Telecommunications in Harare

1. Introduction

Harare is the capital of Zimbabwe and is the economic heart of the country. There are numerous international companies located and thus a lot of communication between companies. This makes it very important to have a good telecommunication network to support the different kinds of communication methods these companies use to communicate with each other.
Furthermore the city of Harare is a big city with 1.4 million inhabitants and 2.2 million inhabitants on the outskirts of the city. All of these inhabitants also want to use some form of telecommunication (mobile phones, e-mail).

The communication system in Harare is outdated, which means that the availability and quality of telecommunication services is limited. Another problem the city of Harare faces is urbanization: The area and inhabitants of the city of Harare are growing rapidly.

By the growing amount of inhabitants the demand for telecommunication is also growing. Especially now a days with the many services provided by telecom operators the demand for quality telecommunication is rising. To provide the people with quality telecom services the current communication network should be upgraded and improved. The advantage of a high quality communication network is that not only the demand for telecom services is fulfilled, it also creates an opportunity for business and economic growth of the city, which is desperately needed since Zimbabwe is in an economic recession for almost a decade.

Our client the Telecommunication Operators Association of Zimbabwe looks after the interest of the operators in the telecom sector. This means to provide good working conditions for the operators, but also a good infrastructure for the telecom sector.
TOAZ, wants to improve the infrastructure of the telecom network, this can restore the economy and lower the unemployment rate. Strangely, this didn't happen.

This issue paper is analyzing the core problem of the current situation and is a proposal for conducting a more thorough research on how to improve the current situation into the desired situation.

The paper will discuss the result of analyzing the current situation using different kind of methods. After the analysis the paper will discuss the research that is needed to solve the problem and what resources are needed to conduct this situation.

2. Problem sketch

Zimbabwe has 3 telecom companies of which one is state owned (Net*One). These companies are very active in African countries and have some connections with bigger Western telecom companies.
The telecom sector in Africa is booming, there are more than 82 million mobile users and this number is increasing. So the market has a high potential.

Zimbabwe is a country were the infrastructure for telecom is of an inferior quality, compared to more developed African countries. There have been pointed out many different reasons for this fact: The economic situation of the country, high taxes on telecom equipment, governmental bureaucracy, political situation etc.
The next chapters use different methods to analyze the problem and try to find out which knowledge gaps/uncertainties are present.

2.1 Boundaries of the problem:

The focus of this paper will be on the city of Harare, because this is the business centre of Zimbabwe and has top-priority to improve. Zimbabwe is suffering from an economic crisis for almost a decade and to get out of this crisis one thing which must happen is to attract (foreign) companies. If the telecom network in Harare is of top-quality, then it becomes more attractive for companies to start a business there or to even place a head office in Harare. It will give a positive impulse to the economy since the telecom companies can increase their profits, create more jobs and the new infrastructure can attract more companies creating even more jobs.
Furthermore the infrastructure for internet is not available in the whole of Zimbabwe, making these area's a different kind of problem, more complex and more capital intensive: One has to make big investments to lay all the lines dealing with a rough landscape and the question remains if it's necessary to have internet accessibility everywhere in Zimbabwe.
Secondly, with the knowledge and skills we gain from improving the network in Harare we can start improving the rest of the network in Zimbabwe. By starting improving the telecom network of Harare (and thus the infrastructure) TOAZ can expand this improvement to other cities.

When one talk about the telecommunication then it might not be clear what is meant with this. In other words: Which communication means are meant with telecommunication?
The definition of telecommunication in the dictionary:

The science and technology of communication at a distance by electronic transmission of impulses, as by telegraph, cable, telephone, radio, or television. Often used in the plural with a singular verb (The American Heritage® Science Dictionary Copyright © 2005 by Houghton Mifflin Company).

In this paper the focus lies on:

- Internet
- Mobile telephone

These are the most important means of telecommunication used in the world. Cable telephony is not considered in this report since this is a different problem: In Africa the most important mean of long-range communication is with mobile phones due to the fact that the infrastructure for cable telephony is very poor. If one wants to consider cable telephony in the city of Harare one must also look at the costs of improving the existing cables and about laying new ones.

