influences both the education and health sector, and in turn the education and health sector influences the economic sector. The interconnectedness is as follows;

Increased economic growth leads to more funds allocated to the education sector. More schools are built which leads to more students that graduate. These graduated students increase the work force which increases tax revenue and thus more economic growth.
As with the education sector, increased economic growth means that the government has more resources to allocate to the health sector. This leads to more health facilities for example clinics. More clinics mean that more people are treated and therefore more health people who contribute positively to the work force. Again, increased work force increases the tax revenue which boots the economic growth. This interconnectedness is not acknowledged by the Norwegian development cooperation system today and therefore difficult to make effective policies. Policies must adopt a problem-solving approach in a mathematical sense if it is to achieve its intention of reducing poverty. With this approach, a problem must be defined as an internal behavioral tendency found in a system and not as a snapshot of existing conditions (Saeed 2003). This approach will be more discussed later. But first, let's look at one of the mechanisms aimed at improving aid effectiveness.

1.3 Institutional responses

Over the years, institutions have developed different mechanisms to improve the effectiveness of development aid. This section introduces one these mechanisms, the Paris declaration which was established in 2005 to improve the ways aid is managed today. The intension is to manage aid effectively in order to reduce poverty in the developing countries.

1.3.1 Paris Declaration (OECD 2005)

In March 2005, senior officials from over one hundred aid receiving countries and donor agencies met in Paris to take concrete steps to increase the effectiveness of aid. The main task of the Paris Declaration was to put in place a series of specific measures for implementation and establishes performance indicators for assessing progress. The uniqueness about Paris declaration is that it encourages an international monitoring system to ensure that donors and recipients hold each other accountable. Five fundamental principles for making aid more effective were established;

Ownership: Developing countries set their own strategies for development, improve their institutions and tackle corruption.

Alignment: Donor countries bring their support in line with these objectives and use local systems.

Harmonization: Donor countries co-ordinate their action, simplify procedures and share information to avoid duplication.

Managing for results: Developing and donor countries focus on producing and measuring results.

Mutual accountability: Donor and developing country partners are accountable for development results.

It is believed that implementing these principles, there will be major improvements in improving aid effectiveness and thus reducing the unintended effects that has hampered the development of many developing countries for decades.

It was agreed upon during the Paris declaration that the above principles should be applied to the United Nations (UN) Millennium development goals (MDGs) which were officially establish in the year 2000.

1.3.2 Millennium development goals (MDGs)

World leaders from 193 United Nations member states and at least 23 international organizations made a commitment at UNs millennium summit in 2000 to work together to reduce extreme poverty and promote development in the developing countries. The goal was to achieve the MDGs by the year 2015 (UN 2000).

MDGs are eight international development goals and they are as follows;

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empowering of women
- Reduce child mortality rates
- Improve maternal health
- Combat HIV/AIDS, malaria and other diseases
- Ensuring environmental sustainability
- Develop a global partnership for development

The agreement concluded that in order to achieve the MDGs, the developing countries had to take the primary responsibility of achieving these goals. Donor countries' responsibility was to support a global partnership for development. Support includes increasing the effectiveness

of aid, and to increase the quantity of aid to developing countries. Effectiveness of aid means ensuring that aid helps developing countries out poverty. The Norwegian development cooperation system follows these MDGs and the Paris declaration. A survey was carried out in 2008 to evaluate the effect of the Paris declaration. The results are discussed in the next section.

1.3.3 Survey about the effects of Paris declaration (OECD 2008)

After three years of Paris declaration on Aid effectiveness reform, OECD conducted a survey in 2008 to evaluate the effect of Paris declaration on MDGs in developing countries. The survey concluded that some developing country governments and civil societies had put the Paris Declaration principles into action and they were gaining the rewards in form of better effective managing of aid, better aligned and more predictable donor support. Many donor countries were also channeling aid through budgetary support to the governments in developing countries.

However, providing aid through budgetary support has been criticized. Hilary Benn, a former UK secretary of state for international development commented in the OECD rapport (2008, p.13) that "giving government support is like writing a blank cheque encouraging corruption and inefficiency" She suggests that aid is best spent through Non- Governmental Organizations (NGOs), but this approach has its critiques; NGOs ignores governments plans and create parallel systems, this is not a long-term solution to corruption nor a sustainable path to development. There is evidence that project aid through NGOs undermines aid effectiveness, distorts priorities and resource allocation, increases budgeting, reporting and audit demands, and weakens mutual and domestic accountability (OECD 2012). Norway operates with both systems of allocating aid through budget support and through NGOs. None of these approaches are effective as discussed above, is there another approach to manage aid effectively? Before investigating other ways of managing aid effectively, it is interesting to know how the public through media perceive the effects of aid.

1.4 Perception of the effects of aid the media

Does development aid do more harm than good? Is the question that has been extensively discussed over the years; the effects of development aid, and the extent to which aid has been effective in stimulating economic growth and thus alleviating poverty. NRK viewed a series of documentary "Den gode vilje" which first aired on 08.01.13. The intention of the series was to analyze how the effects of development aid are perceived from two different parts of the world; respondents from developing countries receiving aid, and respondents working

with development aid from Norway. Most of the respondents from developing countries argued that aid has weakened their governments and their civil societies by making them dependent on aid and awarding corrupt government officials. This means that the public doesn't see any change in aid effectiveness despite the seven years of Paris declaration (NRK 2013, 8.januar)! The kind of argumentation from the respondents is not new! Zambian economist and author Dambisa Moyo wrote a book "dead aid" and she has appeared on several media channels participating in debates. She is asking the donor countries to stop giving aid to African countries because it`s not working. She urges that aid does more harm than good; aid has led to widespread corruption, bureaucracy and inflation, laziness and inertia, and it hurts exports. All of these negative effects undermine growth. Moyo argues further that the economies of those countries that are most dependent on foreign aid have shrunk by an average of 0.2 percent per year ever since the 70s (Moyo 2009).

The idea of stopping aid completely as suggested by Moyo is so dramatic. Aid can reduce poverty and inequality, and increasing growth, but aid effectiveness is critical to maximize the impact of aid and to achieve the necessary changes for long-term sustainable development (OECD 2012). From my experience of working in the development aid agency, aid has improved schools and clinics across Africa, and health sectors which provide the HIV antiretroviral, malaria and TB programs, along with emergency food supplies on which millions of lives depend. Aid is a "double-edged sword", it supports development if managed effectively and aid will be wasted if not (Andrews 2009). Many of the negative effects associated with development aid are connected to the ways aid is administered, and therefore some of those negative effects can be minimized if donors adjust their approaches.
The purpose of the thesis is to demonstrate how a dynamic balanced scored can assist decision makers in exploring new ways of managing development aid more effectively and thus changing the decision structures of their systems. The research question is about exploring the dynamic balanced scorecard approach and this is discussed in the following section.

1.5 Problem statement

Despite the Paris declaration, the citizens of many developing countries doesn't recognize the effectiveness of aid as discussed in section 1.4 as many of them still live below the poverty level. Paris declaration has established measures of performance and indictors for assessing progress which is part of the Balanced Scorecard approach, but the process is missing the interconnectedness of various aspects which is an important element in BSc approach (this

will be discussed in details in section 2). There is no coordination among the entities of the Norwegian development cooperation system and development aid is transferred based on Zambia's development plan and not based on the effectiveness of the policies. With today's policies according to the data from Norad, 58 percent of the aid budget between 1992-2011 was allocated to the economic sector, 24 percent to the education sector and 18 percent to the health sector. Is this the most effective way of allocating aid funds? Well, as discussed earlier it is not! Unfortunately, it is difficult for decision makers to know which policies that works since aid transferred to the different sectors is not evaluated. Even though Norad has the responsibility to carry out evaluations for all development aid from Norway. These missing links limit the learning process because the policies and their consequences are not evaluated and therefore difficult to learn from past experiences in order to improve aid effectiveness.

For these reasons, it is worth to investigate the use of another management tool. A dynamic BSc will be developed in order to demonstrate how it can assist decision makers to gain insight in the complexity development aid allocation aimed at reducing poverty. The research questions are about developing and demonstrating the use a BSc together with simulation models in order to operationalize the interactions of the different sectors that are receiving development aid.
The thesis will demonstrate how the application of a Dynamic Balanced Scorecard (DBSc) to development aid can be an effective tool in assisting decision makers in managing aid effectively so that the percentage of the population under poverty level decreases in Zambia.

i) How do the three sectors influence each other?
ii) Aid is a scarce resource and therefore it should be allocated where it is most effective. How should it be allocated among sectors? Equal or unequal distribution? The thesis will study the consequences of the different policies for each sector.
iii) Which policy(s) seems more effective in reducing poverty?

These questions will be addressed by using a system dynamics based implementation of the balanced scorecard as discussed later.

Development aid problem is a societal problem and it is also defined as a "wicked" or "tricky" problem because there is no solution to such problems, the best that can be done is re-solve - over and over again (Rittel & Webber 1973). The purpose of the thesis is not to find

a solution, but to investigate whether a better understanding of the dynamics of development aid and better analysis tools can improve the effectiveness of aid.

Before addressing the research questions, the literature view will be discussed first. It gives a short presentation of the Balanced Scorecard framework, System dynamics and development aid.

2. Theory/Literature

The literature review is used to discuss the application of the Balanced Scorecard (BSc) and System dynamics, and effective management of development aid. The conclusions from the literature review will be used to explain why the research questions in the thesis are interesting by showing the gap between the available literature and research questions. This section will also review the research methods that can be used to analyze the impact of the suggested policies of allocating equal or unequal aid among sectors. The balanced Scorecard approach is discussed first.

2.1 Balanced Scorecard

Balanced scorecard (BSc) will be used to address the first research question *"how do the three sectors influence each other?"* BSc is about creating a set of measurements for performance where the focus is mainly on management of a few key measures of the strategy. BSc originates from USA from the field of Management Accounting, where measuring performance was based on quantitative financial measures only, this approach was not adequate (Kaplan & Norton 1992). Kaplan recognized a need for balancing presentations of both financial and operational measures. This approach serves as a bridge between different areas. It complements the financial measures with operational measures on different aspects of an organization. BSc puts strategy and vision of the organization in the center and then establishes goals (financial, customer, internal business and learning and growth) that contribute to the achievement of the desired vision. It is assumed that people will adopt the necessary behaviors and take necessary action to achieve those goals. In other words, BSc translates the vision and strategy into objectives and measures. BSc is based on the system thinking approach which focuses on the interconnectedness of various aspects in an organization. System thinking is the ability to see the world as a complex system, in which we understand that all different aspects and functions of an organization are interrelated. Because of this interconnectedness, one cannot improve one area without influencing all the others.

Understanding the interrelationships of different aspects, help managers to improve their decision making.

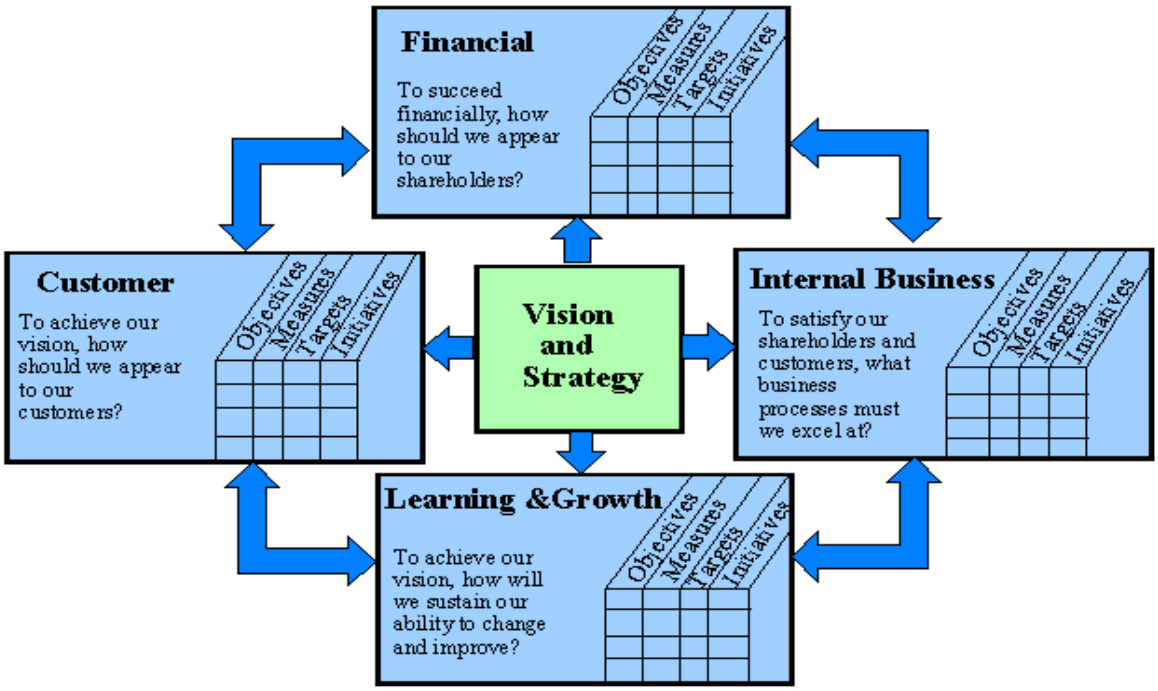


Figure 2.1: Balanced Scorecard Framework (Kaplan & Norton 1996).

As figure 2.1 shows, the performance measurements for each goal is viewed in four different ways;

1) The financial perspective is about a company focusing on how they are viewed by their shareholders in order to achieve their financial goals which are normally measured in return of capital employed, economic value added, sales growth, cash flow.
2) The customer perspective is about how the company wishes to be viewed by its customers in order to achieve their vision. Measurements for customer are customer satisfaction, retention, profitability and market share.
3) The internal business process perspective is concerned with which processes the company must excel at in order to satisfy its shareholders and customers. The measurements for this perspective could be innovation and improving product or service quality.
4) The organizational learning and growth perspective is about which changes and improvements the company must achieve to implement its vision. This includes

measurement for employee retention, training skills, morale, and information availability.

A modified version of the above BSc framework will be developed for the development aid sector in section 2.1.2. Measures of performance for reducing poverty will be developed in section 2.1.3 and these measures will be linked together in a causal diagram to show the interrelationships between the sectors. Before developing a BSc for development aid, let's first discuss how the Norwegian development cooperation system manages aid today compared to the balanced scorecard literature.

2.1.1 Management of development aid today

Figure 2.1.1 below shows the key sectors in the fight against poverty as discussed earlier, it's an aggregated diagram of Norwegian development cooperation system today discussed in section 1.2.5. Development aid is managed in a traditional way of a simple linear relationship of cause and effect closely linked together in time and space. This is referred to as Laundry List Thinking or Factors Thinking (High Performance Systems Inc 1994). The arrows run one-way; development aid is given to education-, health- and economic sector and poverty is expected to be alleviated. But unfortunately, the real world is not that simple. Development aid is a dynamic complex issue that consists of non-linear relationships and time delays. The sectors as shown are not connected in any way which means that there are no collaborations among the sectors. Further, the system does not recognize the feedbacks within the system.

In order for Norad to give effective advice to decision makers, it is important to understand the relationships between the sectors and not just a sector as an independent element, the holistic view is vital. Fighting poverty is an increasing challenge with decreasing resources. There is therefore a need for a better way of analyzing the development aid challenges.

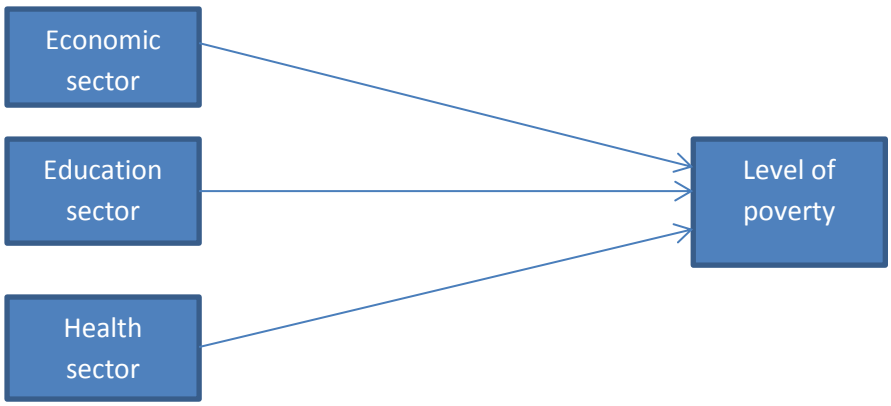


Figure 2.1.1: Traditional linear relationship

There are some criticisms about the way development aid is managed today.

First of all, the policies of allocating development aid funds are not based on the effectiveness of the policies, but on the development plan of the Zambian government according to the Norwegian ambassador in Zambia. On top of that, there is no coordination among the three sectors as the figure shows. The decision makers in each sector are specializing in their own sectors limiting an integrated effort to reduce poverty.

Further, these policies are not evaluated. According to the overview of Norwegian evaluations on Norad's webpage, no evaluation has been done for the economic, education and health sector in Zambia. Norad has been criticized by the external evaluation department for not following up the evaluations (Rand Europe AS 2013). This means that the decision makers do not have an overview of which policies that works and which doesn't work as they cannot evaluate the consequences of their decisions and therefore cannot learn from the past experience and thus no improvement in their policy making.

The ministry of foreign affairs has also been criticized by the Norwegian office of National Auditor for lacking supervision and control of aid funds to ensure that they are used as intended (Riksrevisjonen 2012). Lack of control from the aid agencies can lead to unintended results like dependence and corruption, a well-known problems among many African countries receiving development aid. The majority of the citizens of development aid recipient countries, blame uncontrolled aid funds for weakening their governments and making then dependent on aid and for awarding corrupt government officials (NRK 2013, 8.januar). Corruption and dependence are discussed in details in section 2.3.1.

The Norwegian agencies have not developed adequate results based methodologies to improve accountability and the effectiveness of aid, no system is in place to monitor the results. There is no common understanding of what results can realistically be expected or how these will be measured. This was enlightened during data collection. Five decisions makers in the Norwegian development cooperation were contacted requesting for the key performance indicator per sector and the question asked was "how are the results for the economic, education and health measured?" none of the five decision makers provide that information, it was assumed that they didn't know the answer.

The section that follows discusses the development of BSc for the development aid sector.

2.1.2 BSc development for development aid sector

The desired way of management thinking is a causal relationship whereby each sector is both cause and effect. This is a shift from static orientation discussed above to a more dynamic orientation management. The circular causal structure is a characteristic of the Balanced Scorecard (BSc). BSc is adopted in many companies from different fields (Kaplan & Norton 1992), but it's not fully adopted in the development sector. Studies show that BSc is not applicable to humanitarian aid, but can be applied to development aid. These are two different forms of development aid mechanisms.

Humanitarian aid is defined as material or logistical assistance provided for humanitarian purposes, typically in response to humanitarian crises including natural disaster and man-made disaster. The primary objective of humanitarian aid is to save lives, alleviate suffering, and maintain human dignity. It may therefore be distinguished from development aid, which seeks to address the underlying socioeconomic factors which may have led to a crisis or emergency (Wikipedia 2013).

Jan Wulf studied the application of BSc to the humanitarian sector and concluded that the approach is not applicable to the system-wide management in humanitarian aid. This is because the Balanced Scorecard framework works on the implicit assumption that all aspects of performance are measurable to a certain extent. The humanitarian sector shows characteristics that make it nearly impossible to measure the contribution of humanitarian interventions to the overall mission to save lives, alleviate suffering, and maintain human dignity (Wulf 2012).

Another study about application of the BSc to humanitarian sector was carried out by Fitz-Gerald and Neal. They also concluded that BSc is not applicable to humanitarian aid because BSc is about interconnectedness of different aspects and this interconnectedness is impossible to achieve in humanitarian sector. As mentioned earlier, humanitarian aid focuses on helping people in areas affected by natural disaster and conflicts. Because of these disasters, a huge number of people are displaced, deterioration of health of many people, limited access to food, water and shelter. This put pressure on the international donors to provide funding rapidly. In response to such diverse needs, development aid is allocated into these areas through numerous different players, each with different core competencies. These organizations range from multi-international organizations to local NGOs all specializing in

different fields. Coordination between these numerous actors to provide a more integrated effort is impossible (Fitz-Gerald & Neal 2001).

The purpose of the thesis is to focus on the long-term development aid where the policies are intended to promote sustainable economic growth. BSc will be developed and the key performance measures for each sector will be identified. Only policies concerning the allocation of development aid from the Norwegian aid agencies will be considered as they are adequate for explaining the persistence of poverty in Zambia. Development aid is a complex issue. It involves nonlinear, multiple interacting feedback loops as shown in the figure 2.1.2 below. The arrows runs both ways which means that it is difficult (if not impossible) to change one area without influencing all the others. As a result, many variables change simultaneously leading to changes in the system behavior. The problem also involves time delays between taking a decision and noticing its effect of the system, this creates instability in the dynamic system.

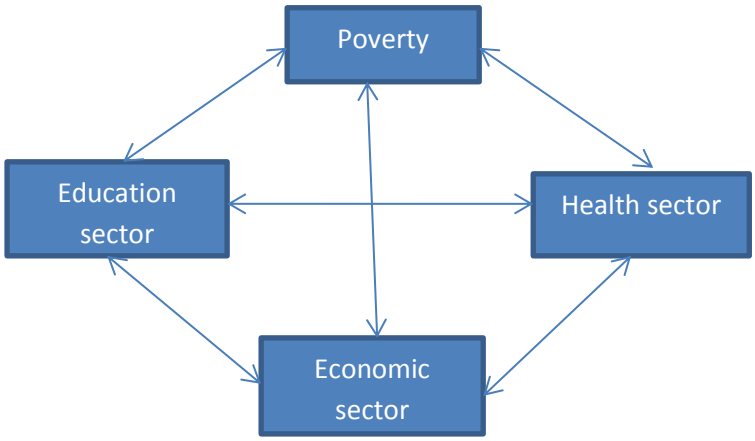


Figure 2.1.2: Interconnected relationship, BSc approach

Saeed carried a study where a dynamic BSc was applied to a developmental problem of rural poverty in Pakistan. The intention was to find an explanation to why public policies that were intended to reduce rural poverty in Pakistan didn't work. The failure of the public policy is often attributed to the unforeseen events that occur over the course of implantation of a development program. The analysis was based on a dynamic BSc model that incorporated the income distribution process of the country's economy which consists of a capitalist and a self-employed farmer's sector. Different policies were assessed and the study suggested that the

absence of an economic force that encouraged land ownership by its cultivators was a key factor responsible for poverty persistence in the rural areas. Land was easily separated from the farmers and was concentrated among the few capitalist households. This concentration significantly reduced income of the self-employment farmers and left them with very little bargaining power for negotiation compensation for their labor. The development policies striving to increase productivity only served to increase income of the few capitalist households, leaving incomes of the poor majority unchanged or worse. This is because the farmers often have to give up a large share of their production to the land owners. The study concluded that a development policy for alleviating poverty should simultaneously incorporate fiscal instruments to encourage transfer of land ownership from capitalists back to its cultivators and provide technological means that help increase the productivity of land (Saeed 1982).