2.2 Back to the source:

To understand the problem and trying to find certain policies to solve the problem, on must first know what the main goal of our client (TOAZ) is. In the introduction it is stated that the goal is to create a strong telecom sector, more specifically to ensure continuity of the telecom sector.
In annex A this main goal is further explained by more concrete goals. Important to note is that the main goal is split into a financial part and a more technical part:

- Strong financial foundation: So the sector can cope with times of a decreasing economy.
- High quality network: To provide good service to its costumers, build up a good name and create prospects on expanding its market to other countries.

These objectives are split in lower-level subjects to explain what a high quality network is for our client.
From the objectives tree are the criteria derived that measure the quality of the network. The values of the criteria are determined by the fact on how high quality does TOAZ wants the network to be and how strong the foundation must be. From the perspective of TOAZ this means that the network has a quality comparable to the best telecom network in Africa and this is South-Africa. In this way the companies of Zimbabwe can compete with all the other companies in Africa and expand their market.
So for the values of the criteria one should use the network of South Africa as a benchmark.

2.3 Problem Fundamentals

Now that it is clear what our client wants it time to look at the structure of the system. To understand the fundamentals of the problem, one needs to identify the factors that play a role within the system and needs to know how they can be influenced.

In Annex C one sees a system diagram which is a simplified representation of our problem. In this system diagram are the factors represented which influences our system. On the outside of the diagram there are the external factors: Factors that cannot be influenced by TOAZ. And on the lower level are the measures TOAZ can take to influence the system (see annex end-means).

Zimbabwe is suffering from an economic crisis, causing a situation of hyperinflation which makes it very difficult for the companies to buy high quality equipment. The equipment is priced in dollars or euro's which are much more worth than the national currency, making the equipment immense expensive. The equipment they can afford to pay has to be earned back by raising the prices of the telecom services. To make things even more difficult is the fact that the government puts a high taxation on the import of telecom equipment, making it even more difficult for the telecom companies to purchase these items.
In the system diagram one can see that when the prices of the services increase the number of costumers will decrease. One sees also that economic growth increases the number of subscribers, but when the economy is shrinking the number of subscribers will decrease. Due to the economic crisis Zimbabwe has a very high unemployment rate (in 2008 this was an average of 80%) so the average income of the inhabitants of Harare will not be very high.
In the system diagram one can see a tendency between the number of subscribers and the prices of the telecom services: An increase in the telecom prices will cause a decrease in the number of subscribers, but will increase the profits of the organization. An important question is what an affordable price for the telecom services is or in other words: *What is the optimal price for the telecom services so the companies make the highest profit?*
Another question that it interesting to consider is the question what *possibilities there are to keep the prices low of the telecom services?*

Parts of these profits will ultimately become part of the budget of the telecom companies for the upgrading of the infrastructure (some of the profit will be turned out to the stakeholder or invested in a new Head office etc.). This budget is also influenced by the investments made by the private sector and governmental sector. The private investments are influenced by the investment risk and the size of the market which both are influenced by the number of subscribers. The number of subscribers seems to be a crucial factor in the system to create a strong financial foundation for the telecom sector (see the objectives tree).
A third question one might ask is *how TOAZ can attract more investments into the telecom sector?*
In annex D (end means) and in the system diagram (annex C), there is already identified one mean which could result in more investors. It is useful to consider that investments are not only improved by creating good investment situations, but also by so-called "Animal Spirits". This is an economic theory from Keynesian economics, which states that investors only invest when there is a positive vibe. For instance when the economy is growing, there is a positive vibe a there will be more initiative to invest. This even works with positive or negative impulses from the media (some say this makes the credit crisis so difficult to solve). Here might lay some possibilities for TOAZ to increase investments.