Saeed's study proves that a dynamic BSc is applicable to development aid. The thesis will focus on evaluating the different policies aimed at reducing poverty. This will assist the decision makers in the Norwegian agencies to understand why today's policies are not working and how they can be improved. It is important for the Norad's advisory team understand the structure of the system. This will enable them to identify the key measures of performance which are useful in evaluating the policies. Applying balanced scorecard will be a suitable tool to enable the study of few key performance measures per sector and study how these sectors influence each other. This will lead to the designing of more effective policies aimed at reducing poverty.

The advantage with the BSc approach is that it links key performance indicators together in a causal loop diagram which provides a way for decision makers to externalize their mental models and assumptions. BSc forces decision makers to explore the beliefs and assumptions which underpin their strategy.

Another advantage of BSc is that it suggests that only a few key performances measures should be used to measure the performance. This makes BSc approach easy to apply as few measures are monitored.

The performance measures and the linkages between these sectors are discussed in section 2.1.3 and 2.2.1.

2.1.3 Key performance measure

Key performance measures are indicators used to evaluate the success of activities. These indicators are driven from the Norwegian development cooperation's goal of reducing poverty through focusing on different sectors in Zambia. The sectors which are focused on in the thesis are: education, health and economic sector. The Key performance indicators (KPI) per sector are viewed in the table below.

Education sector	Health sector	Economic sector
• Number of schools • Number of students completing primary and secondary school • Level of general knowledge	• Number of health facilities, these will be represented by number of clinics • Number of sick people • Level of health	• Tax revenue • Development aid • Number of workers

Table 2.1.3: Key performance indicators (KPI)

According to the Balanced Scorecard approach, managers don't have to monitor dozen of performance indicators, but just focus on the few important key performance indicators for each sector to measure the effect of development aid.

These KPIs will be used in the development of the Causal Loop Diagram (CLD). The linkages between these KPIs are shown in CLD in section 2.2.1. The linkages will also be discussed in the same section. Before discussing the CLD, let's look at some of the limitations of the Balanced Scorecard approach.

2.1.4 Limitations of the Balanced Scorecard (BSc) approach

Despite the popularity of the Balanced Scorecard concept, it is not without criticism. With BSc approach, manager need to monitor few key performance indicators (KPIs) as mentioned earlier. The weakness with this approach is that it is not certain that those few selected KPIs are the right ones or that they target the right values in the right time frame (Akkermans & Oorschot). This leads to question of the validity of the BSc approach. Validity requires the use the correct measures for the case being studied.

A second critique of the BSc approach is that causal loops do not distinguish between stocks and flows variables. Because of this the loops do not capture whether the key variables are accumulating or depleting. To know whether the key variable stock is increasing or decreasing one must know the net rate of change (Sterman 2000). Because the causal loop

does not identify stocks and flows, it is difficult to capture time delays which are critical in creating the dynamic behavior of the system.

These limitations of BSc approach are solved by applying System Dynamic (discussed in the next section) to the approach creating a Dynamic Balanced Scorecard (DBSc).

2.2 System Dynamics (SD)

System dynamics will address the second and the third research questions. System dynamics, an approach to thinking that facilitates problem solving pioneered in the 1950s by Jay Forrester, an engineer at the Massachusetts Institute of Technology. Forrester introduced computer simulation as a business problem-solving tool and taught leaders in business, government, academics, and other disciplines how to look for the unintended consequences of policies before they are implemented. System dynamics was first applied when Forrester worked for to General Electric in the 50s. The company was struggling to find an optimal hiring schedule to their plants. Forrester investigated the hiring and inventory policies and built a simulation model. From the given policies the company followed, one could decide how many people would be hired in the future. This gave a new condition of employment, inventories and production. Since then, system dynamics is widely applied in many fields (Forrester 1989). According to my research System dynamics is not yet adopted by the Norwegian development cooperation system.

System dynamics is a method that reinforces learning in the complex system. It is a methodology for analyzing the behavior of complex feedback systems over time through developing management flight, often computer simulation models to assist decision makers to learn about dynamic complexity, understand the consequences of their decisions, and design more effective policies (Sterman 2000). According to Sterman, learning depends on feedbacks operating in the system. System dynamic emphasis feedback loops rather than one direction causality which the Norwegian development cooperation system is operating with today. This is because managing development aid is a real world problem and in the real world everything influences each other. The time delays are not recognized in today's approach of managing development aid because cause and effect are joined together in time. SD recognizes the time delays between cause and effects in the feedback loops. These delays are generated by accumulations in the stock variables and it's the delays that cause instability in the system, therefore cause and effect are separated in time and space with SD approach. One of the advantages of SD approach is that the findings can be validated by continuous testing of the

model either using the quantitative data from the real world or other unrealistic figures to test the robustness of the model.

In the Norwegian development cooperation system, feedbacks are supposed to be attained by evaluating projects and programs funded by Norway. The evaluations are supposed to be conducted by external experts and these evaluation reports should be published and the results communicated to the decision makers. According to the evaluation study, the intentions of the evaluation reports are to monitor whether development aid produces results as intended, and report the results to the decision makers in order to improve future aid policies through feedback of lessons learned. The intention of evaluation is to promote learning in the development aid administration. However, according to the evaluation study there is little knowledge and research about the degree to which these evaluations are actually used, when and how they are used, and which factors influence their use (Rand Europe AS 2013).

Norad is required by the Evaluation Department to prepare a follow-up plan within six weeks of receiving the recommendations from the Evaluation Department to account for how they intend to follow them up, and by which timelines. Within a year, the responsible section /unit must report on progress made on these actions. According to the Evaluation Department's own records for the period since 2006, not all the evaluations produced by the Evaluation Department have the required follow-up plans and/or progress reports (Rand Europe AS 2013).

Evaluation without following the feedbacks in the evaluation reports is useless because it does not promote learning. This means that the decision makers can't learn more about the complexity of poverty reduction, the consequences of their decisions and therefore difficult to make effective policies.

The development aid allocated to Zambia for reducing poverty depends on the requests from the recipients either it's the government or other organization in cooperation with Norway. According to the Norwegian ambassador in Zambia Arve Ofstad, aid is allocated either to the Zambian government or other organizations in terms of budget support or through programs depending on Zambia's development plan. According to my experience working in an aid agency, development aid from NGOs allocated to programs or projects that are aimed at promoting the development of for example the education sector, depend on the request from the ministry of education. The ministry sends an application together with a budget of the program or project to the donor organization. The donor evaluates the relevance of the

program/project and if approved, they transfer the aid funds to the recipient. This means that aid allocated to the economic, education and health sector is upon the budget per sector. According to the overview of Norwegian evaluations on Norad's webpage, no evaluation has been done for the economic, education and health sectors. However, the education sector is scheduled to be evaluated towards the end of the year 2013, with in 11th December. As per today, the feedbacks about the effects of aid for the three sectors are not gathered yet, and therefore the consequences of their decisions are not known. In turn, the policies cannot be improved.

The ministry of foreign affairs has been criticized by the Norwegian auditor office for lacking supervision and control of aid funds to ensure that they are used as intended as mentioned earlier. The recipient government can ignore clarifying the use of aid funds without having any consequences from Norwegian aid agencies. Norway has fail to make written flow-up reports despite the fact that the national auditor office has pointed out significant errors and omissions (Riksrevisjonen 2012). It is difficult to promote learning when one does not know whether the policies are working or not.

The purpose of the thesis is to demonstrate how feedbacks from Zambia can change the decisions made in Norway. The outcomes from the three sectors in Zambia will influence the Zambian development plan which the decision makers in Norway base their decisions. This will be discussed in details in section 4.

System dynamics (SD) is suitable for managing development aid because designing and implementing effective policy requires understanding of the complexity of development aid, the cause and effects of the policies made to reduce poverty in the developing countries. SD is a useful tool for decision makers. The method can assist decision makers in understanding the complexity of the feedbacks in the system and to study the consequences over time. Aid is a scarce resource and it is important to ensure that it goes where it is needed most. Norad does not apply SD today, they follow the Paris declaration discussed in selection 1.3 whereby aid is transferred based on the development plan of the Zambian government and not based on the effectiveness of the policies. A concrete example that shows that the Norwegian development cooperation allocating the aid fund based the recipient was enlightened during the analysis of the quantitative data received from Norad, which was used for the development of reference modes. An email was sent requesting for an explanation to why development aid allocated to the three sectors fluctuated so much over the last 20 years. The intention was to understand

their decisions rules. The reply was "*We have not done concrete analysis of the aid to Zambia. We can therefore not say why there have been changes in the different sectors. One reason for fluctuations between sectors could however be that Norway has given unearmarked budget support to Zambia in the period 2007-2011*". (Sindre Wennesland, Adviser statistics unit, Department of quality Assurance). No analysis available even though it is stated in Norad's strategy report that one of their operational activities is to continue compiling high-quality statistics, and prepare their own analysis of data on use of development aid statistics (Norad 2011)

It's clear that the complexity of development aid is not understood and this leads to unintended effects like corruption discussed in detail in section 2.4.1. Complexity in the system arises from the interactions among different elements of the system. The Causal Loop Diagram (CLD) in section 2.2.1 shows the linkage between the sectors and the feedback loops which reflect both anticipated and unanticipated side effects of the decision maker`s actions. Unintended effects arises because there are other actors, with their own goals offset the intended effects of the policies.

2.2.1 Causal Loop Diagrams (CLDs)

CLDs represent the linkages among key performance indicators with arrows from cause to effect of the different sectors; economic, education and health sectors mentioned in figure 2.1, a detailed view of the Balanced Scorecard (BSc). The link polarities (+. -) describes what would happen if there were a change of variables, (+) indicating an increase while (-) denote a decrease in the variables. Determining whether the loop is positive or negative, one has to trace the effect of a change in one of the variables and examine how this effect affects the other variables round the loop. The polarity of the loop describes the structure of the system. If the feedback effect reinforces the original change, then the loop is positive (+) or reinforcing behavior. If the effect opposes the originate change then the polarity of the loop is negative (-) or a balancing behavior. To simplify the model, education facilities will be represented by schools and health facilities will be represented by clinics.

CLD is a useful tool for showing the feedback structure of the system, a way of externalizing mental models and assumptions. CLD forces managers to explore the beliefs and assumptions which drive their strategy (Sterman 2000). It also links the financial and non-financial aspects of the structure together as explained below. The linkages show that the decision maker cannot improve one sector without affecting the others. The decision is how

should development aid be distributed effectively among the different sectors in order to reduce poverty?

This CLD will be translated in a system dynamics software simulation tool called Vensim PLE for all the simulations done in section 4.

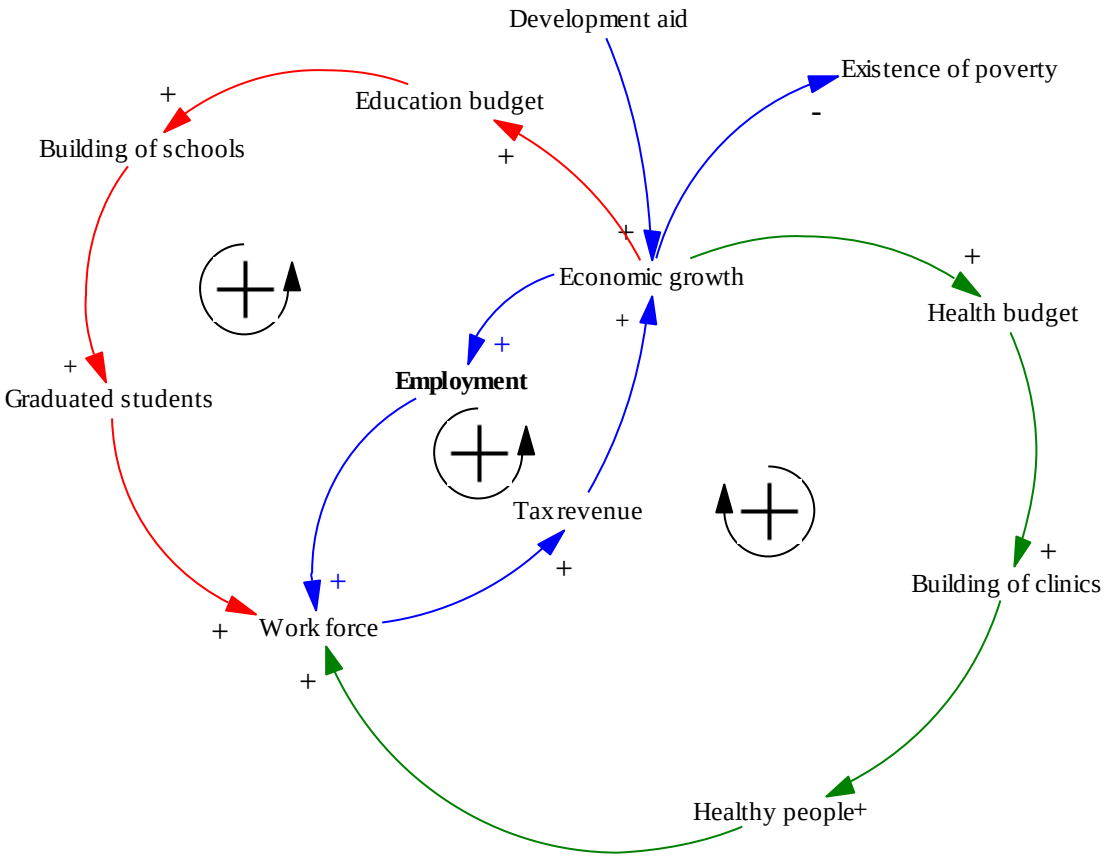


Figure 2.2.1: Causal loop diagram (CLD)

The economic sector is represented by color blue in the diagram. It represented by economic growth in the diagram. It is influenced by development aid for all the three sectors and tax revenues from domestic earnings. The economic sector influences the health and education sector and vise-versa. The first loop in color blue is the economic sector. It is a positive loop; increased economic growth lead to creation of more jobs and more jobs leads to more workers. This in turn increases the tax revenues which lead to more economic growth which leads to the reduction of poverty.

The second loop represents the education sector denoted by red arrows. An increased economic growth will lead to an increase in education budget expenditure and this will lead to an increase in the building of more schools. In turn, this will lead to an increase in the number

of graduated students. Graduated students contribute positively to the work force. An increased work force leads to and increased amount of tax revenue collected by the government. This causal loop is positive, reinforcing economic development in Zambia.

The third loop with green arrows depicts the health sector is also positive. Economic growth increases the health budget expenditures which lead to building of more clinics. More clinics means that more people are being treated which lead to more healthy people. A healthy population is generally more productive and employable (UNDP 2011). Healthy people increase the work force which again leads to increased tax revenue and thus economic growth.

Work force connects all the three sectors; the education sector is responsible for educating the work force, the health sector keeps the work force healthy and the economic sector is responsible for increasing the work force by creating more jobs. All the three sectors contribute to the economic development which reduces the poverty level.

Nothing grows forever! The reinforcement that creates economic growth will trigger a limit at some point. One day development aid will stops coming and this will limit the economic growth described in the CLD if the Zambian government doesn't invest the tax revenue funds wisely to promote sustainable economic growth. Low economic growth means that the government has no resources to invest in job creation, in building of schools and clinics. This will lead to the reduction in the work force and thus reducing tax revenue which again leads to increased poverty.

The CLD discussed above shows in details the interconnectedness of the BSc mentioned earlier in section 1.2.5. Using causal loop diagram help decision makers get a clear view of the dominant feedback loops that dominant in determining the overall behavior of the system and what is causing the different effects. The causal loop diagram will be used to construct a system dynamic model of the three sectors (economic, education and health) focused on in the thesis. Even though system dynamic is a useful tool for decision makers, it is not without any criticisms. Some of those are discussed in the section below.

2.2.2 Limitations with System dynamics approach

System dynamic is based on modeling to understand the behavior of complex problems. Modeling is time-consuming iteration of tests, observations, and hypotheses. Another element that contribute to the time-consuming procedures of modeling is that most of the software used in system dynamics have no technical support for helping users understand the connections between model structure and behavior (Richardson 2013). Understanding the

connections between complex model structure and behavior comes from a sequential modeling process that moves from simpler model to more complex structure and continuous testing of the model at each stage. The simpler stage guides the path to the understandings of the complex structure. Attempting to build a complex model at the outset is likely to fail.

Another critique is that formal complex models are designed, formulated and presented in way which are not understood by the widest possible audience, but a tiny minority of modeling experts. It is therefore unsure whether the use of causal loop diagrams showing the relationship between stocks and flows is reliable (Richardson 2013).

Richardson argues further that there are no appropriate procedures and standards for establishing user confidence in system dynamics models in various decision environments. Model validation and user confidence is difficult to achieve. According to Richardson, in 1980 Forrester and Senge published a classic statement on model validation and the development of user confidence. Examining the triple relationships of model structure, model behavior, and linkages between structure and behavior, they proposed a suite of seventeen separate tests that can be used ensemble to establish user confidence in system dynamics models. One standard procedure could not serve as a single and uniform path to model validation because models are built to serve different purpose and therefore will meet different levels of scrutiny from the users. For example, models built to support testimony in court should surely adhere to different confidence and validity standards than those used to inform the strategic thinking of a small corporate board of directors. Similarly, models that support public infrastructure planning efforts will meet a different level of scrutiny and review than will those supporting policy development in a legislative environment

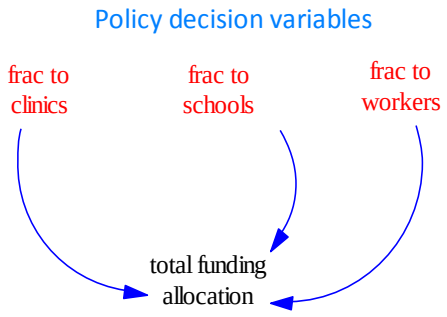
Richardson suggest that the field needs to achieve greater consensus concerning what types of confidence building and validation procedures and tests are more appropriate in what types of decision environments. The future of the field of system dynamics rests on our abilities to widen its base, the population understanding the significance of feedback and circular causality in living systems.

2.3 The development of a Dynamic Balanced Scorecard (DBSc) model

The thesis focus on four stages of model development according to ithink (High Performance Systems Inc 1994);

Stage 1: Focusing the effort. It is about defining the purpose of modeling, developing reference behavior patterns and developing a system diagram. The first two elements are discussed in section 1. The third element a system diagram, is a high-level diagram of key sectors within the model and the interconnectedness between them. This is the Balanced Scorecard developed in section 2.1.2. Stage 2 mapping, is about identifying the stocks that are responsible for generating the behavior of the system. These stocks were identified in section 2.1.3, the key performance indicators. These will also be used in the third step which is modeling. This will be discussed in this section. Stage 4 simulate, which is about testing the model and evaluation of different policies will be discussed in section 4.

The purpose of this section is to develop a DBSc model structure that shows the relationship between the economic, education and health sector. A system dynamic model starts with identifying the main operation variable of the system. The causal loop diagram developed in the section 2.2.1 consists of these operation variables, and these will be translated into a quantified simulation model using key data from Norad. The model provides a framework for understanding the structure and the dynamic of the development aid sector. The reference modes constructed in section 1.2 set the boundary of the model. The model consists of three aggregated sectors that display the structure and decision variables in The Norwegian development cooperation system. The decision variables are how much development aid should be distributed to each sector as shown in the figure; what fraction of aid should be allocated to the health sector which is represented by clinics, education sector represented by schools and economic sector donated by workers. These decision variables will address the second research question of "*How should development aid be allocated among sectors? Equal or unequal distribution?"*



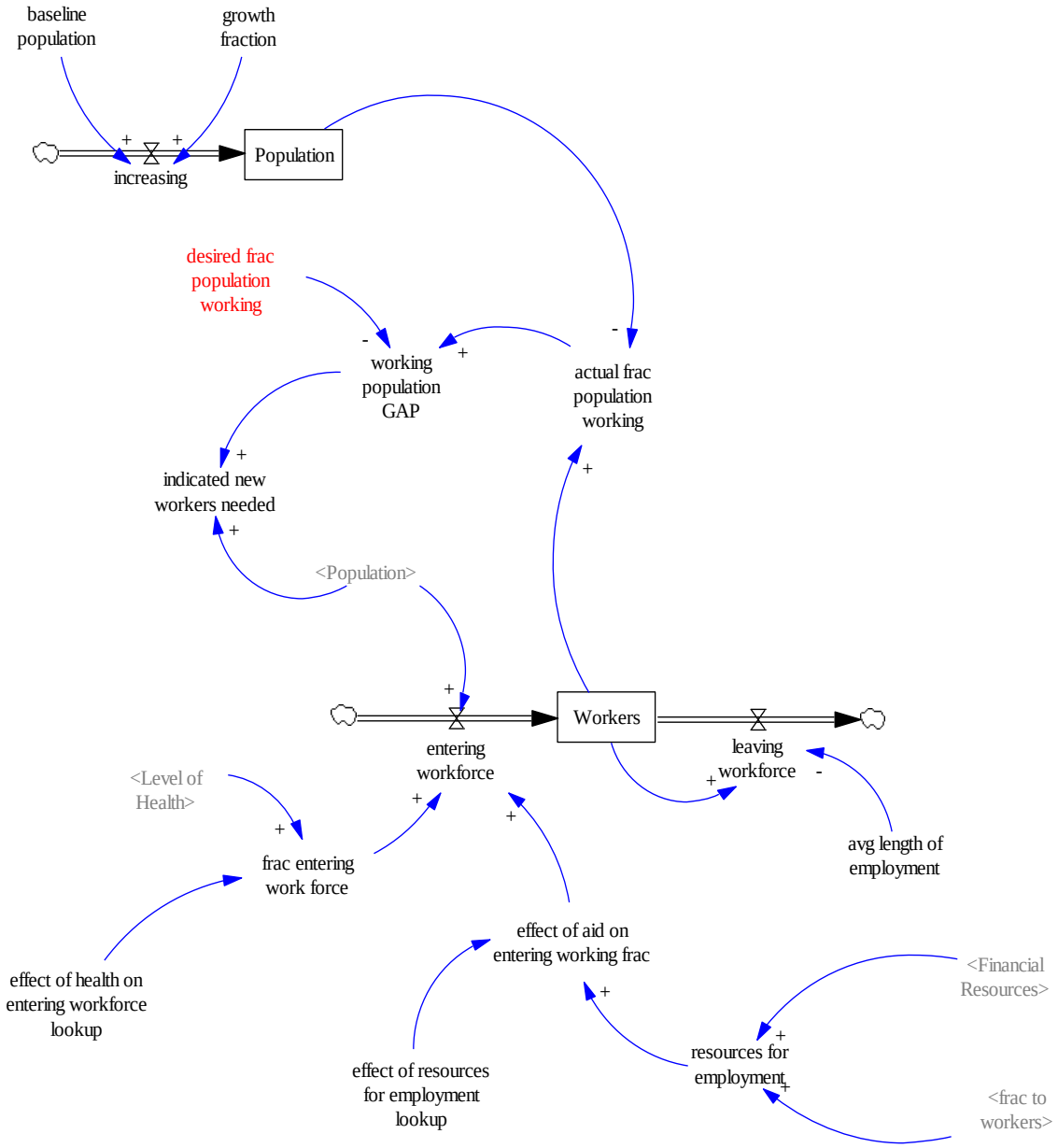
The sectors are interrelated to portray the dynamic balanced scorecard model which is a combination of BSc and System dynamics. The model uses the stock and flow language of system dynamics to represent the key performance indicators mentioned in section 2.1.3 as stocks. The flows for each sector will be identified. Stocks characterize the state of the system and generate the information upon which decisions are based. Flows are the rates of increase or decrease in the stock. Adding stock and flow terms to the model is important as it

allows simulations to be carried out (Sterman 2000). Stock and flow allows the advisory team in Norad and decision makers in the Norwegian development cooperation system to use actual or approximate measurement data to infer the end effects of their policies. The decision makers and advisory team can also use the stock and flow elements to change measurements within the system and simulate to study the effects of the changes. In the structure model, the sectors will be interconnected using shadow variables. The algebraic relationship between different variables will be specified. Parameters which consist of constants, initial values, and graphical functions will also be specified (equations and all the documents will be provided in the appendix).

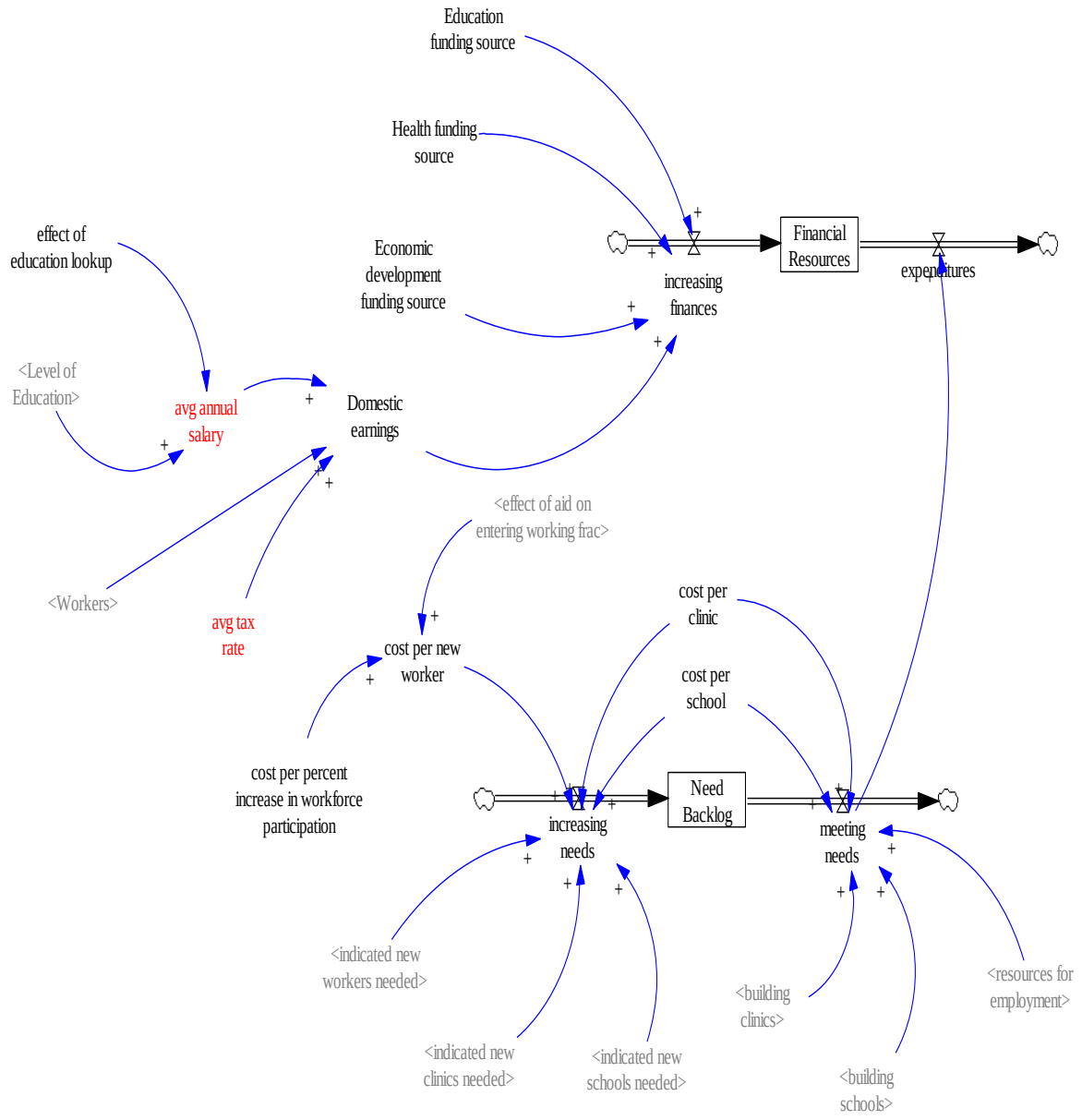
Economic sector

The economic sector is influenced by funds from development aid and domestic earnings in terms of tax revenue. Development aid allocated to the economic sector is intended to increase the level of work force in the country. The increase of workers depends on various factors: First is the total population and to what rate the population increases each year. Population times the working fraction gives the number of workers in the country. It is assumed the population group between 15 -50 years of age is considered to be the working population. The early retiring age is due to the low life expectancy in the country which 52,57 (CIA 2013). There is a working population gap when there is difference between the desired level of work force and the actual work force. In case the desired level of work force is less than the actual work force, this indicates the need for more workers and therefore more focus on economic development. If the opposite is true, then there is no need for additional economic support for the time being. The variable "desired fraction population working" is donated in red to indicate that this is a part of the decision variable mentioned earlier for the economic sector.

The increase of workers is influenced by a number of elements; first is the amount of resources allocated to increase employment. This amount is influence by the total financial resources and the fraction of development aid allocated to the economic sectors (to workers). Another factor is the level of health among the working population, high level of health increases the working population. But, people don't work forever, they leave the work force at a certain age depending on the average length of the employment which is assumed to be 30 years. Work force can therefore increase when the number of people entering the work force is greater than those who are retiring.



Apart from development aid allocated to the economic sector, the financial resources of the country are also influenced by the domestic earnings (tax revenue) which come from annual average salary of the workers times the average tax rate. The average salary is influenced by the level of education. The total financial resource stock is therefore development aid (allocated to the education, health and economic sector) plus domestic earnings.



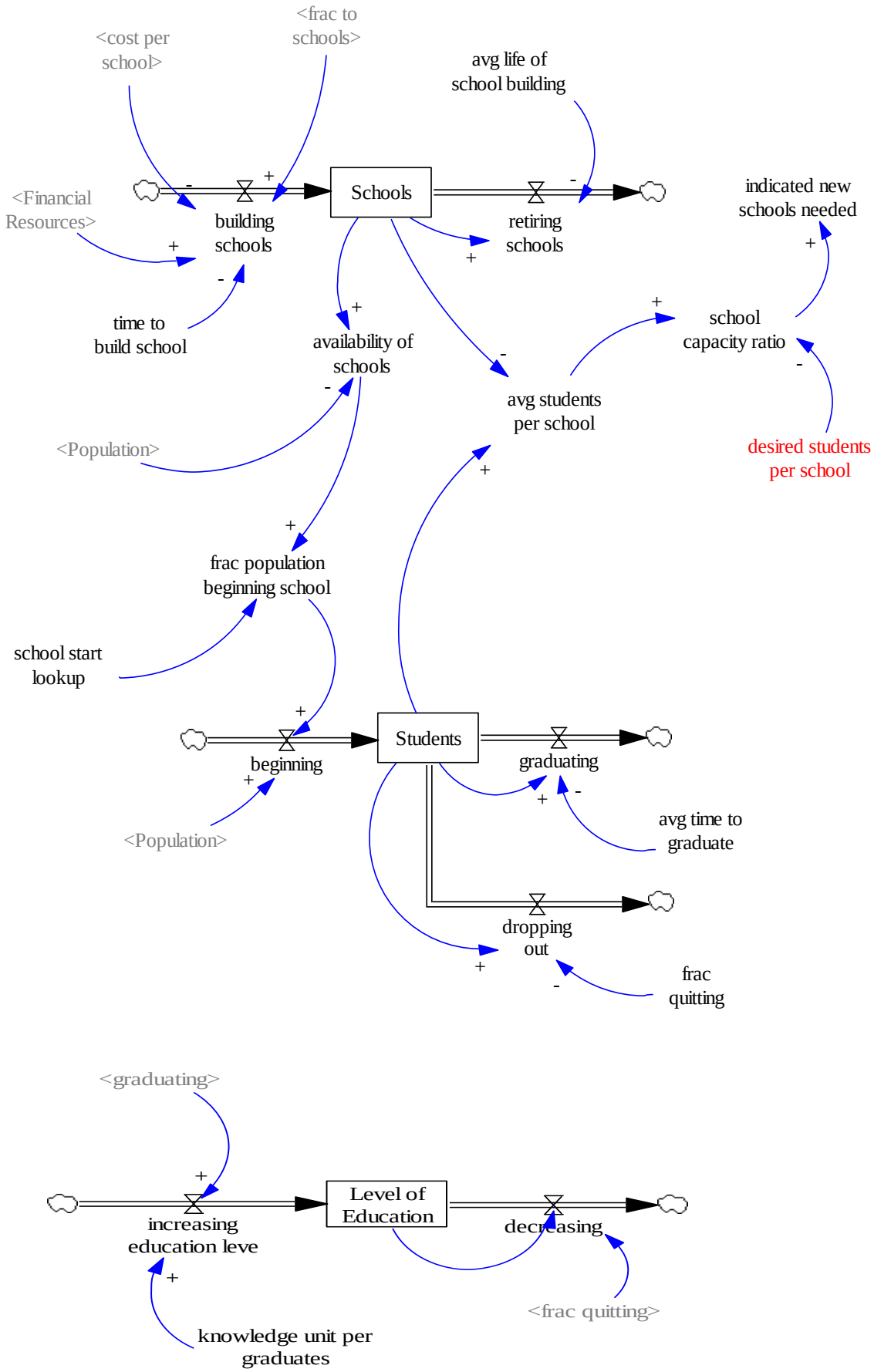
The financial resources are used to meet the needs per sector depending on the need backlog per sector. Need backlog is the sum total of all indicated social needs per sector measured in monetary units. This is to facilitate comparison with available financial resources, regardless of application and to enable decision makers to investigate the consequences of their priorities. The need backlog is increased by the following elements: the need for new workers times the cost per new worker, the need for new clinics times the cost per clinic, and need of new schools times cost per school. The needs are met by building the schools and clinics, and by allocating resources to improve the employment situation. All these needs are expenditures that reduce the financial resources. The total financial resources are reduced when the expenditures are greater than the incoming resources. The indicated need for building more

schools and clinics will increase as the population increases. It is assumed that it will cost 1.2 million to build a school or a clinic. Building of a primary and secondary school will take four year to complete. The cost includes the construction, desks, chalkboards, textbooks, clean drinking water, sanitation, ventilation and electricity. The clinic will take three years to build and cost includes construction, emergency medical supplies and all medical equipments.

The model shows how the economic sector influences both the education and health sector. The linkages to the economic sector from both education and health sector are represented by the shadow variable in grey color with parenthesis. Population also influences all the three sectors as discussed in the following sections.

Education sector

This model has three stocks; schools, students and education level. All these stocks are interconnected with each other. The schools stock is increased when the number of schools built is greater than the decaying schools. Building of school is influenced by a number of factors; the financial resources allocated for building schools, the cost per school and the time it takes to build the school. The availability of adequate schools is assumed to be one school for every 10 000 people in the general population. The availability of schools increases the fraction of the population that is expected to attend schools. This fraction increases the number of students. This again increases the number of students that graduates. However, not all the students manage to graduate, some drop out of the school due to different reasons among others; poor quality of education, economic constraints and long distances to school. The student stock is increased when the number of students starting school is bigger than the number of students graduating or dropouts. The average number of students per school depends on the initial number of schools and the initial number of students. The desired number of students per school is 1000. In case the average number of students per school is more than the desired students per school, there is a need for building more schools. The variable "desired student per school" is part of decision variable for the education sector. The financial resources and the cost of building a school are shadow variables that connect the economic sector to the education sector. Population as with the economic sector also influences the education sector in terms of the fraction of the school age population that is expected to attend schools.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avg life of school building
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Schools
building schools
retiring schools
indicated new schools needed
time to build school
availability of schools
school capacity ratio
avg students per school
<Population>
desired students per school
frac population beginning school
school start lookup
Students
beginning
graduating
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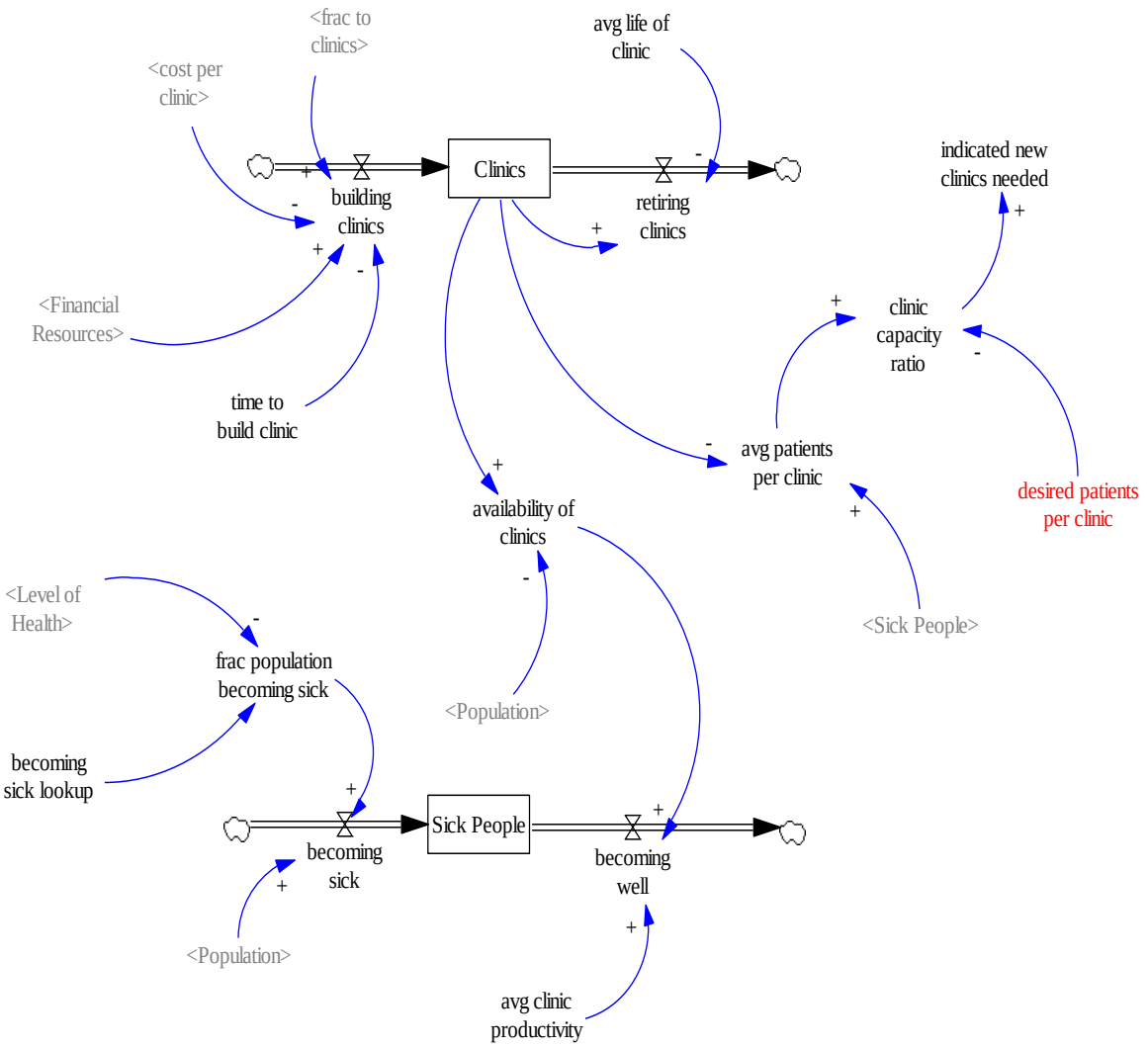
avg time to graduate
dropping out
frac quitting
<graduating>
Level of Education
increasing education leve
decreasing
knowledge unit per graduates
<frac quitting>

The level of education stock is influenced by the number of graduated students and the knowledge unit per graduate which is assumed to 1 percent. The level of education is decreased when the number of students that drop out of school are more those that graduates.

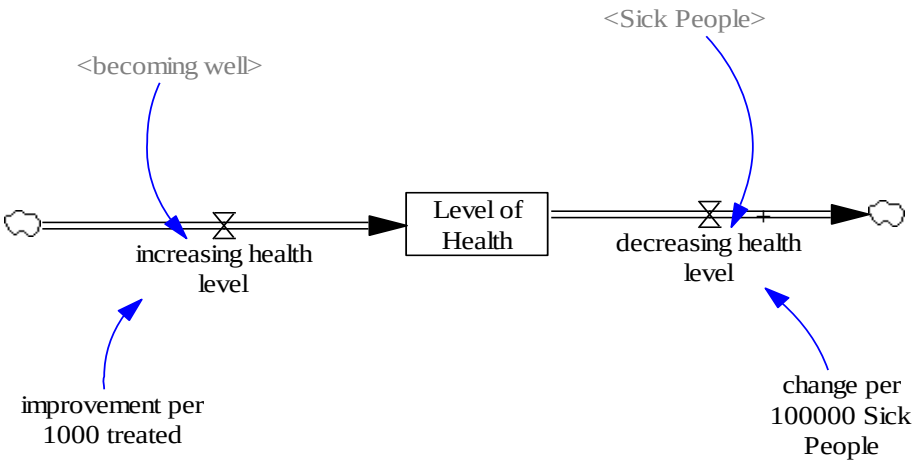
Health sector

The health sector has also three stocks; Clinics, sick people and level of health. The clinics stock is increased when clinics built are greater than those clinics that are being destroyed. Building of these clinics depends on; resources allocated to the health sector, cost per clinic and the time it takes to build each clinic. The retiring rate of the clinics depends on the number of clinics divided by the average life time of the clinics. The average patients per clinic are determined by the number of sick people divided by the clinics. The desired number of patients per clinic is 1 000. If the average number of patients per clinic is more than the desired patients per clinic, there is a need for building new clinics.



The availability of the clinics and the average productivity of the clinics determine the number of sick people getting treatment and therefore becoming well. The number of sick people depends on the general health level the population has and the fraction of the population that become sick. The sick people stock is increased when the number of sick people is greater than the number of people being cured.

The general health level of the public is influenced by the number of people getting cured and those that get sick. It is assumed that every 1000 people cured increases the general health level of the population and every 100000 sick people reduces the level of health.



The health sector is linked to the education sector through the work force in the sense that the health level of the population influences the fraction of the population entering the work force. This sector is linked to the economic sector through finances allocated to this sector and this is indicated by the shadow variables.

The models show a holistic picture of all interconnections and relationships that exist in the system and this will enable Norad's advisory team to visualize and understand these interrelations clearly. The structure could lead to both the intended effects and the unintended effects of development aid. The next section discusses the theory behind the Paris declaration followed by the Norwegian aid agencies which leads to the unintended effects of development aid.

2.4 Theory behind the Paris declaration

Over the past years different mechanisms for improving the quality of aid have been developed. One of these mechanisms is the 2005 Paris Declaration on Aid Effectiveness

which is focusing on country ownership, donor harmonization, alignment to recipient countries' national development strategies, managing for results and mutual accountability between donors and aid receiving countries in order to reduce poverty as mentioned earlier in section 1.3.

Richard Manning, a former chair of the OECD Development Assistance Committee and the principal architect of the Paris Declaration, wondered how the Paris Declaration will affect behavior on the ground in developing countries (Eyben 2008). The declaration is about forming relationships between donors and recipients. Eyben suggests that it is a way of framing organizational relationships that is derived from rational choice theory in Economics. Putting principal-agent theory into practice requires institutionalized positive and negative incentives to align actors' interests with the interests of those who have set the agenda but do not have the power to implement it. Changing behavior through incentive structures has become so 'naturalized' in modern management as one of the theories that seek to explain human behavior.

According to the 2008 progress report on implementing the Paris Declaration, the behavior patterns for some of the donors and recipients have not changed. Inefficient patterns of managing development aid persist and there are few signs of change. This explains the continuous existence of corruption and dependency on aid in many aid recipient countries.

The establishment of Paris declaration principles is a step towards effective management of aid, but more need to be done to reduce the negative effects of development aid spread around many African countries. Some of these unintended effects are discussed below.

2.4.1 Unintended effects of aid

Corruption is one of the main problems of development aid. It is a well-known issue among many African countries. As development aid pours in the country, the officials, politicians and government workers shift their efforts away from skills and knowledge that will benefit the economic and social sectors, towards skills that will optimize their share of aid (Knack & Azfar 2000) in order to pursue their personal objectives. This is the shifting of the burden discussed in section 1.2.5. The government officials shift their efforts from developing their country to focusing on person gains, leaving the burden of fighting poverty to the aid agencies.

Another issue with corruption is that aid intended for the social and economic sectors in order to generate improvements in welfare may simply free the funds that governments would have

spent on these sectors. The freed funds can be used to fund other activities not intended by the donor like military or used on personal favors or other activities that will help the government to stay in power. Again shifting the burden as discussed above.