In the system diagram one can also see the stress put on to the system by the growth of the population. The demand will increase and if the income of the inhabitants will increase the network needs to expand dramatically, costing even more money.
It is quite sure that the population will grow (unless there will be a huge war, but the country is more or less stable these days) and so will the demand. What is not sure is the economic growth of Harare, making it uncertain how much subscribers the telecom sector will have. If the economy grows the number of subscribers will increase and puts a huge stress on the network of Harare. So the effect of urbanization (the extreme growth of population in a city) will not directly increase the stress on the network, because of the bad economy and the low incomes of the inhabitants. When the economy grows and the average income of the inhabitants' increases, than the network will have to grow rapidly.
In annex (actor analysis) it is identified that the government wants to have a high economic growth, so they will take measures to improve the economy. This means that in the future there will be a more subscribers, which is good for the telecom sector but they need to cope with this increase in subscribers.

In the objectives tree (annex A) another sub objective was indentified and that was the creation of a high quality network. One can see that a lot of the quality of the network is influenced by the government who sets up certain regulations. These are the minimum standards for which a network must comply to be used, but the quality isn't only determined by regulations but also by the budget of the telecom companies and indirectly on the taxation that is put onto the equipment. Here is a connection between the finances of the telecom sector and the quality of the network: Although the companies make high profits in the local currency, this doesn't mean that they have enough money to upgrade and expand the infrastructure. This has a few causes:

- High profits are in the local currency, telecom equipment is priced in dollars. Due to hyperinflation the dollar is much more worth then the local currency, causing the equipment to be very expensive.
- High taxes are put on telecom equipment, which enforces the above mentioned situation.
- Due to the economic situation and the low average income of the inhabitants of Harare, the telecom companies can not take full advantage of their capital. Even if they could afford the highest quality equipment, it be would economically seen unwise to implement these materials since the investment has to be earned back. In order to do so the price of the services need to be increased, this makes it impossible for the inhabitants to use this services, causing a decline in subscribers and eventually a decline in profits leaving the company that invested in debt. As a side effect the

private investments will also decrease due to the increase of the investment risk (not even having mentioned the global credit crisis, which already lowered the incentive to invest).

To conclude the analysis of the system we can state the problem a little clearer: From the analysis one sees that there is a tension between the quality of the network and the number of subscribers. This is caused by the costs of a high quality network that needs to be covered. So the real question is: **How can the Telecommunication Operators Association of Zimbabwe realize a high quality network in Harare, without making the telecom services unaffordable for the inhabitants/companies at Harare?**

A question that directly results from this statement is: *What are the investments needed to improve the network?* We consider that TOAZ wants to achieve a quality as high as in the Western countries, so in this way it can be investigated what this means for the criteria that are used in the system diagram (which values should they have) and if these criteria need to be extended with some more criteria.
Next step is to analyze which actors are relevant in the system: Which actors will support the goals TOAZ and which actors could block the goals of TOAZ?

2.4 Actor analysis: Friends or Foes?

So which actors have the same interests as TOAZ and which actors have opposite interest? Most importantly, which of the actors with opposing interests have the power to block our ideals? To answer this question one must first find out which actors have the same interests.

In annex E table 11 there has been made a separation between dedicated and non-dedicated actors. The dedicated actors are actors that want to actively change something on the current situation and the non-dedicated are more passive in this situation.

Furthermore, there is a separation between dedicated and critical or non-critical (the same counts for the non-dedicated actors). In short this means that the critical actors are very important within the system. This is determined by the fact if they have important resources and if they are irreplaceable, if both are the case than these are the important actors in our system (see table 10).

In table 11 one sees that of the dedicated and critical actors there are two actors with similar interests (Local government and national government) and one actor with opposite interests (Environmental groups).

A note has to be made concerning to the environmental groups. In the past it has been seen more than once that big projects which are more or less harmful for the local environment (UMTS masts) are being canceled or adjusted because of extensive protests of environmental groups. The project might under find extensive delays due to protests and blockages. To prevent these problems one should include these groups at different stages into the project to let them hear their voice and to come to a solution at which both parties are happy.

Although there formal powers are small, their informal powers can increase dramatically, especially when they get the support of the public. That is why they are considered as critical actors.

Other non-critical, but dedicated actor group is the hackers. They don't have any formal power but can cause severe damage. Since they are criminals it is not realistic to involve them into the project, but one should but the safety of the network high on the agenda (one could even consider to invite ex-hackers to help with the security of the network).