According to the Aftenposten accessed on the 31.01.13, money intended for development of the country is illegally transferred out of the country in many developing countries. Illegal money transfers from the developing countries increased by 11 percent in 2010. A staggering 4700 billion kroners disappear every year. Money disappears through tax evasion, mispricing and corruption. Large sums are hidden in international tax paradises.

Many African countries experience the greatest impact of this problem. Even though Norway is supporting good financial management in Zambia, such as building capacity in the Zambia Revenue Authority to enable the government correct taxes, Zambia has been drained for decades of funds equivalent to twice the country's annual income. According to the development minister Holmaas, the mining companies in Zambia are often seen as avoiding taxes through transfer pricing and lack of transparency in terms of volumes produced and exported, prices and costs. Only one or two companies in Zambia declare profits and pay corporate profit tax (The Royal Norwegian Embassy in Lusaka 2013). Overall, developing countries lose ten times as much illegal money outflows, as these countries receive in development aid. Zambia's international mining companies have been investigated for hiding large amount of money to avoid paying taxes to the government.
Aid funds also disappear in the illegal capital flight, even if money flows are better monitored. Donor countries should be worried! (Aftenposten 2013).

Political leadership and the elite are central in hiding tax money into tax paradises. It may be that the political elite can have their own interests to maintain a regime that does not serve the general population in order to continue receiving aid. This has resulted in dependency as it induces a lazy and dependent mentality of the governments and civil societies. This undermines the peoples' faith that they can improve development on their own. This reduces the incentives to invest, especially when the recipient is assured that future poverty will call for more aid. It seem like most African countries are so dependent on aid that without it almost half of their yearly budgetary commitments cannot be fulfilled (Andrews 2009).

Corruption and dependency hinders the implementation of fundamental policies which promote economic growth and this keeps the country in poverty. Combining the Paris declaration with a dynamic balanced scorecard will be a useful tool in fighting corruption and

thus reduce dependence on development aid. This is because when development aid is managed effectively there is less room for corruption.

In addition to the unintended effects, there are other limitations of the Paris declaration and some of them are discussed in the section below.

2.4.2 Limitation of the Paris declaration

According to OECD report 2012, efforts have focused more on aid effectiveness processes than on the impact of better aid. The transaction costs of aid effectiveness processes are high, in particular for donor country staff, and there is a risk that the costs are disproportionate to the benefits. In addition, demonstrating and attributing the impact of aid effectiveness is challenging and there is no common understanding of what results can realistically be expected or how these will be measured. Greater efforts are required to improve wider understanding of aid effectiveness principles by the government officials and the civil society.

Another concern is related to the fact that management for results is often misinterpreted as management by results. This generally leads to changes in allocation patterns towards quick wins, easily measurable results, and short-term deliverables to the disadvantage of investment in long-term changes (Koster & Holvoet 2012). There is a need to agree on realistic results and how they should be measured in order to promote aid effectiveness and realistic timeframes for achieving change. The time aspect for change should be realistic because it takes time to change behaviors and processes.

Both donor and receipts are committed to the Paris declaration but, the principles are not put into practice as intended. This fact is also supported by the case-study carried out by Koster, findings show that, in spite of bilateral agencies' discussion and commitment to more harmonized and aligned approaches in the area of measuring and assessing Paris declarations' effectiveness, the current level of harmonization and alignment on the ground is relatively low. Evidence from Belgium, the Netherlands and the UK hints at the fact that this may to some extent be related to the diverging performance management cultures in which the bilateral donor agencies are embedded (Koster & Holvoet 2012). There is an urgent need to scale up implementation by a wider range of donors and recipient countries, and to identify incentives to make this happen. Greater effort is required to strengthen and use country systems that meet accepted standards, to actively reduce project aid and increase the longer-term predictability of aid and to institutionalize common results framework and mutual accountability measure.

There are conflicting views about whether global programs strengthen or undermine country ownership. The slow pace of harmonization and alignment of global programs at country level and heavily earnmarked funding potentially hinder country ownership (OECD 2012).

The next section discusses the research methods used to find the relevant information and data collection methods.

3. Method

In this selection, the choice of research method, data collection methods and data analysis methods are discussed. The research method is discussed first.

3.1 Research method

There are two types of research methods that could be used; qualitative and quantitative methods which are defined according to the methods used to collect data and the purpose of the research (Askheim & Grenness 2008). Quantitative method seeks to explain something and the data collection is normally done through surveys using structured questionnaire forms. Data collection using qualitative method is normally done through group interviews, observations or personal depth interviews, and from multiple data sources. Qualitative method was chosen because it will provide a better understand of how development aid is managed today by The Norwegian development cooperation system and how Norad evaluate the policies of the activities funded by development aid. And further, how Norad's advises impact the decision making in The Norwegian development cooperation system. Qualitative method is the most appropriate method for my research question because;

- The intention is to understand how the Norwegian development cooperation system make their decisions which leads to the observed effects of development aid
- How Norad evaluate the decision policies and what impact has these evaluations on decision making
- Focus on one case study (Norad) which is a representative for a large population of development aid agencies
- Collect data from multiple sources and analysis the data material parallel with data collection.

3.2 Data gathering approaches

Data collection and data analysis frequently overlap in the case study research. Data collection and analysis of data was conducted parallel. This joint work was very helpful

during the construction of reference modes whereby references modes were constructed and analyzed at the same. Case study research generates a large amount of data from multiple sources. This provided an opportunity to triangulate the data in order to strengthen the findings of the case study. The data was collected from the follow sources;

i) Articles/books available on development aid in general and effective management of aid. The purpose was to search for facts and evidence about development aid.

ii) Norad was contacted both by phone and email and the statistical data for development aid allocated to Zambia per sector from 1991 to 2011 was provided. The data was used to construct reference modes and it will be used in the modeling process. Different reports from Norad's webpage were also used to understand Norad's strategy and the way they make decisions. It was difficult to conduct interviews because Norad does not have the capacity to allocate time to that. Because of that the questions where sent by email requesting for information about how the policies of allocating aid to Zambia is made, how these policies are evaluated and which impact they have on decision making, what are the key performance measures per sector, and whether there is any coordination within the Norwegian development cooperation system.

iii) Information about Zambia`s development trend was attained from rapports gathered from various websites.

iv) Followed the media to capture the perspectives the public has about the effect of development aid.

The knowledge from these sources is discussed throughout the thesis.

3.3 Data analysis

Data analysis is divided into two stages.

First stage; the first analysis was done in section one. The qualitative data needed for development aid transferred from Norway to Zambia per sector was analyzed and reference modes were developed. Reference modes showed the relationships between development aid and the effects to; the economic, education and health sectors in Zambia as explained in sections 1.2.1 to 1.2.4. The conclusion from this analysis was that development aid does not achieve the intended effects.

Second stage: the second analysis is the model analysis in section 4. The analysis will be done using simulation modeling. Simulation modeling will assist in addressing research questions

ii) and iii) by evaluating the policies of whether to allocate equal or unequal aid among the three sectors. Different scenario runs will be developed to examine possible futures policies and to identify the policies that seem effective for reducing poverty.

3.4 Limitations of organizing the research as a case study

Critics of the case study method believe that the study of one case cannot offer grounds for establishing reliability or generality of the findings (Askheim & Grenness 2008). Reliability is easily achieved with quantitative research method because the method is objective and more structured in form of surveys which makes it easier for other researcher to evaluate the reliability of the results. When it comes to qualitative method however, the researcher is subjective and not as structured as with the quantitative method which makes it challenging for other researchers to evaluate the reliability of the results. It is normally the researchers themselves who consider the reliability of qualitative results through continuous feedbacks between the researcher and the respondents. Due to the fact that it is not easy to replicate the results from qualitative research method, it is considered one of the weaknesses of this method.

Concerning generalizing of the findings however, I believe that the findings from the case study in this thesis is generalizable because Norad is a typical aid agency and can therefore represent other aid agencies. Zambia is also a typical developing country receiving development aid. Therefore, Norad as a case study and Zambia as an example of a country have no impact on the findings, it could have been another aid agency and another country. This means the tools used to produce the results can be applied to any other aid agency and to any country receiving development aid.

Data collection using qualitative method is normally done through interviews and from multiple data sources as mentioned earlier. The intention was to conducted open-ended interviews with key decision makers responsible for development aid allocated to Zambia and the advisory team in the Norad. The purpose of the interview was to understand the policies used today, the reasoning back those policies, whether decision makers fully understand the consequences of their decisions, finding the key performance indicators for the economic, education and health sector and how the decision makers coordinate with each other. Unfortunately, it was not possible to conduct these interviews due to time constraints and other hindrances among potential respondents. The alternative was to communicate via telephone and emails. It wasn't quit the same because all the information needed was not

provided, a number of questions remained unanswered. In the absence of being able to conduct interviews with policy makers some assumptions were made based on my own experience working in an aid organization and also based on the way decision makers avoided answering some vital questions. For example the Norwegian ambassador in Zambia was asked to explain how the four entities in the Norwegian development cooperation (Norad, MFA, Norfund and the embassy) collaborated with each other in the fight against reducing poverty. The response was "*I am sorry, but it is really not my job to make the assessments that you ask for. I suggest you revert to spokespersons for the various institutions to make interviews with them. Good luck on your work".* I assumed there are no collaborations that's why he didn't know the answer! Other decision makers were contacted, but they were all bouncing me around from one decision maker to another without getting any answer. It was therefore concluded that there was no collaboration among the entities since nobody could give answer.

The next and final stage in modeling is simulation. The structure model developed in section 2.3 is going to be simulated and the results will be discussed in the next section.

4. DBSc model analysis and demonstration of development aid policies

In this selection, the structure models of the three sectors built in section 2.3 will be used to demonstrate the use of a DBSc model. The policies will be tested through experimental modeling. The testing begins with formulating the equations to specify the algebraic relationship between stocks and flows. When the equations are already, the model will be simulated to study the dynamic behavior of development aid allocation. The model will be tested under extreme conditions that may never happen in the real world. This is critical to discover the flaws in the model and better the understanding of the model. After testing the model, it will be used to evaluate the policy alternatives mentioned in section 1.5 of how much aid should be allocated to each sector and to find the most effective policy of reducing poverty. The interaction of different policies will also be assessed to identify policies that reinforce one another and generate a substantial synergy effect. The high leverage policies will be recommended and this will lead to changing the structure system of the Norwegian development cooperation through Zambian development plan.

The time horizon for modeling is from 1960 – 2050. Time horizon from 1960 was chosen because the Norwegian agencies started giving development aid in the 60s but Norad, did not have the data from that period. The data that is available is from 1991 to 2011. The average

development aid provided for the last decade (2001-2011) will be used in the model. The year 2050 was chosen to be the end of the simulation period because the intention was to extend the time horizon far longer enough into the future to capture the delayed and indirect effects of the policies, and to infer the future development.

The behavior of the system is generated from its feedback structure. There are six common fundamental modes of dynamic behaviors which are expected to be observed during the simulations;

- Exponential growth which arises from a positive or self-reinforcing feedback loop.
- Goal seeking which is derived from a negative feedback loop, act to bring the system in line with the desired goal. Both of these behaviors were observed and discussed under the causal loop diagram in section 2.2.1.
- Oscillation is caused by negative feedback with time delays whereby the system is constantly overshoot its goals from the presence of time delays. The delays cause corrective actions to continue even after the system reaches it goals, triggering a new correction in the opposite direction.

The first three dynamic behaviors are created from the feedback of the system. The next three are created from the nonlinear interaction of the basic structures above.

- S-shaped growth is exponential growth at first, but then gradually slows down until the system reaches its goal. This behavior is a combination of exponential growth and goal seeking.
- Growth with overshoot is similar to the S-shaped growth, but with time delays so that the system overshoots producing an Oscillation behavior.
- Overshoot and Collapse is when the system grows exponentially until it reaches its equilibrium and then collapses because the carrying capacity is consumed.

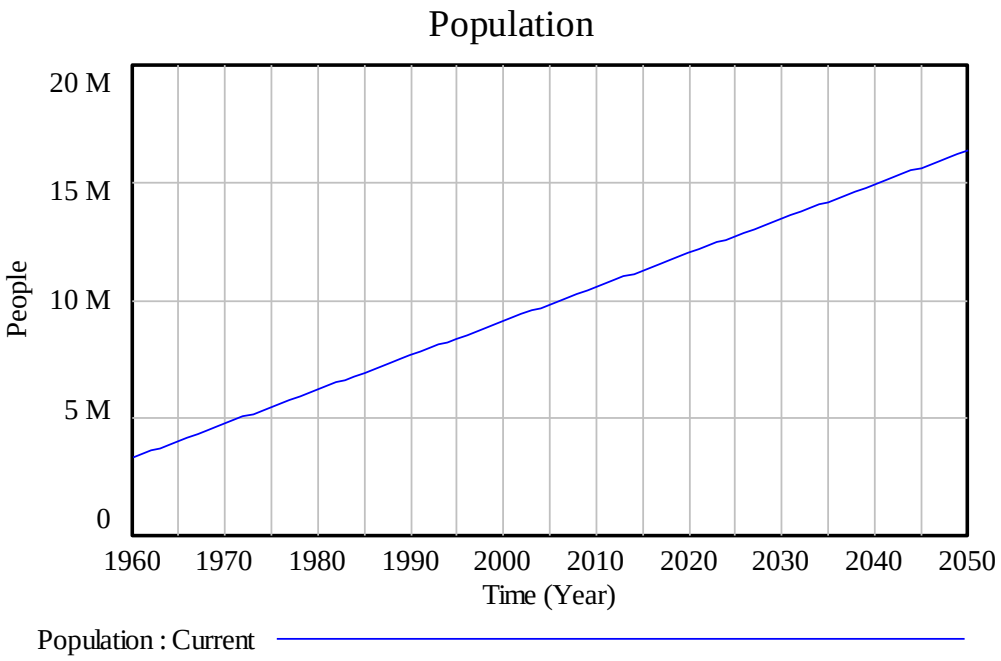
Some of these behaviors will be discussed in details according to what behaviors that are portrayed during the simulation runs.

4.1 Simulation runs

This selection presents the fourth stage of a dynamic BSc modeling discussed in section 2.3. Simulation assists in building confidence in the model through iteration of tests and experimenting with different policies before they are implemented. It is recommended to start simple, one sector at a time and then gradually run a combination of sectors. The thesis

presents computer simulation models for each sector showing the impact of the different policies aimed at reducing poverty. Vensum PLE simulation modeling tool is used for all the runs. A system dynamic model developed in section 2.3 is used for all the runs. The model was tested first by putting some of the sectors into the equilibrium state using arbitrary figures in order to ensure that the model behaved appropriately.

Next, the equilibrium was disturbed by changing the arbitrary figures with real life figures to replicate the population reference behavior modes in section 1. Not all the references could be replicated because not all the real data need was available. The intention of replicating the population mode was to ensure the robustness of the model. The run shows the population development in Zambia from 1960 to 2050. The initial population was estimated to be 3.3 million people in 1960, growing at a rate of 4.4 percent. The Zambia population has been increasing since independence in 1964 as discussed earlier in section 1. According to the 1980, 1990 and 2000 censuses the population of Zambia was estimated at 5.7, 7.8 and 9.9 million respectively. These figures are attained in the run below. According to UNESCO, the annual average population growth rate has declined from 4.4 in 1960 to 3.1 between 1969 - 1980, and further from 2.7 percent between 1980 -1990 to 2.4 percent between 1990 -2000 (UNESCO 2008). As the run shows, the population will continue to rise. It is estimated to be around 17 million people in the year 2050. Population is an endogenous factor in the simulation model that influences all the three sectors.



After testing the model, it's time to evaluate the policies. First to be evaluated is how the system will react when no resources is allocated to any sector, followed by today's policies implemented by the Norwegian agencies, and lastly evaluating different policies of whether to allocate equal or unequal shares of aid funds among different sectors. The evaluation will lead to the identification of policies that seems to be more effective. The benefit of a balanced scorecard with simulation is that experiments can be carried out before allocating aid to the economic, education and health sectors in Zambia. Assumptions can be tested through experimentation and the existing decision rules can be modified. Simulation modeling is a learning laboratory were both the decision makers and advisers can learn through working together.

The decision variables are constructed in such way that the policy makers can change the values of the variables to observe the consequences of each policy. Four runs will be carried out per sector; the basis run, the run for today's policies, equal distribution run and unequal distribution. Some estimates that are made in the model will be explained along the way.

4.2 Baseline scenario, no distribution of financial resources

The baseline run is the first scenario which shows how the systems reacts with no financial resources allocated to the economic, education and health.

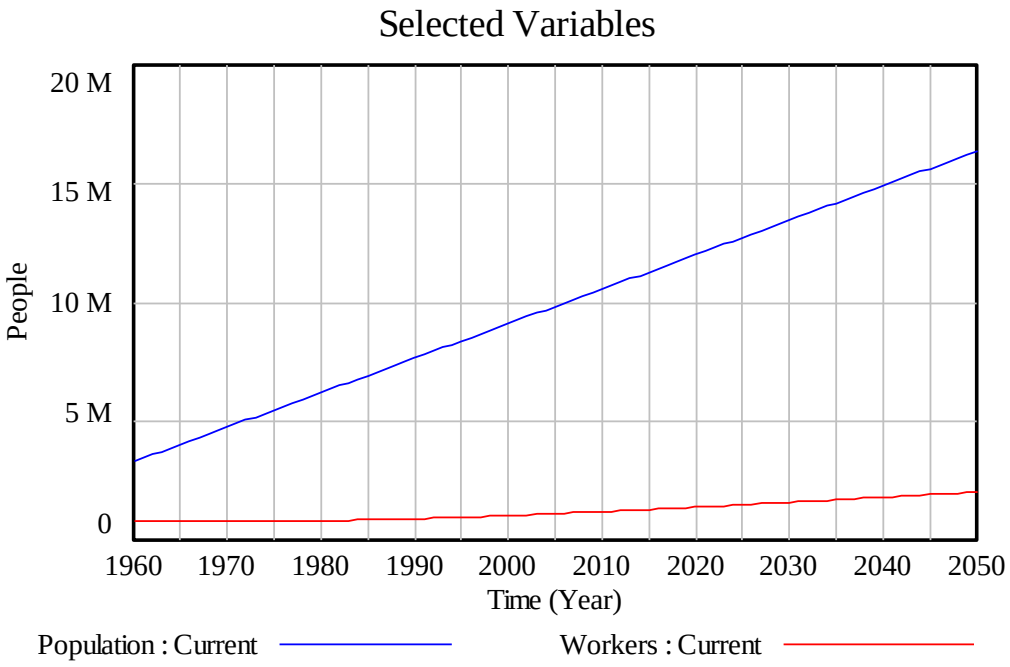
4.2.1 Economic sector, 0 percent

The financial resources for this sector are intended to promote economic growth through creation of employment indicated by the number of new workers entering the work force. To demonstrate this, some estimates are made; the work force influences the domestic earnings of the country though paying taxes from the worker's average annual salaries. It is assumed that the baseline average annual salary per worker is NOK 50 000 per year. And because the salary is low, the average tax is estimated to be 15 percent. It is estimated further that the population in 1960 was 3.3million and that 25 percent of the population between the ages of 15-50 are considered to be a working population. 20 million NOK is assumed to be the initial financial value. Apart from the population, the work force is also influenced by the amount of resources allocated to increase the employment rate. This depends on the gap between the actual number of workers and the desired number. In case the average number of workers is lower than required, then there is a need for financial resources to increase the number of people entering the work force.

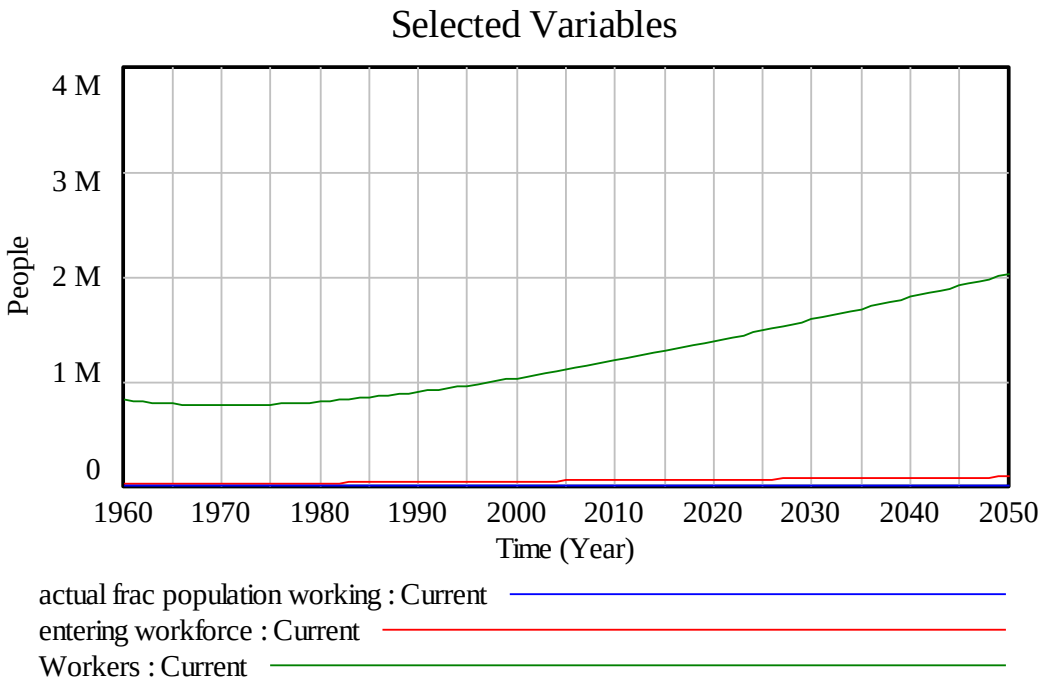
It is assumed that it will require NOK 100 000 per one percent increase in the fraction of entering workforce. In addition, there are other costs involved in creating new jobs which are not specified.

There is no financial resources allocated and this means that they will not be any increase in the work force. It is assumed that 25 percent of the population between the ages 15-50 is in the working population, but with no financial resources to increase the employment rate it is not certain how many of the working population will be actually working throughout the simulation period. The runs in this section will demonstrate how the fraction of actual workers will react to no funding.

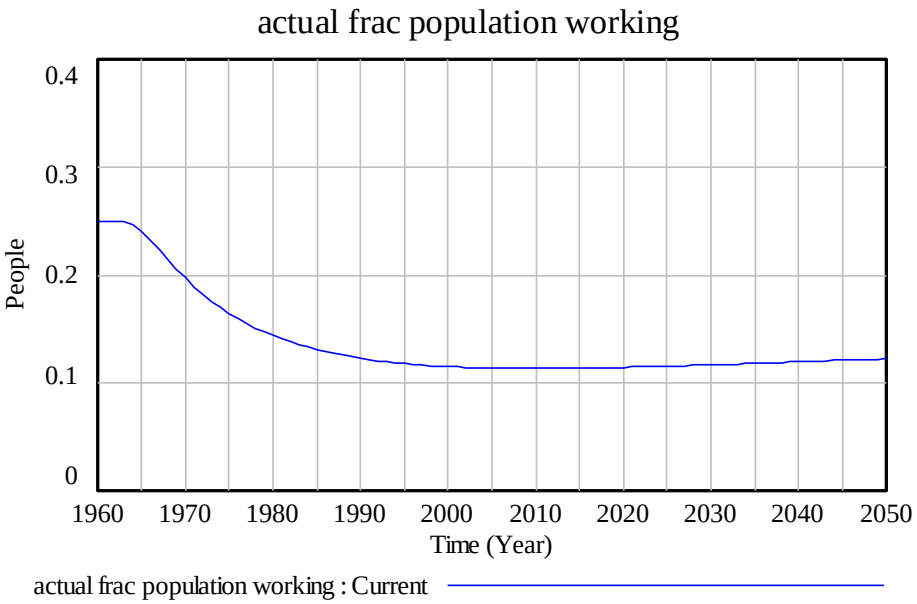
The first run shows that the fraction of workers is less than 25 percent of the population and the gap gets wider and wider. This is because there are no financial resources to increase the employment rate.



The next run shows a clear development of the number of workers per year without any financial resources. The initial number of worker in 1960 was 825 000, this number started to decrease from 1961 up to 1978 with the lowest number of worker of 79 669. This decrease indicated a need for financial resources to increase employment. However, because the population was increasing, the number of workers also started to slightly increase exponentially from 1979. According to the run, they will only be 2 026 977 workers out of the estimated 17 million people.



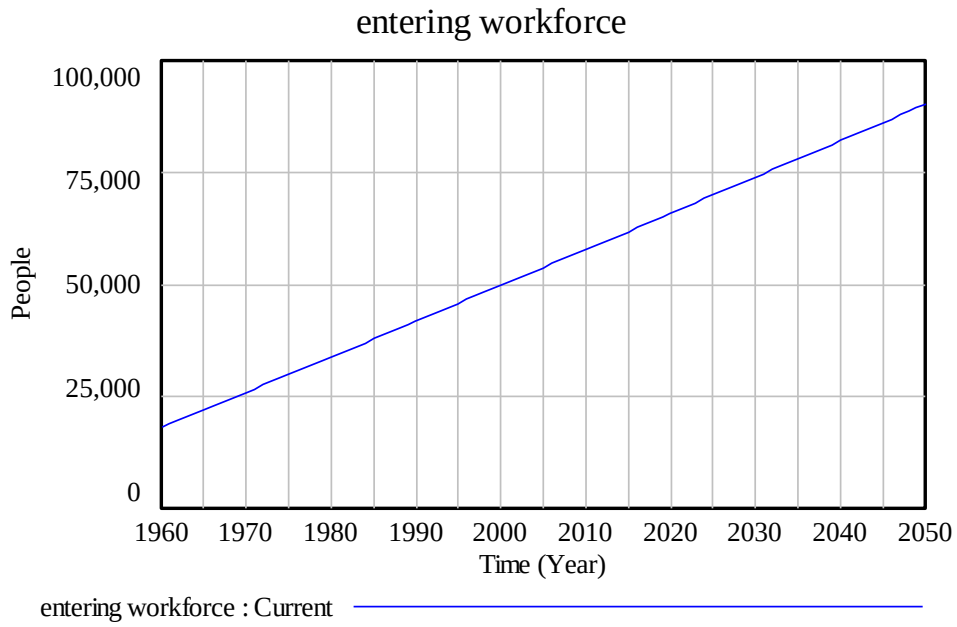
To get a clear view of the development of actual fraction of the working population and the number of workers entering the work force, the graphs for these two variables are developed separately below. The graph for the actual fraction of the working population is discussed first.



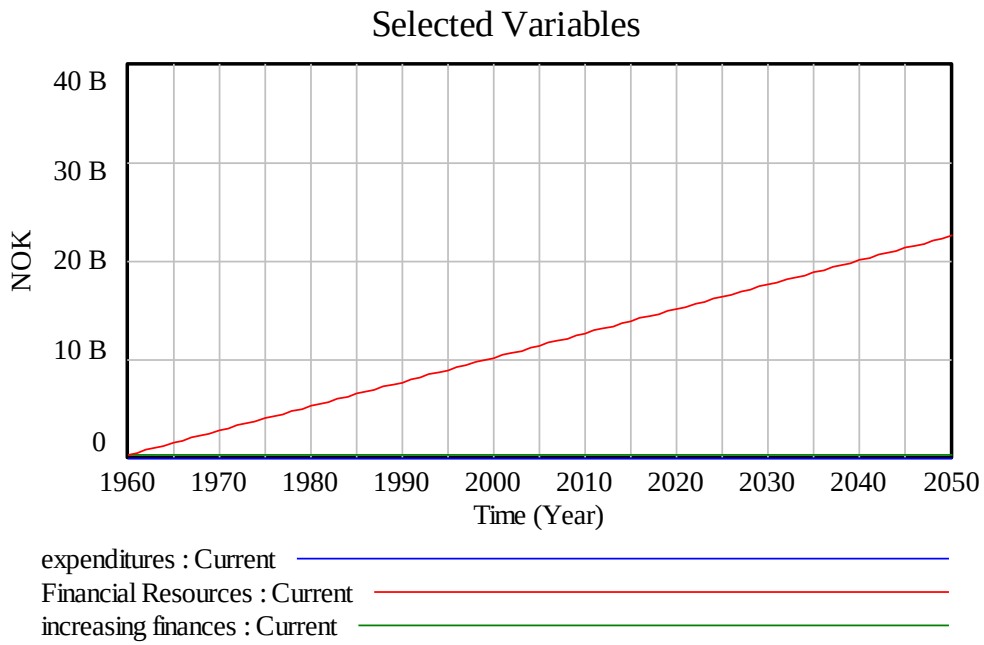
The graph shows that with no financial resources, the fraction of the actual working population decreases. The initial fraction was 25 percent in 1960 and this fraction lasted until 1963, but then it started dropping at a low rate. From the year 2000-2025 the actual fraction of

workers is approximately 11.5 percent. Because of population growth, the fraction will start increasing at a low rate from 2026. By 2050 the fraction of actual worker will be 12.2 percent. The fraction of actual is so low compared to the desired fraction of 25 percent. The average fraction of worker throughout the simulation period is estimated to be 13.74 percent. This means that 11.26 percent of the working population is without jobs. This will affect the domestic earning negatively and it will slow down the economic growth in the country.

Because there are no financial resources, the number of people entering the work force is also low. As the graph below shows, the initial number of people entering the work force was 17 983 in 1960 and this number increases at a low rate due to population growth. By 2050 they will be 90 284 people entering the work force. This means that 0.53 percent will be entering the work force in 2050. This is relatively low compared to the population of 17 million estimated in 2050.



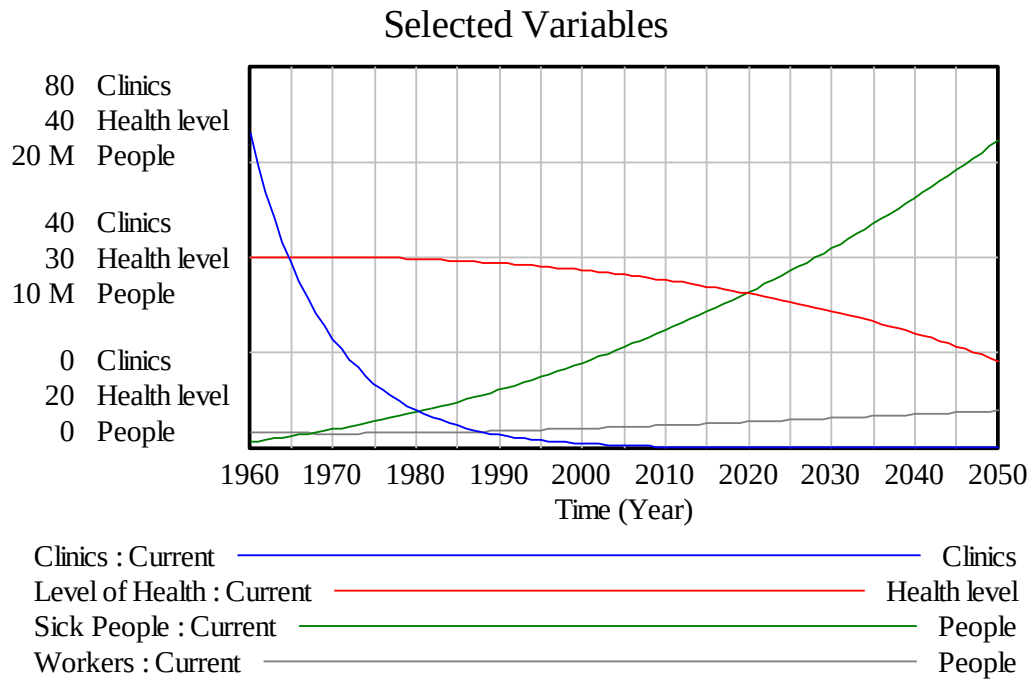
The next graph is about the financial resources stock. This stock consists of development aid and tax revenue from domestic earnings. There are no resources allocated to neither the education nor health sector either. This means that there are no expenses in this run. As shown in the run, the expenditures are equal to zero because no schools and clinics are being build, and no increase in the employment rate. The financial resources show exponential growth because of the domestic earnings coming in and there are no expenses. The financial resources will decrease when the expenses are more than the incoming domestic earning and the development aid.



Not investing in building of schools and clinics will affect the work force negatively; it will contribute to the increase of uneducated work force which means low average salary and thus low tax revenues for the government. In turn, this will slow down the economic growth. The domestic earnings will also be affected when the health level of the general population is low. Fewer people will be able to work because they are not being treated. Reducing the domestic earnings and therefore slowing down the economic growth.

4.2.2 Heath sector, 0 percent

The initial number of clinics was 66 in 1960. This was achieved by assuming that 20 percent of the population 660 000 (3300 000*0.2) needs medical attention and the number of desired patients per clinic is 10 000. No finances resources allocated to this sector mean that no more clinics will be built. This means that the number of clinics will be decreasing from its initial value of 66 to zero clinics by the year 2002. This is because the deteriorating rate is greater than the building rate, an exponential decay behavior. As an effect of that, the level of health of the general population will also decrease from the initial value of 30 to below 20. Reduction in the number of clinics results in an increase in the number of sick people because they are not getting treated. The run shows that the number of sick people increases exponentially. This will have a negative impact on the work force as many people will not be able to work. This will affect the domestic earning because fewer people working result in less tax revenue to the government and thus slowing the economic growth.

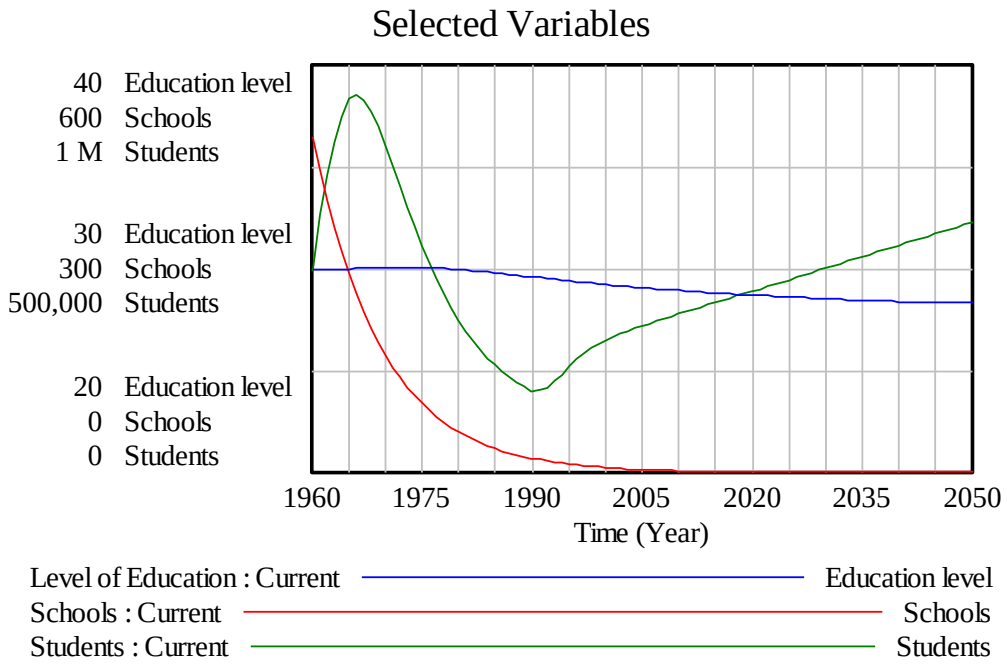


4.2.3 Education sector, 0 percent

In Zambia the school age for primary and secondary school is in the 7-18 year range, it takes 12 years to graduate. It is assumed that the school age population constitutes 30 percent of the population, but only half of them attend school initially. The initial population in 1960 is estimated to be 3.3 million and this gives initial number of students to be 495000. This number of students requires 495 schools to get the required 1000 students per school.

Because there are no financial resources provided to build more schools, the number of available schools reduces exponentially because the deteriorating rate is greater than the building rate. The number of students starting school shows an oscillation behavior, they are increasing in the beginning even though the number of schools is decreasing. This is because there is a delay in realizing that there are no enough schools to accommodate all. The number of students starts to fall until middle 90s in responding to lack of schools. But due to the increasing population, the number of students starts to increase again, even though the number of schools is diminishing. This leads to more students per school than what is required. A classroom will therefore accommodate more than 40 pupils per teacher, thereby reducing pupil-teacher contact. This will lead to a low completion rate discussed earlier of 2.1. Fewer students will be graduating and therefore many dropouts. This will affect the tax revenue negatively because the majority of the population will be uneducated. The annual average salary for the low educated work force is lower than the estimated average annual salary and

this reduces the tax revenues which again lead to low economic growth. This will also lead to a reduction in the general education level of the country.



4.2.4 Summary of the baseline run

Input, decision variables	Output
Economic sector, 0%	Because there is no financial resources to increase the employment rate, the number of workers is low, an avereage of 13.74 percent. This is low compared to the desired rate of 25 percent. Unemployment reduces domestic earning and therefore slowing down the economic growth.
Health sector, 0%	No funds allocated means that no clinics are build and therefore those which exists deteriorates eventually leading to no clinics that provide treatment to the general population. This leads to the increase in the number of sick people which effects the work force and the national income negatively.
Education sector 0%	No money means no building of schools and thus fewers students that graduate. This leads to an increase in the number of uneducated work force with low average salary. This results in low tax revenues and thus low economic development.

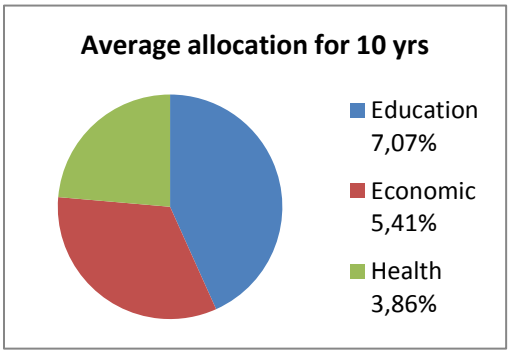
The intention of baseline runs was to test how the models will react to not receiving any financial resources. The conclusion is, without financial resources allocate to any of the sectors, they will be no economic development in the country and this will lead to more poverty.

The conclusion from the runs is still consistent with system theory of interconnectedness and therefore the model can be used for several scenarios. The different types of scenarios that are discussed in the following sections are chosen for assessing today's policies and the policy alternatives of whether the Norwegian agencies should allocated equal or unequal shares among the economic, education and health sector. This is meant to be a demonstration to how policy makers can promote learning through evaluating the consequences of their policies and therefore make changes which can improve the effectiveness of development aid towards reducing poverty. The next run evaluates today's policies used by the Norwegian agencies.

4.3 Second scenario, today's policies

The intention of this run is to evaluate today's policies using the data from 1991-2011 provided by Norad's statistics unit. The evaluation will be done using a simulation model. The baseline run indicated a working population gap of 11.26 percent therefore financial resources are need to increase the number of people entering the work force in order to reduce the gap.

The total development aid allocated for the three sectors from 1991-2011 is NOK 4 475 237 million and from this amount 58 percent was distributed to the economic sector, 24 percent to the education sector and l8 percent to the health sector. Today the Norwegian agencies are practicing uneven distribution of development aid among the three sectors. The average development aid and average percent rate for the last 10 year (2001-2011) will be used in the simulation model. The average development aid for all the three sectors is NOK 247 497 000.



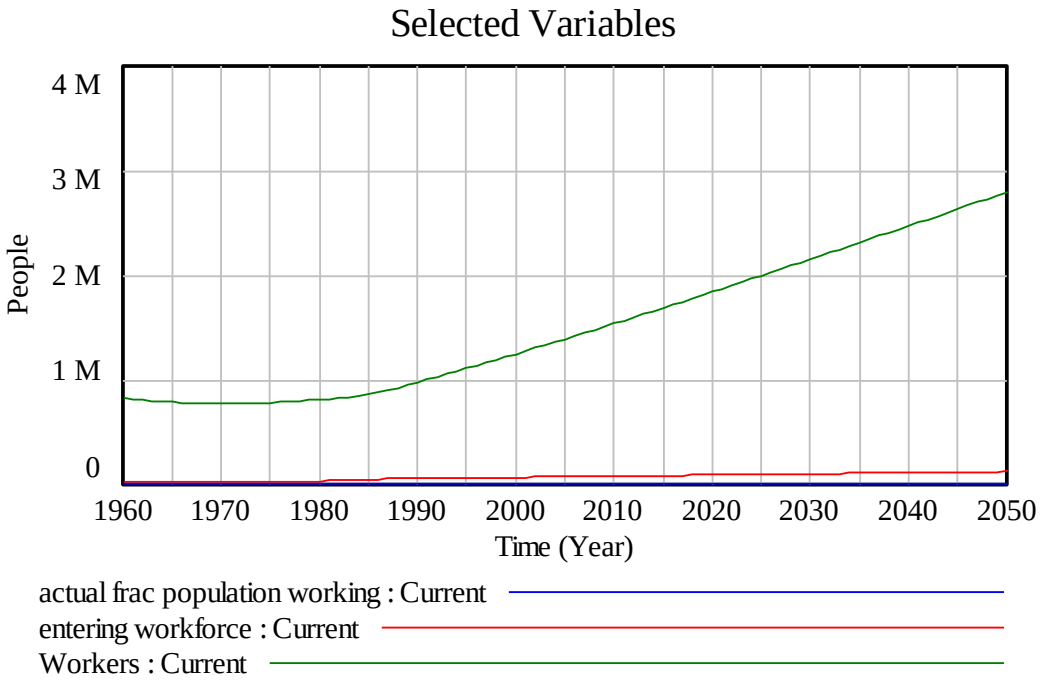
Using the average percentage allocation per sector between a 10 years period 2001-2011, the education sector received the largest share followed by the economic sector. The percentages does not necessarily sum to 100 percent if the decision is made to not use all the resources for each year, essentially saving them for the future.

The run for the economic sector is developed first followed by the health sector and lastly the education sector.

4.3.1 Economic sector, 5.41 percent

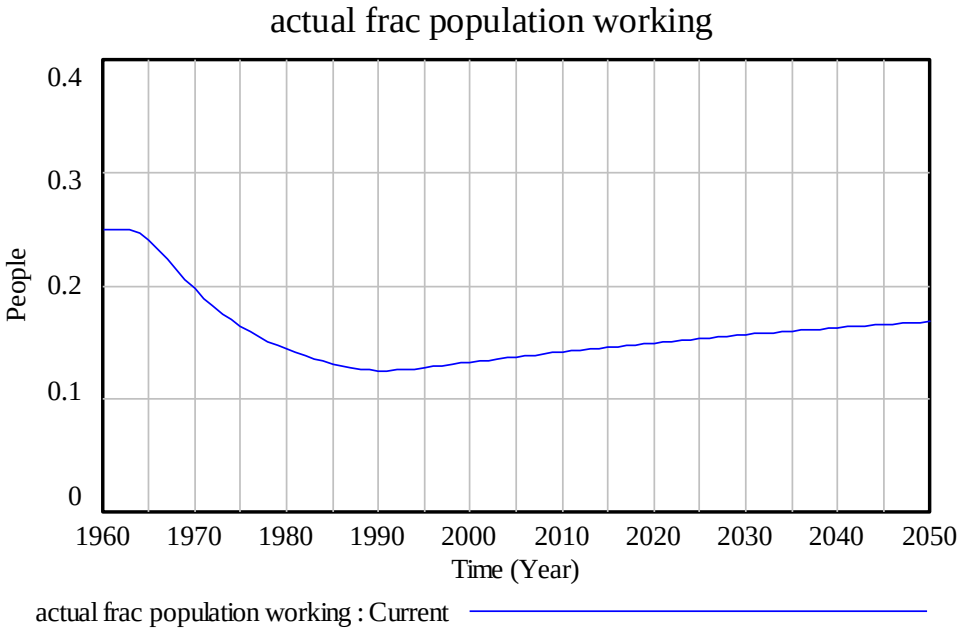
Norway provides support to the economic sector in terms general budget support directly to the government of Zambia and through different Non-Government Organizations (NGOs). The main focus for the Norwegian agencies is supporting good financial management in Zambia, such as building capacity in the Zambia Revenue Authority to enable them collect tax revenues. In order to collect tax revenues this model focuses on increasing the employment rate which leads to more workers and thus more tax revenue which in return promotes economic growth. In this run, there is a working population gap of 11.26 percent carried over from the baseline run and this gap requires financial resources.

This run shows the effect of allocating 5.41 percent of the financial resources to the economic sector. The graph shows an exponential increase in the number of workers. The initial number of workers in 1960 was 825 000. This number of workers started to decrease from 1961 until 1981. This indicated a need for financial resources to increase employment. The funds contributed to the increase in the number of workers from 1982 throughout the simulation period. By 2050 they will be 2 794 075 compared to 2 026 977 in the baseline run.

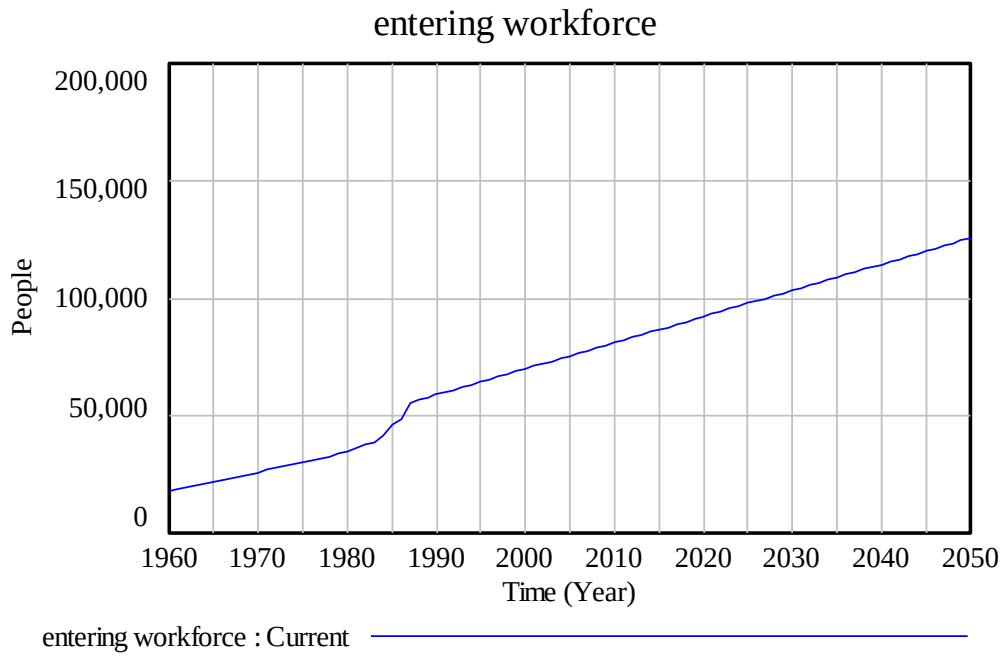


The actual fraction of the working population and the number of workers entering the work force are shown separately to get a better view of the effect of this policy.

As shown in the graph below, the fraction of the working population has increased due to allocation of financial resources. The fraction was 25 percent from 1961 until 1963, but then it started falling from 1964 until 1994. Because of the availability of financial resources, the fraction started to slightly rising again. By 2015 the fraction of actual workers will be 14.6 percent and by 2050 they will be 16.8 percent. The average fraction of actual workers for this policy is 15.8 percent. The gap of 11.26 will be reduced to 9.2 percent. More financial resources are needed in order to achieve the target fraction of 25 percent.



Allocation of financial resources resulted in the increase of the number of people entering the work force as shown in the graph below. The initial number of entering the work force in the 1960 was 17 983 and this increased at a low rate until 1983. Because of financial resources allocated, there was a higher increase in the number of people entering the work force and the numbers continued to increase throughout the simulation period. By 2050, they will be 125 632 people entering the work force compared to 90 284 in the baseline run.

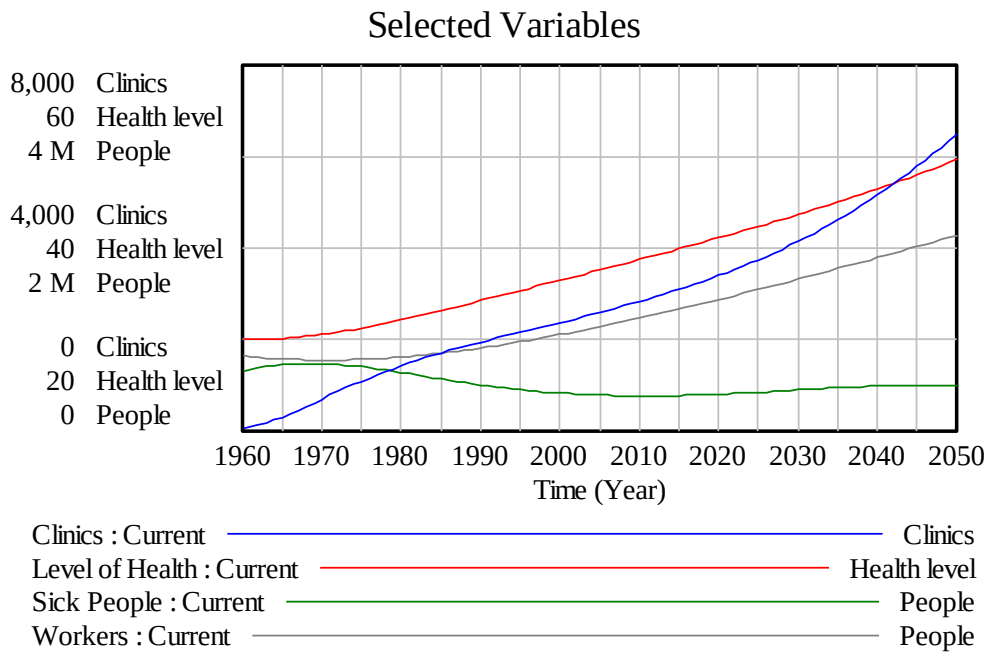


The allocation of 5.41 percent of the financial resources has led to a slight increase in the number of workers entering the work force compared to the baseline, but this sector needs more financial resources in order to achieve the required number of workers of 25 percent. The average percentage of workers has increased from 12.2 to approximately 15.8 percent. This reduced the gap from 11.26 to 9.2 percent, a 2.06 increase. More financial resources are required to cover this gap. This means that allocating 5.41 is not effective as it does not produced the required results.

4.3.2 Health sector, 3.86 percent

Millions of people in Zambia battle daily with diseases associated with poverty. The Norwegian agencies assist by allocating aid to the health sector through budget support directly to the Zambian government and via international organizations for improving health facilities, other social infrastructures and services, and water and sanitation. To simplify the model these goals are represented by building clinics which are responsible for improving the general health level of the population.

The run shows that the financial resources contribute to the building of many clinics. As a result, the number of sick people reduces which result in increasing the number of workers which again contributes positively to economic growth.



The problem with this policy is that there is more aid provided than what is needed for this sector, there are too many clinics. There were enough clinics from 1960 as each clinic served the desired number of patient of 10 000. But then the number of clinics continued to increase leading to fewer patient per clinic than what is desired. For example, in 1970 there were 1 053 patients per clinic, 272 in 1990 and 175 patients in the year 2000. The number of patients per clinic continued to decrease as the number of clinics increased. It is clear that this policy is not effective. The allocation to this sector has to be reduced to avoid unnecessary building of more clinics.

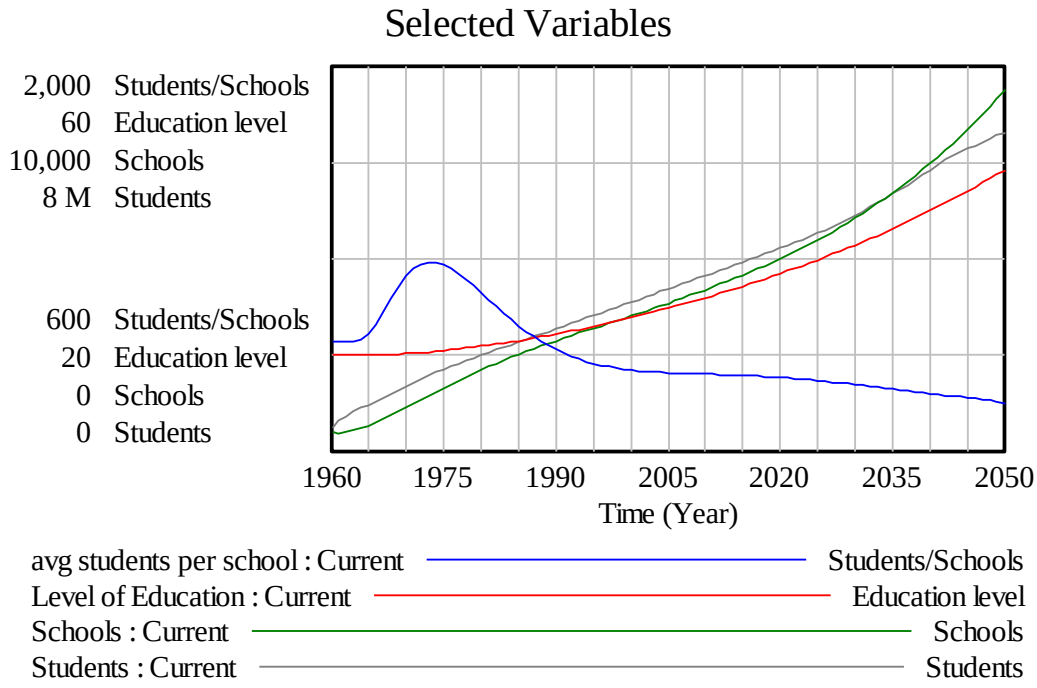
In Zambia the number sick people per clinic depend on where the clinic is allocated. The clinics in the urban area are intended to serve 30 000-50 000 sick people while clinics in the rural areas are intended to cater for 10 000 people within 29-km radius. This thesis focuses on the rural clinics as poverty is more spread in the rural areas. So much money in the system can cause unintended effects like corruption a well-known problem in many African countries. In reality, there are few clinics in Zambia. In the 2000s the Zambian government had a total of 1124 health facilities, represented by clinics in the model (Picazo & Zhao 2009). The target goal was to establish 1 385 health facilities, but this target where never achieved because the government allocated less financial resources to the health sector.

Further, the run show that if the Norwegian agencies continue to allocate aid funds using today's policies, in theory the number of clinics will be more than the number of patients in

the year 2037. This will never happen in reality as this is just a model, but it demonstrates that the way development aid is managed today is not effective and therefore can produce unintended results.

4.3.3 Education sector, 7.07 percent

Millions of children do not have access to basic education in Zambia and million adults are illiterate because they have never got any education. According to Norad, they are all being deprived their basic human right: The right to education (Norad 2011). In order to ensure that many children receive education, Norway offer development aid in terms of budget support directly to the government of Zambia for the education sector. This support is represented in the model in terms of building more school.



The run shows that because of the financial resources allocated to this sector, many schools are built. As a result of this, the number of students attending school increases exponentially and so is the general education level of the population. The initial value for the education level was 30 and by 2050, the level of education will increase to 49. An educated population contributes positively to the work force. And this will increase the domestic earnings and thus contribute to economic growth.

The problem with this policy is that it is not effective. According to the simulation run, there are more financial resources allocated than what is need. This is indicated by the number of students per school. From 1960-1963 there were enough schools each accommodating 1000

students per year. The number of students started to increase in 1964 and by 1973 the schools had the highest number of student of 1 288. This indicated the need for building more schools. As the schools were built, the number of students per school started to decrease reaching the desired number of students of 1000 in 1988. But, schools continued to be built because the resources were available. This leads to the further reduction in the average number of students per school. As the run shows, from 1990- 2050 the average number of students per school will be between 984-777 students. The average number students per school with this policy are 949. In order to achieve the target number of students per school, the resources for this sector should be slightly reduced.

According to UNDP 2011, the recommended students per classroom per teacher are a maximum of 40 pupils leading to 1000 student per school. This recommendation is however not considered by many schools as there are normally more students than the recommended number. The number of students needed per school normally exceeds 1000. This means that the Zambian government builds fewer schools than what is portrayed in the run. To give an example, there were 55 government schools in 1996 (Zambia Central Statistcal Office 2006). This means that the excess money for building more school end put in the hands of corruption leaders and government officials.

4.3.4 Summary of the second run, Today's policies

Input, decision variables	Output
Economic sector, 5.41%	The allocation contributed to a slight increase in the number of works, the average of 15.8 percent. There is a gap of 9.2 percent which requires more financial resources in order to achieve the target rare of 25 percent.
Health sector, 3.86%	The policy is not effective. Too much aid funds allocated which leads to building of many clinics than needed. This leads to fewer patients per clinic than the desired 10 000.
Education sector 7.07	The allocation is more than what is needed because the average number of students per school is 949 which below the required number of 1000 students.

This run shows that the way development is managed today is not effective as the aid funds is not producing the intended results. This does not seem to bather the norwegian aid agencies

since the the policies are not evaluated. The policy makers have little insight to what polices that works and what doesn't. The agencies does not seem to be interested in achieving the best effect for the money and this may be because the policies are based on political or industrial reasons. Zambia is know for its mining industry like cooper and other industrial minerals. If the policies are not based on economic reasons, they fail because the poverty reduction problem is complex and the behavior of the system cannot be easily predicted by using traditional analytical tools. With simulation it is easier to understand the behavior through experiments. Because the norwegian aid agencies has not adopted a dynamic BSc, they have no opportunity to experiment with their policies and to evaluate the consequences of each policies before they are implemented. It is clear that today's policies has to be changed in order to promote economic growth and thus reducing the poverty level in Zambia. The economic sector should be allocated more resources than its receiving today. Both the education and the health sector should be allocated less than what is allocated today. This will be discussed in details in section 4.5. The following section will evaluate the policies of allocating equal share to all the three sectors. Try-and-error method will be used in order to find more effective distribution. However, it not expected that equal share will be an effective policy for all the sectors. The intention is to study how the system reacts.

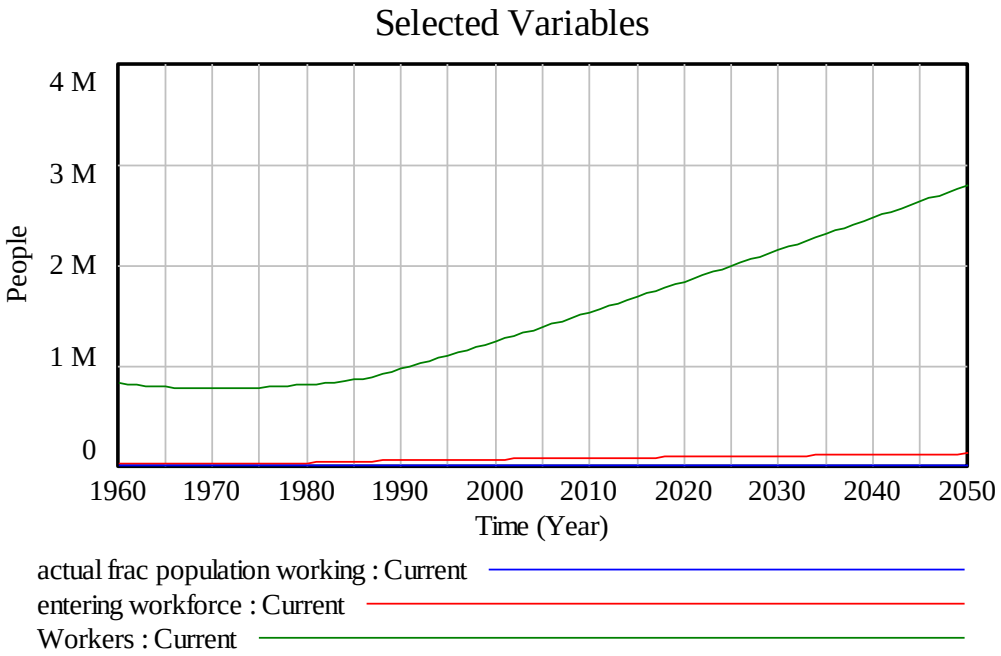
4.4 Third scenario, equal share for all sectors

The third run is about testing the first policy of the Norwegian development cooperation system of allocating equal share of development aid to all the sectors. As discussed in the second scenario, the economic sector needed more than 5.41 percent while the education and health sector need less. The intention of this run is to study how the three sectors react to receiving the same amount of financial resources. The percentage of aid allocated per sector will be attained by using try- and -error method. The initial value of the financial resources and all the other assumptions made in the second scenario remain the same. The only changes are the share allocated per sector. The results from this run will be compared to the results from the second scenario.

4.4.1 Economic sector, 5.5 percent

As discussed earlier in the second run, 5.41 was not enough to increase the employment rate up the desired rate of 25 percent. Increasing the allocation to 5.5 percent was chosen because it was effective for the education sector as discussed later. However, it makes no visible difference for the economic sector as the graph below shows. But, there is a marginal increase of few workers as discussed below.

This run shows the effect of allocating 5.5 percent of the financial resources to the economic sector. The graph shows an exponential increase in the number of workers. The initial number of workers in 1960 was 825 000. The number of workers started to decrease from 1961 until 1979. This indicated the need for funds. Additional 0.09 percent was allocated and then the number of workers started to increase again from 1980 throughout the simulation period. By 2050 they will be 2 804 812 compared to 2 794 075 in the second scenario where 5.41 percent was allocated. This means that they was an increase of 10 737 workers at the end of the simulation period, an average of 32 workers per year.

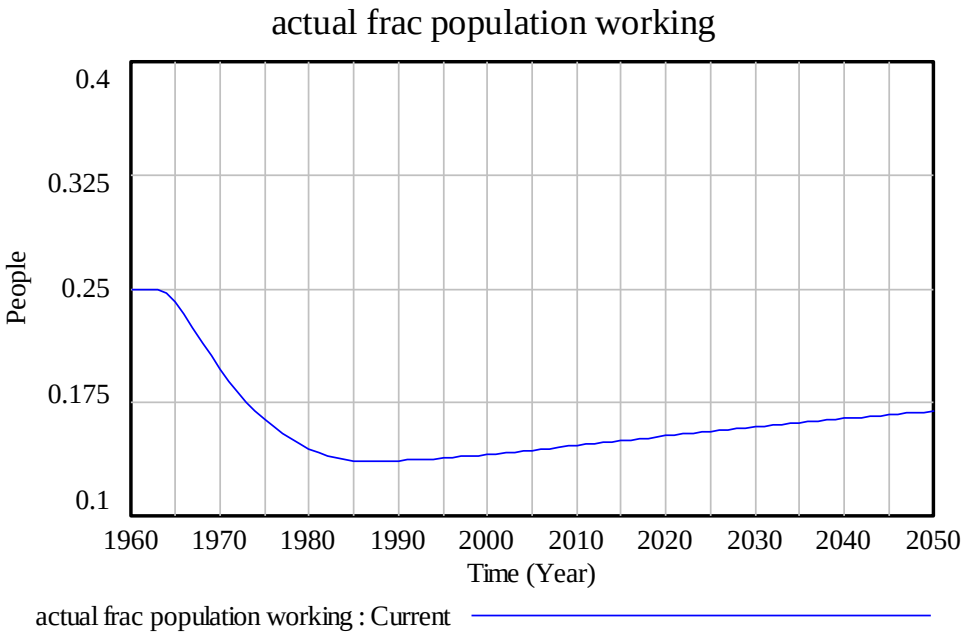


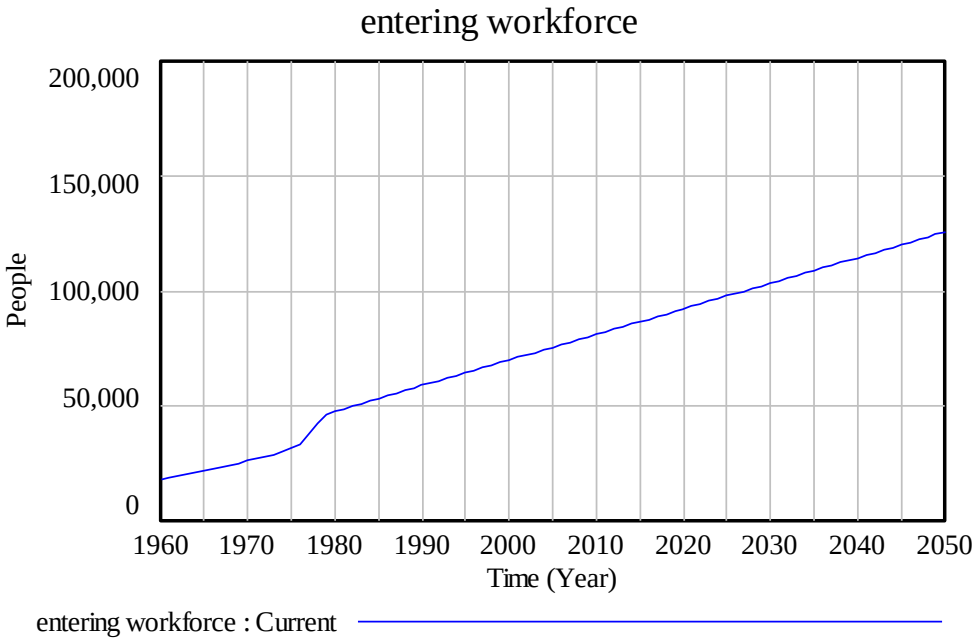
The actual fraction of the working population and the number of workers entering the work force are shown separately to get a better view of the effect of increasing the allocation from 5.41 percent to 5.5 percent.

As shown in the graph below, it looks exactly like the run from the second scenario. This is because the effect of increasing the allocation from 5.41 to 5.5 percent is marginal. But, there is a slight increase in the actual fraction of the working population.

The fraction is 25 percent from 1961 until 1963 and from 1964 it starts to fall until 1991. Additional resources were allocated and then the fraction started rising slightly again. By 2015 they will be 15.6 percent against 14.6 percent workers in the second scenario. By 2050 they will be 16.9 percent compared to 16.8 percent from the previous scenario. The average fraction of actual workers has increased from 15.8 percent to 16.2 percent, an increase of 0.4

percent. The gap is reduced from 9.2 percent to 8.8 percent. This sector still needs more money to close the gap.

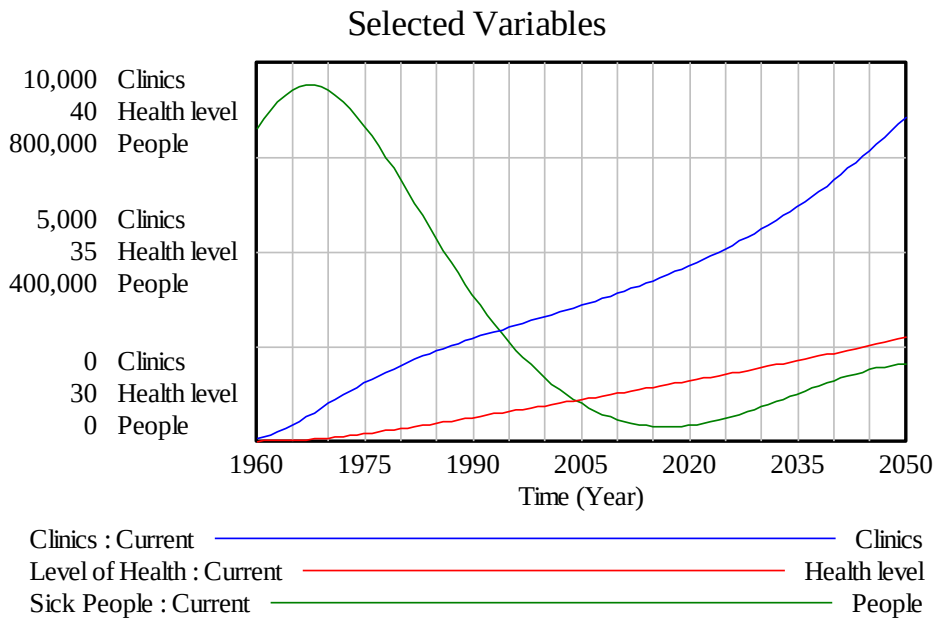




The effect on the people entering the work force is shown in the graph above. Allocation of financial resources resulted in the increase of the number of people entering the work. The initial number of entering the work force in the 1960 was 17 983 and this increased at a low rate until 1976. Because of the available of financial resources, there was a higher increase from 1977 and the number of people continued to increase. By 2050, they will be 125 632 workers. The average number of people entering the work force per year were 73 585 people compared to 72 408 people from the previous scenario. This means an increase of 1 177 people.

4.4.2 Health sector, 5.5 percent

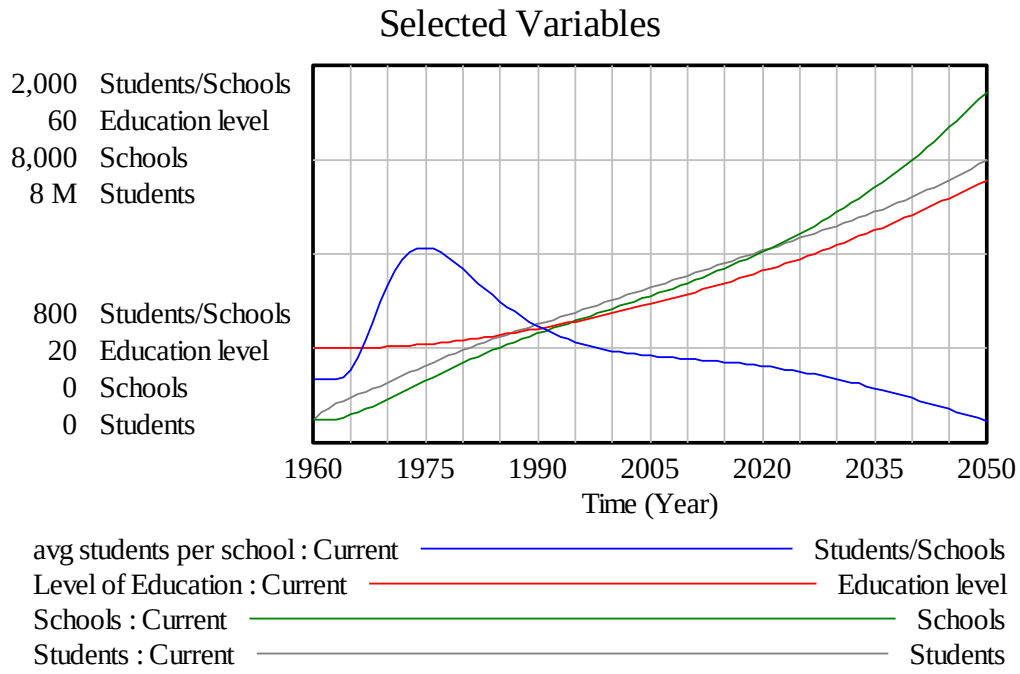
The run shows that as the number of clinics increases, the number of sick people reduces and the level of health increases. However, the allocation of 5.5 percent of the financial resources leads to building of many clinics than needed. This is not surprising as it is already known the 3.86 percent from the second scenario was too much. More funds led to the increase in the number of clinics and the result was that the number patients per clinic decreases. This leads to fewer patients than the desired number of 10 000 sick people per clinic. On average there were 451 patients per clinic with this policy. The policy of allocating equal share is not effective for this sector. The allocation should be reduced.



4.4.3 Education sector, 5.5 percent

Allocating 5.5 percent of the financial resources to the education sector is an effective policy because it produces the desired results concerning the number of schools and the average number of students required per school of 1000 as discussed in the third scenario.

The run shows that the number of schools increases as the number of students increases. As a result of this, the level of education also increases. The run shows an exponential growth behavior for the number of schools, number of students and the education level. The number of students per school however, shows growth with overshoot behavior which is caused by a delay in building new schools.



In the 1960, there were enough schools serving 1000 student per school. From 1961 to 1976 the number of students increased and there were therefore fewer schools compared to the students, the average number of students per school were between 1201 and 1658 which is more than what is desired. This indicated the need for more schools. More schools were built and from 1977 to 2013 the number of student per school reduced to a desired number. The run shows that the number of students per school was between 1185 and 1002. The optimal number of students per school is attained in the year 2013 of 1002 students before the number start decreasing. The further decrease in the number of students is because more schools continued to be build, the number of students between the year 2014 and 2032 will be 901-999. This number is still acceptable as it is not so far from the desired number. However, from

2033-2049 the number of students per school will reduce even further. They will be 800-895 students per school. The policy can be revised then to reduce the amount of funds allocated to this sector in order to reduce the building of more school. All in all, allocation 5.5 percent of the financial resources is appropriate for this sector because it produces the desired outcome compared to 7.07 percent of today's policy. The average number of students per school with this policy is 1056 throughout the simulation period.

4.4.4 Summary of the third run, equal distribution to all the sectors

Input, decision variables	Outcome
Economic sector, 5.5 %	A slight increase in the number of workers reducing the gap from 9.2 percent to 8.8 percent. More financial resources is need to close the gap.
Health sector, 5.5 %	Ineffective policy for this sector. Too much financial resources in the system which leads to building of more clinics. This leads to a reduction in the number patients per clinic. There are 451 patients per clinic on average compared to the desired 10 000.
Education sector, 5.5 %	Effective policy for this sector because it produces the desired results. The average number of students per school is 1056 which is closs to the desired number of 1000 per school.

The policy of allocation equal share to all sectors does not work because different sectors have different needs. This policy only works for the education sector as it produces the required results.

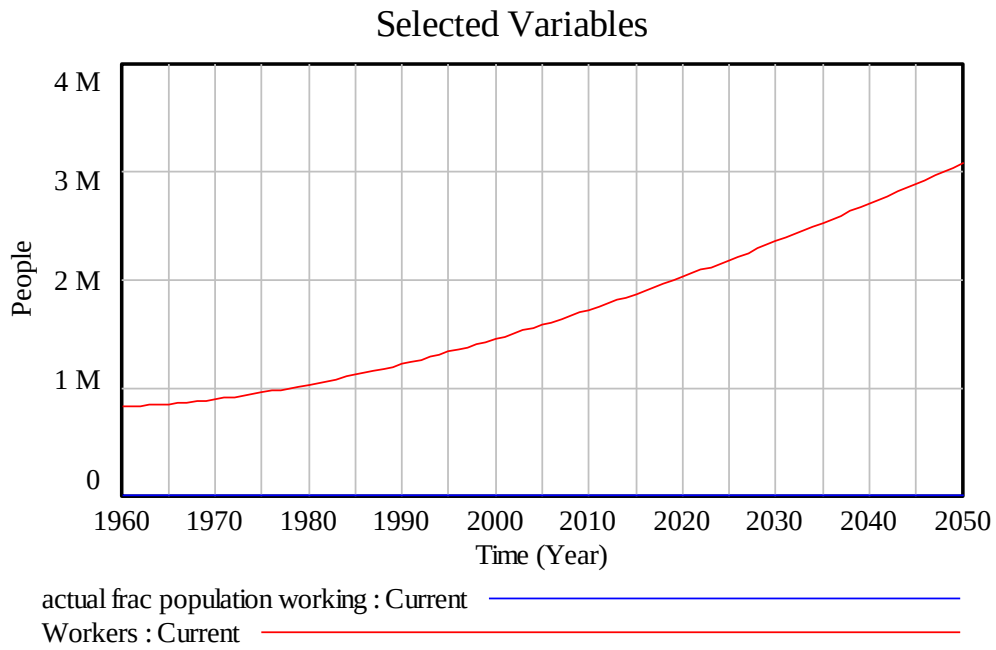
4.5 Fourth scenario, uneven distribution

This run is intended to test the unequal allocation of aid among sectors. From the previous run we have seen that allocating 5.5 percent of the financial resources to the education sector produce the desired results therefore the same percentage will be used in this run. We saw also that allocating 5.5 percent of the financial resources to the health sector were more than needed, so the allocation for this sector has to be reduced. Further, the run from the third scenario shows that the economic sector needs more that 5.5 percent. The percentages for the economic and health sector will be attained using a try-and-error method.

4.5.1 Economic sector, 15 percent

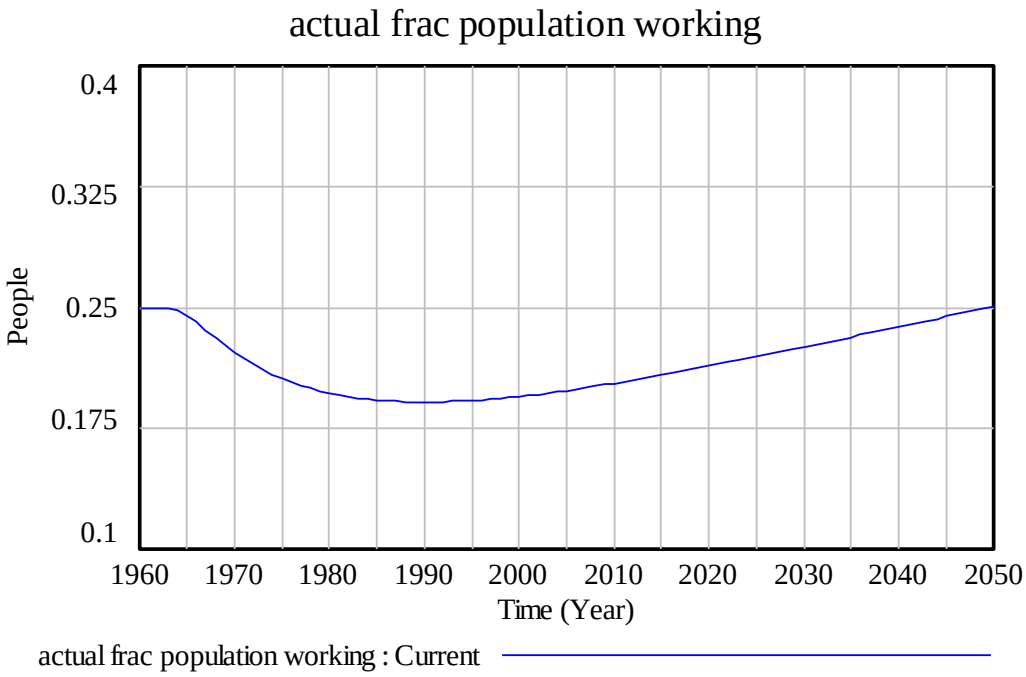
Increasing the share to the economic sector from 5.5 percent to 15 percent produces the desired results. The runs shows that the number of workers creases exponentially from the

initial value of 825 000 to 3 079 296 workers by the end of the simulation period.



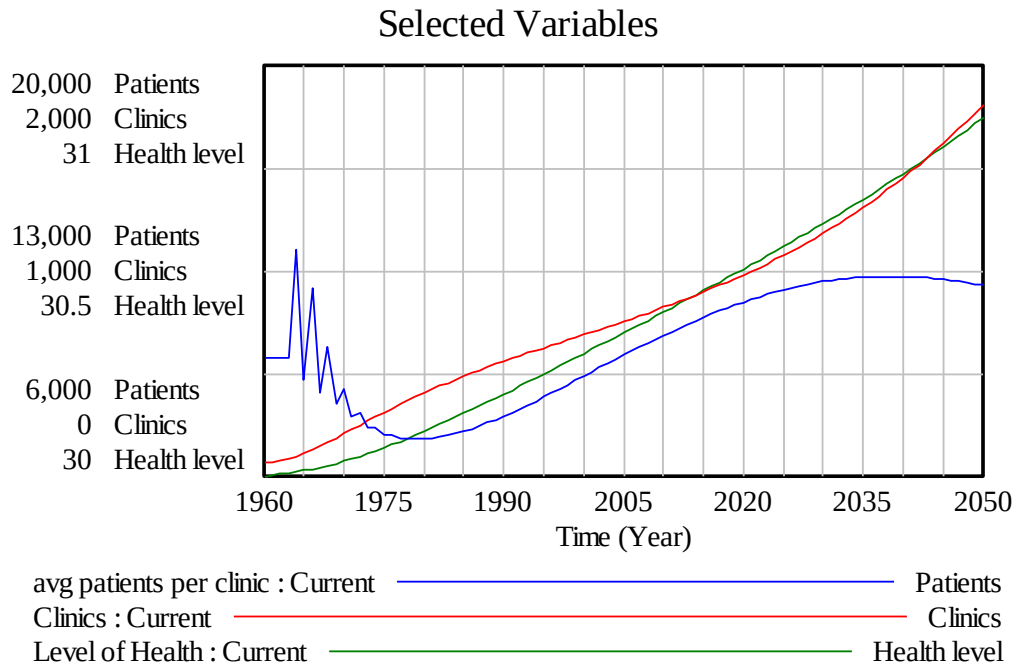
Comparing the effect of this policy to the previous of allocating 5.5 percent, the number of workers has increased from 2 804 812 to 3 079 296, an increase of 274 484 workers. This increase represent 8.9 percent and it closes the working gap of 8.8 from the previous run were 5.5 percent was allocated.

Concerning the actual fraction of the working population shown by the run below, the allocation has resulted in increasing the fraction to the desired level by 2050. The fraction is 25 percent from 1961 until 1963 and from 1964 it starts to fall until 1995. This indicated a need for more resources in order to increase employment. It takes time to recognize the impact of the financial resources. From 1996 the fraction starts slightly rising again until the end of the simulation period. By 2015 they will be 25.1 percent which is the desired fraction of actual workers. This is a goal seeking behavior derived from a negative feedback loop. The financial resources act to bring the system in line with the desired goal of 25 percent. The gap of 8.8 percent from the third run will therefore be closed at by 2050 and they will be no need for more financial resources for this sector.

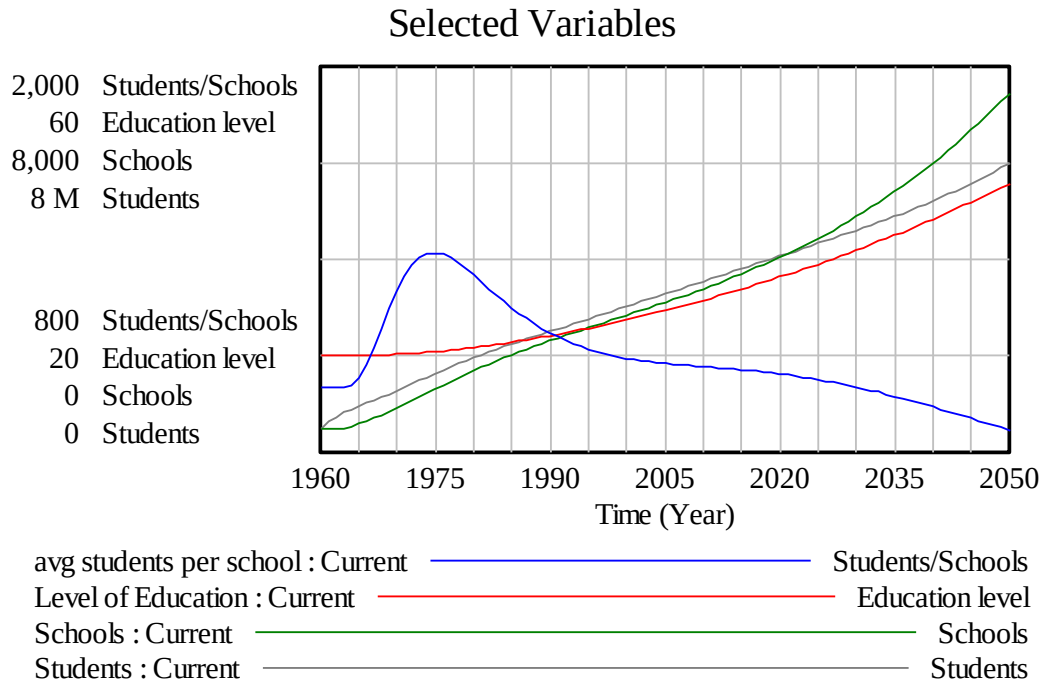


4.5.2 Health sector, 1 percent

The run shows that the number of sick people reduces as the number of clinics increase. The health level of the general population also increases as many people are getting treated. The most effective policy for this sector is to allocate 1 percent of the financial resources. The average number of patients per clinic shows an oscillation pattern in the beginning of the simulation period because there is a delay in building new clinics. In 1960 there were enough clinic to serve 10 000 patients per clinic. Because the population increases, the number of patients also increased. From 1961- 1965 the average number of patients per clinic were between 11 100- 11 430. This indicated a need for more clinic and more were built. Because of more clinics, the number of patients per clinic reduced from the year 1966-2002, the runs shows that they were between 7 263-9 985 patients in that period. This put a stop on the building of more clinics and the number of patients increased again from 2003-2050, ranging between 10 127-12 804 patients per clinic, indicating a need for more clinics. Over-all, the average number of patients throughout the simulation period is 10 449. This is not so far from the desired number of patients per clinic of 10 000. All in all, this policy produces the desired results. It can be revised in the year 2050, to increase the allocation in order to build more clinic as it is assumed that the number of patients will be increasing as the population increases.



4.5.3 Education sector, 5.5 percent



As discussed in the third scenario, allocating 5.5 percent of the financial resources to the education sector is an effective policy because it produces the desired results concerning the number of schools and the number of students required per school.

The run shows that the number of schools increases as the number of students increases. As a result of this, the level of education also increases. The run shows an exponential growth behavior for the number of schools, number of students and the education level. The number of students per school however, shows growth with overshoot behavior which is caused by a delay in building new schools. In the 1960, there were enough schools serving 1000 student per school. From 1961 to 1976 the number of students increased and there were therefore fewer schools compared to the students, the average number of students per school were between 1201 and 1658 which is more than what is desired. This indicated the need for more schools. More schools were built and from 1977 to 2013 the number of student per school reduced to a desired number. The run shows that the number of students per school was between 1185 and 1002. The optimal number of students per school is attained in the year 2013 of 1002 students before the number start decreasing. The further decrease in the number of students is because more schools continued to be build, the number of students between 2014 and 2032 will be 901-999. This number is still acceptable as it is not so far from the desired number. However, from 2033-2049 the number of students per school will reduce even further. They will be 800-895 students per school. The policy can be revised then to reduce the amount of funds allocated to this sector in order to reduce the building of more school. All in all, allocation 5.5 percent of the financial resources is appropriate for this sector because it produces the desired outcome compared to 7.07 percent of today's policy. The average number of students per school with this policy is 1056 throughout the simulation period.

4.5.4 Summary of the fourth run, unequal distribution

Input, decision variables	Outcome
Economic sector, 15%	This policy is effective because it produces the desired results. The fraction of actual working will be 25.1 percent by 2050 and therefore no working gap.
Health sector, 1 %	This is the most effective policy for this sector. There is an average of 10 447 patients per clinic for the whole simulation period. Not far from the desired target of 10 000 patients pr clinic.
Education sector, 5.5 %	Effective policy for this sector, the average number of students is 1056 which is not so far from the desired outcome of 1000 students per school.

The more effective policy is to allocate unequal shares among the three sectors. The share for economic sector was the largest because there was a big gap between the actual working population and the desired working population. In addition, there are higher expenses involved in creating jobs than building of schools and clinics. The education sector should receive more than the health sector.

This feedback should be incorporated in the Zambian national plan for development. This will lead to changes in the Norwegians policies of aid allocation.

The results from all the runs are based on both real figures from Norad and estimates since not all the information need was available. Because of that the results does not represent the real world, but it demonstrates how decision makers can use a dynamic BSc to evaluate the consequences of different policies before they are implemented. And further, how policies can be changed.

5. Results and conclusion

5.1 Main findings from the scenarios

The purpose of the simulation was to evaluate the dynamic behavior of the development aid per sector and the consequences of the policies on poverty reduction from 1960 to 2050. Policies have been evaluated in section 4 and the main results are as follows;

1) The Norwegian agencies have to provide development aid to all the three sectors as they all contribute to economic development. The baseline run concluded that without financial resources allocated, they will be no economic development in the country and this will lead to more poverty.
2) The way development is managed today is not effective as the aid funds is not producing the intended results. These policies need to be changed. The education sector is receiving the largest share followed by the economic sector and lastly the health sector. The aid allocation to both the education and health sector is more than needed which leads to unnecessary building of more schools and clinics. The economic sector is not allocated enough funds to increase the employment rate to the desired level of 25 percent.
3) The policy of allocation equal share to all sectors is not effective because different sectors have different needs.

4) The more effective policy is to allocate unequal shares among the three sectors. The share for economic sector should be the largest share because there is a need work for workers as there was a gap between the actual working population and the desired working population. In addition, there are higher expenses involved in creating jobs than building of schools and clinics. The education sector should receive more than the health sector because it is assumed that an educated work force earns a higher average salary which leads to more tax revenue for the country. This contributes to economic growth.

The analysis was based on the average allocation of development aid for the last 10 years. It is between 3-7 percent per sector of the total aid as discussed above. It is assumed that other donor countries have the same allocation range for the three sectors. If I was to advice the Zambian government, all aid provided to Zambia should have been evaluated and not only the percentage from Norway. Further, it is not possible to analyze Zambia without development aid since the country has been receiving development aid since the 60s and the development plan of the country depend on aid.

5.2 Conclusion

The goal of this thesis was to create and demonstrate the benefits of applying a dynamic balanced scorecard to development aid. For research purpose, Norad was used as a case study and Zambia as an example where a dynamic balanced scorecard was applied. The interdependences between sectors where identified together with key variables for each sector. Further, key performance indicators (KPIs) for the chosen variables were also identified and these were used as basis for the contraction of the causal loop diagram. This enabled the creation of aggregated DBSc models which portrayed both stocks and flows, and auxiliary variables. Finally, aggregated DBSc models were simulated in Vensim to evaluate the policies and their consequences. The decision variables were constructed in such way that the policy makers can change the values of the variables to observe the consequences of each policy. The time horizon for the model was 90 years, from 1960 to 2050, as this was a sufficient amount time to capture the dynamic of the problem and to infer the consequences of the policies in the future. The model was simplified only to deal with the aid management problem that the Norwegian development cooperation is facing today.

The model was tested by replicating the population reference mode in section 1 and by running a baseline scenario. The model was consistent with system theory and therefore it was

used to assess several scenarios of either allocating equal or unequal financial resources to the three sectors. The intention was to study the consequences of each policy on the sectors.

The results from the scenarios were the basis of evaluating how policies affect poverty reduction. The effective way to reduce poverty is to implement policies that contribute to sustainable economic growth. This can be achieved by allocating development aid to all the sectors (economic, education and health sector) as they all contribute to economic growth through improving the work force. Unequal distribution of development aid is recommended as it seems to be more effective. This is because allocation equal share to all sectors is not effective as different sectors have different needs. According to the runs, it is recommended that the economic sector receives the largest share because of the high unemployment rate in Zambia and the expenses involved in creating employment is greater than for building schools and clinics. The education sector should receive more than the health sector because it is assumed that an educated work force earn a higher average salary which leads to more tax revenues for the country. This contributes positively to the economic growth.

Aid effectiveness could benefit from better prioritization at the country level, concentrate efforts on sectors with greatest potential for development as mentioned above. The Norwegian agencies should support this prioritization by providing predictable budget aid. The Zambian government should prioritize their development plan according to the benefits from each sector and this will change the allocation policies in Norway as those policies are influenced by the Zambian development plan. The policies recommended are not final as there is no solution to the poverty problem. The policies have to be re-evaluated over and over again as there are other actors in the system with their only interests that can offset the intension of these policies.

With today's policies for the last decade (2001-2011), the education sector received the largest share followed by the economic sector. The analysis of these policies suggests that the poverty persistence is strongly linked to the way development aid is managed today. There is more development aid in the system than needed and due to the lack of an effective management tool, unintended effects like corruption and dependency are unavoidable. A dynamic BSc will be a useful tool in assisting decision makers in evaluating the consequences of their policies before implementing them by using experimental computer models. This will promote learning about the dynamics of development aid and contribute to implementing of

more effective policies. Continuing with today's policies sustainable development will never be achieved and Norway will provide development aid to Zambia forever.

Effective aid plays an important role in reducing poverty and inequality, increasing growth, building capacity, achieving human development and accelerating achievements of Millennium Development Goals (OECD 2012).

There is a correlation between aid and economic growth if aid is managed effectively (Andrews 2009). There is evidence that aid effectiveness improves sector planning, budgeting and government capacities, strengthens national systems, and contributes to results through more efficient and sustainable implementation of national policies, plan and strategies (OECD 2012). The challenge is finding a balance between programs that score well on delivering short-term measurable results at expense of aid effectiveness and longer-term programs with sustainable development, but more challenging to measure. It is important to consider the holistic picture of reducing poverty and not focusing on single elements.

Specifically for the health sector, effective aid can deliver improved health results. Available evidence suggests that aid delivered through sector-wide approaches can increase overall resources for health and this is correlated with improved health service delivery, better coverage and health population as an outcome.

6. Limitations of the study

This section discusses the limitations encountered during my research. Norad was used as a case study and Zambia as an example. Norad was the main source of data collection for development aid allocated to Zambia and for providing information about today's policies. The data for Zambia's development was attained from different sources. However, not all the necessary data for the study was provided from Norad. The intention was to conduct interviews with key decision makers per sector, but Norad didn't have the capacity to allocate time to that. The different sources couldn't provide all the needed data for Zambia either. Because of that, several simplifying assumptions were made and these limited the scope of the study. Some figures are estimates and do not depict reality. Because of this, all the reference modes described in section could not be replicated in section 4.

Modeling is time-consuming iteration of tests, observations, and hypotheses. Getting the expected outcomes was a challenging task of constant evaluation of the equations that represent the algebraic relationship between stocks and flows of the different variables. It was

fun when the model produced the expected behavior and very frustrating when it produced bazar behaviors. The experience was more frustrating than fun unfortunately as it was impossible to get the entire model to behave as expected. The stocks for the financial resources and the need backlog produced unrealistic behaviors and it was impossible to identify the source of the problem. Unfortunately, Vensim software has no technical support system (at least not in Norway) for helping users understand the connections between model structure and behavior. The simulation runs for these stocks were therefore not included in the analysis. This however, did not affect the results per sector. As it was only intended to show the incoming financial resources against the expenses of building more schools and clinics, and increasing employment.

Another limitation worth to mention is that models are about modeling a specific problem and not the entire system, therefore some elements of development aid were ignored. The problem modeled in the thesis is the management of development aid within the Norwegian development cooperation system. The aggregated model constructed was intended to evaluate different policies on a few key variables per sector, a simplified version of the development aid sector. Modeling is just a simplification of the real world and therefore all models are wrong, but can be useful in assessing specific problems.

The model did not incorporate all the endogenous factors determining the rate of population growth and economic growth. There are also more factors that influence the various sectors than the model portrays, but they were no considered. Other sectors that contribute to the development of a sustainable economic growth like the environment and energy sector were also ignored.

The thesis did not consider all the development aid allocated to Zambia from other donors countries around the world. Norway contributes a small fraction of the total aid Zambia receives and therefore difficult to isolate the effect of only Norwegian aid.

Additional work is needed to reduce the simplifying assumptions and expand the scope of the study to incorporate most of the endogenous factors and other sectors that contribute to a sustainable economic growth which leads to poverty reduction. Further, to get a more realistic view of the effects of aid, the future DBSc model should incorporate all development aid allocated to Zambia from different donor countries.

7. Appendix

7.1 statistics for the model

Development Aid allocated to Zambia per sector. 1991-2011 (NOK 1000)

Sector	1991	1992	1993	1994	1995
Economic development	128660	104889	134019	178983	124285
Education	25165	12386	17459	12670	11248
Health and social services	46549	29210	20739	55712	49602
Total	**200374**	**146485**	**172217**	**247365**	**185135**

Sector	1996	1997	1998	1999	2000
Economic development	106804	128908	89697	37179	17836
Education	8575	12757	35801	44676	58578
Health and social services	58231	66903	55711	47026	32499
Total	**173610**	**208568**	**181209**	**128881**	**108912**

Sector	2001	2002	2003	2004	2005
Economic development	37209	48355	43292	58309	73116
Education	65443	91928	106217	98027	130699
Health and social services	25117	28893	37181	36956	34499
Total	**127769**	**169176**	**186690**	**193292**	**238314**

Sector	2006	2007	2008	2009	2010	2011
Economic development	150592	175007	242549	269937	224410	221519
Education	126536	126994	34438	24681	14411	17533
Health and social services	43220	38061	29112	25256	25508	17476
Total	**320348**	**340062**	**306100**	**319874**	**264329**	**256527**

7.2 Equations and documentation

(01) actual frac population working=SMOOTH3(Workers/Population, 5)
Units: People
The actual average fraction is assumed to be estimated based on a 5 year average.

(02) availability of clinics=Clinics/(Population/22000)
Units: Clinics/Population

(03) availability of schools=Schools/(Population/10000)
Units: Schools
Adequate school availability is assumed to be one school for every 10000 people in the general population

(04) avg annual salary=50000*effect of education lookup(Level of Education)
Units: NOK
Assume baseline average annual salary to be 50000.

(05) avg clinic productivity=10000
Units: Patients
Clinic productivity is measured in patients treated to health per year, assumed to be 10000 per clinic per year.

(06) avg length of employment=30
Units: Year
Assume 30 year working career. It is shorter due to the low life expectancy of the total population and the more labor intensive nature of the work, resulting in physical exhaustion.

(07) avg life of clinic=10
Units: Year
Assume average life of all types of clinics equals 10 years.

(08) avg life of school building=10
Units: Year
Assume average life of all types of school building equals 10 years.

(09) avg patients per clinic=SMOOTH3(Sick People/Clinics, 2)
Units: Patients/Clinic
Used a 2 year average to compute clinic capacity ratio.

(10) avg students per school=SMOOTH3(Students/Schools, 10)
Units: Students/Schools
Used a 10 year average to compute school capacity ratio.

(11) avg tax rate=0.15
Units: Rate
Assume average tax on income to be 15% due low average annual salary.

(12) avg time to graduate=12
Units: Year
Based on studies secondary school - 12 grades. University education is not included.

(13) baseline population=3.3e+006
Units: People

(14) becoming sick=Population*frac population becoming sick
Units: People

(15) becoming sick lookup(
[(0,0)-(100,0.1)],(0,0.0377193),(14.0673,0.0311404),(30.8869,0.0263158),(
50.1529,0.0214912),(63.3028,0.0179825),(75.2294,0.0153509),(99.6942,0.0118421))
Units: People

(16) becoming well=availability of clinics*avg clinic productivity
Units: People

(17) beginning=Population*frac population beginning school
Units: Students

(18) building clinics=((Financial Resources*frac to clinics)/cost per clinic)/time to build clinic
Units: Clinics

(19) building schools=((Financial Resources*frac to schools)/cost per school)/time to build school
Units: Schools

(20) change per 100000 Sick People=1
Units: People

(21) clinic capacity ratio=avg patients per clinic/desired patients per clinic
Units: Patients

(22) Clinics= INTEG (building clinics-retiring clinics, 66)
Units: Clinics

Assume that 20 % of the population needs medical attention. Initial population is 3300000 and the desired nr per clinic per year is 10000. This gives 66 as the initial nr of clinics.

(23) cost per clinic=1.2e+006
Units: NOK

(24) cost per new worker=effect of aid on entering working frac*cost per percent increase in workforce participation
Units: NOK

(25) cost per percent increase in workforce participation=100000
Units: NOK
Assume that it will require 100000 per one percent increase in the fraction of entering workforce.

(26) cost per school=1.2e+006
Units: NOK

(27) decreasing=(Level of Education*frac quitting)
Units: Education level [0,100]

(28) decreasing health level=(Sick People*change per 100000 Sick People)/10000
Units: Health level [0,100]

(29) desired frac population working=0.25
Units: People
Societal goal for workforce participation. A policy decision variable.

(30) desired patients per clinic=10000
Units: Patients
Assume that 20% of the population requires clinical services per year. Based on an initial population of 3300000, this indicates a need for 66 clinics to serve 660000 people.

(31) desired students per school=1000
Units: Students
Assume ideal number of students per school.

(32) Domestic earnings=Workers*avg annual salary*avg tax rate
Units: Tax revenue

(33) dropping out=Students*frac quitting
Units: Students

(34) Economic development funding source=1.4039e+008
Units: NOK
Average external aid provided for economic development programs for the last decade, assumed to be increasing fraction of population participation in the workforce.

(35) Education funding source=7.6082e+007
Units: NOK
Average external aid provided for educational programs for the last decade, assumed to be spent on building schools.

(36) effect of aid on entering working frac=effect of resources for employment lookup(resources for employment)
Units: People

(37) effect of education lookup(
[(0,0)(100,1.5)],(0,0),(24.7706,0.230263),(37.6147,0.335526),(49.8471,0.506579),(74.6177,1.18421),(86.2385,1.41447),(100,1.5))
Units: Education level

(38) effect of health on entering workforce lookup(
[(0,0)-(101,0.05)],(0.308868,0.00285088),(10.8104,0.00416667),(25.0183,0.00526316),(36.7554,0.00570175),(50.0367,0.00592105),(63.0092,0.00657895),(69.1865,0.00679825),(77.2171,0.00679825),(85.8654,0.00701754),(93.2783,0.00701754),(100.382,0.00767544))
Units: Health level

(39) effect of resources for employment lookup(
[(0,0)-(1.5e+006,0.15)],(0,0),(192661,0.0197368),(399083,0.0269737),(605505,0.0289474),(940367,0.0309211),(1.22936e+006,0.0315789),(1.49541e+006,0.032897),(1.50459e+006,0.0256579))
Units: Employment

(40) entering workforce=(Population*frac entering work force)+effect of aid on entering working frac
Units: People
Rate of increasing the work force is the sum of effect of health level and the additional impact of focused aid to increase employment.

(41) expenditures=meeting needs
Units: NOK

(42) FINAL TIME = 2050
Units: Year

The final time for the simulation.

(43) Financial Resources= INTEG (increasing finances-expenditures, 2.47497e+008)
Units: NOK

(44) frac entering work force=effect of health on entering workforce lookup(Level of Health)
Units: Rate
This fraction represents the growth of the economy, as indicated by the number of new workers.

(45) frac population becoming sick=becoming sick lookup(Level of Health)
Units: People

(46) frac population beginning school=school start lookup(availability of schools)
Units: Students

(47) frac quitting=0.2
Units: Rate
Percent of students who never complete their studies. Assume 2%.

(48) frac to clinics=0.01
Units: Rate
Fraction of total financial resources allocated to building clinics, assume even distribution initially.

(49) frac to schools=0.055
Units: Rate
Fraction of total financial resources allocated to building schools, assume even distribution initially.

(50) frac to workers=0.15
Units: Rate
Fraction of total financial resources allocated to economic development - operationalized as increasing the "frac entering work force," assume even distribution of resources initially.

(51) graduating=Students/avg time to graduate
Units: Students

(52) growth fraction=0.044
Units: Rate

(53) Health funding source=3.1025e+007

Units: NOK
Average external aid provided for health improvement programs, assumed to be spent on building clinics.

(54) improvement per 1000 treated=0.6
Units: **undefined**

(55) increasing=baseline population*growth fraction
Units: People

(56) increasing education leve=(graduating*knowledge unit per graduates)/100
Units: Education level [0,100]

(57) increasing finances=Domestic earnings+(Economic development funding source+Education funding source+Health funding source)
Units: NOK
Total Financial Resources are composed of external development aid and domestic earnings from taxes on labor.

(58) increasing health level=(becoming well*improvement per 1000 treated)/1000
Units: Health level [0,100]

(59) increasing needs=(cost per clinic*indicated new clinics needed)+(cost per school*indicated new schools needed)+(cost per new worker*indicated new workers needed)
Units: NOK

(60) indicated new clinics needed=INTEGER(clinic capacity ratio)+1
Units: Clinics

(61) indicated new schools needed=INTEGER(school capacity ratio)+1
Units: Schools

(62) indicated new workers needed=Population*working population GAP
Units: People
This represents a shortfall of desired workers in the economy.

(63) INITIAL TIME = 1960
Units: Year
The initial time for the simulation.

(64) knowledge unit per graduates=0.01
Units: Students

(65) leaving workforce=Workers/avg length of employment
Units: People

(66) Level of Education= INTEG ((increasing education level-decreasing)/1000,30)
Units: Education level [0,100]

(67) Level of Health= INTEG ((increasing health level-decreasing health level)/1000,30)
Units: Health level [0,100]

(68) meeting needs=(building clinics*cost per clinic)+(building schools*cost per school)+resources for employment
Units: NOK

(69) Need Backlog= INTEG (increasing needs-meeting needs,1e+006)
Units: NOK
The sum total of all indicated social needs measured in monetary units. This is to facilitate comparison with available financial resources, regardless of application and to enable decision makers to investigate the consequences of their priorities.

(70) Population= INTEG (increasing,3.3e+006)
Units: People
Initial population of 3300000 people

(71) resources for employment=Financial Resources*frac to workers
Units: NOK

(72) retiring clinics=Clinics/avg life of clinic
Units: Clinics

(73) retiring schools=Schools/avg life of school building
Units: Schools

(74) SAVEPER = TIME STEP
Units: Year
The frequency with which output is stored.

(75) school capacity ratio=avg students per school/desired students per school
Units: Students

(76) school start lookup
([(0,0)(5,0.5)],(0.01529,0.0109649),(0.030581,0.00657895),(0.504587,0.0504386),(0.856269,0.0767544),(1.49847,0.0833333),(2.49235,0.0986842),(3.63914,0.100877),(4.25076,0.105263),(5.03058,0.118421))
Units: Students

(77) Schools= INTEG (building schools-retiring schools, 495)
Units: Schools
Assume that 495000 students require 495 schools at 1000 students per school.

(78) Sick People= INTEG (becoming sick-becoming well, 660000)
Units: People
Assume that 20% of the population is in need of medical care as a baseline.

(79) Students= INTEG (beginning-dropping out-graduating, 495000)
Units: Students
Assume that students are in the 7-18 year range and constitute 30% of the population, but only half of them attend school (495000 students).

(80) TIME STEP = 1
Units: Year
The time step for the simulation.

(81) time to build clinic=3
Units: Year
Assume a three year construction time for clinics.

(82) time to build school=4
Units: Year
Assume a 4 year design and construction period for both primary and secondary schools.

(83) total funding allocation=frac to clinics+frac to schools+frac to workers
Units: NOK
Indicators of policy allocation. This number may not necessarily sum to 100% if the decision is made to not use all annual resources in the year that they are given, essentially saving them for the future.

(84) Workers= INTEG (entering workforce-leaving workforce, 825000)
Units: People
Assume that the 15-50 age group is the working population, and that 25% of the population meet this criterion and are working under normal conditions.

(85) working population GAP=actual frac population working-desired frac population working
Units: People
A positive gap value indicates more focus on economic development. A negative gap value indicates no additional economic support required for the time being.

8. References

Aftenposten. (2013). *Slik tappes utviklingsland for milliarder: Enorme pengesummer havner i skjulte bankkonti styrt av internasjonale selskaøper eller korrupte eliter*. Available at: http://www.aftenposten.no/nyheter/uriks/Slik-tappes-utviklingsland-for-milliarder-7105729.html (accessed: 31.01.13).

Akkermans, H. & Oorschot, K. Developing a Balanced Scorecard with System Dynamics.

Andrews, N. (2009). Foreign aid and development in Africa: What the literature says and what the reality is. *Journal of African Studies and Development*, 1: 008-015.

Askheim, O. G. & Grenness, T. (2008). *Kvalitative methoder for markedsføring og organisasjonsfag*.

CIA. (2013). *The World Fact Book*: Central Intelligence Agency. Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/za.html (accessed: 07.01.13).

Eyben, R. (2008). Power, Mutual accountability and Responsibility in the Practice of International Aid: A Relational Approach. *IDS Working Paper 305*. Brighton: Institute of Development Studies. 51 pp.

Fitz-Gerald, A. M. & Neal, D. J. (2001). Aid Management: Exploring the utility of generic management applications in the humanitarian aid sector. Brussels.

Forrester, J. W. (1989). *The Beginning of System Dynamics*. Massachusetts, USA.

High Performance Systems Inc. (1994). *Introduction to Systems Thinking and ithink*.

Index mundi. (2013). *Country Facts*. Available at: http://www.indexmundi.com/facts/zambia (accessed: 08.03.13).

isee systems. (2006). *Applying Systems Thinking and Common Archetypes to Organizational Issues*. Available at: http://www.iseesystems.com/Online_Training/course/module6/6-02-0-0-what.htm (accessed: 28.02.12).

Kaplan, R. S. & Norton, D. P. (1992). *The Balanced Scorecardcard: Measures that drive performance*: Harvard Business Review. p. 28.

Kaplan, R. S. & Norton, D. P. (1996). *The balanced scorecard : translating strategy into action*. Boston, Mass.: Harvard Business School Press. XI, 322 s. : ill. pp.

Knack, S. & Azfar, O. (2000). *Are larger countries really more corrupt?*, vol. 2470. Washington, D.C.: World Bank. 28 s. pp.

Koster, K. D. & Holvoet, N. (2012). Bilateral Donors' Efforts to Assess and Manage UN Agencies' Effectiveness: Seeking a Balance between Paris Principles and Domestic Accountability. *Development Policy Review*, 30: 399-424.

Moyo, D. (2009). *Dead aid : why aid is not working and how there is another way for Africa*. London: Allen Lane. XX, 188 s. pp.

Newby, T. M. J. (2010). Unintended Effects of Development Aid. *DIIS Working Paper 2010:06*.

Norad. (2011). Norad's Strategy towards 2015: Results in the fight agansit poverty.

NRK. (2013, 8.januar). *Den gode vilje: 1:5* [TV-program]. Oslo: NRK 1.

OECD. (2005). The Paris Declaration on Aid Effectiveness.

OECD. (2008). Reaching Our Development Goals: Why Does Aid Effectiveness Matters?

OECD. (2012). Aid Effectiveness in the Health Sector: Progress and Lessons.

Picazo, O. F. & Zhao, F. (2009). *Zambia health sector public expenditure review : accounting for resources to improve effective service coverage*. Washington, D.C.: World Bank. xix, 92 s. : ill. pp.

Rand Europe AS. (2013). Study of Evaluation use in the Norwegian development cooperation system.

Richardson, G. P. (2013). *Problems for the Future of System Dynamics*. Available at: http://www.albany.edu/~gpr/Problems.pdf (accessed: 08.04.13).

Riksrevisjonen. (2012). Riksrevisjonens undersøkelse av norsk bistand til helsesektoren i Malawi.

Rittel, H. W. J. & Webber, M. M. (1973). Dilemmas in a General Theoty of Planning. *Policy Sciences*, 4: 155-169.

Saeed, K. (1982). Public Policy and Rural Poverty: A system Dynamics Analysis of a Social Change Effort in Pakistan. *Technological Forecasting and Social Change*, 21: 325-349.

Saeed, K. (2003). Articulating Developmental Poblems for Policy Intervention: A system Dynamics Modeling Approach. *Simulation and Gaming*, 34: 409-436.

Sterman, J. D. (2000). *Business dynamics : systems thinking and modeling for a complex world*. Boston: Irwin McGraw-Hill. XXVI, 982 s. : ill. + 1 CD-ROM (12 cm) pp.

The Royal Norwegian Embassy in Lusaka. (2013). Norway's Minister Holmaas visited Zambia. Available at: http://www.norway.org.zm/News_and_events/Norways-Minister-Holmaas-visited-Zambia/ (accessed: 08.02.13).

The World Bank. (2013). *World Bank Search*. Available at: http://search.worldbank.org/data (accessed: 17.01.2013).

UN. (2000). Millennium Development Goals.

UNDP. (2011). Zambia Human Development Report 2011: Service Delivery for Sustainable Human Development.

UNESCO. (2008). The Development and State of the Art of Adult Learning and Education (ALE).

Unicef. (2013). *Statistics*. Available at: http://www.unicef.org/infobycountry/zambia_statistics.html (accessed: 15.03.13).

Wikipedia. (2013). *Humanitarian aid*. Available at: http://en.wikipedia.org/wiki/Humanitarian_aid (accessed: 09.04.13).

Wulf, J. (2012). A Balanced Scorecard for the Humanitarian Sector? *Working Paper* Ruhr University Bochum: International Law of Peace and Armed Conflict (IFHV).

Zambia Central Statistcal Office. (2006). Living Condition Monitoring Survey Report 2006.