The actor analysis provided us with the following actors that need to be considered in our policy:

- National Government (similar interests)
- Local Government (similar interests)
- Environmentalists (opposing interests)

The Telecom Operators Association of Zimbabwe needs to activate these actors and try to cooperate with them in achieving their goals. But the government of Zimbabwe already owns a telecom company and there have been minimal changes in the quality of the network, so: *How can the government be involved in developing a high quality network?*

2.5 Uncertainties:

In the system diagram (annex C) some external factors where included, these factors can not be influenced by TOAZ. Three of these factors are considered to be driving forces; their importance in the system diagram is significantly for the problem. In annex F different scenarios were developed to get an insight in the effects of these driving factors.

As stated earlier in the paper, the economy of Zimbabwe is in a bad state when this improves there will arise more possibilities to increase the quality of the network: The unemployment rate will decrease and the inhabitants of Harare will have more money to spend. What makes this especially uncertain is the ongoing global credit crisis, which also affects Zimbabwe. No one knows when this crisis is going to end and how the world will recover from this crisis.

Then we also have the political situation and thus the regulations on telecom. The last years the political situation of Zimbabwe has been unstable. Zimbabwe turned from a democracy to a dictatorship, back to a democracy. This has all kinds of affects for the regulations on telecom: One political leader can consider telecom important for the economy of Zimbabwe and wants to stimulate this by investing in equipment, while another leader he considers this of less importance and wants to invest more in the agricultural sector. A more difficult situation arises when Zimbabwe again gets a dictatorship; some countries might boycott Zimbabwe closing them down from buying equipment from Western countries.

Finally there is the situation of technical development. When there are big breakthroughs in the telecom sector this might be a negative thing for Zimbabwe: They are lagging behind (still have to implement 3G) and then there is already a new generation of telecom services being introduced in the Western World. Before they can even earn back the investments of implementing the 3G network, they already are lagging behind again. So in the case of Zimbabwe it is better to slow down the technical developments or at least slow down the implementation of these technologies in the Western World.

3. Plan of action

3.1 New focus on problem:

During the analysis of the problem the core of the problem was found, namely the tension between the price of telecom services and the quality of the network. This led to the following problem definition:

How can the Telecommunication Operators Association of Zimbabwe realize a high quality network in Harare, without making the telecom services unaffordable for the inhabitants/companies at Harare?

This shifts the focus from only a high quality network and investments on the network, towards the market. If one wants to make profits one not only needs quality, but also needs costumers who can afford to pay for that.
To solve this problem a few knowledge gaps need to be "closed":

- *How can the government be involved in developing a high quality network?*
- *How can the communication network of Harare meet up with the future telecommunication demand?*
- *What is the optimal price for the telecom services, so the companies make the highest profit?*
- *What possibilities are there to keep the prices of the telecom services low?*
- *How can the Telecommunications Operators Association of Zimbabwe stimulate investments in the communication network of Harare to improve the quality of the network?*
- *What are the investments needed to improve the network?*

To answer these questions some further research has to be done.

3.2 Benchmarking:

Numerous countries in Africa have been in similar situations as Zimbabwe and now have a good telecom network. It could be useful to work together with other countries and use their knowledge on how to create a high quality network in financially difficult times.
A country that had a similar situation in the past as Zimbabwe has now is South –Africa. After the Apartheid-regime the country was left divided and poor, but now a days South Africa is one of the richest countries in the region and they posses a high quality network.

3.3 More cooperation with the government:

The government doesn't take enough actions to improve the network, although this fits their interests. The government is concerned with improving the economy of Zimbabwe and has to be made aware that a good telecom network is crucial to achieve this.
When TOAZ develops a good relation with the government than the importance of a good network will be put higher on the agenda. Secondly, there will be more governmental investments in the telecom sector, which not necessarily have to be earned back within a certain time.
Thirdly, if TOAZ cooperates more with the government than they can influence the regulations on the telecom sector and impose high quality/security standards. In this way the telecom network has to comply legally with a certain standard which increases the quality of the network and raises the security of the network.

3.4 Research proposal:

The objective of this research will be to investigate the possibilities to improve the network of Harare. Here it is also important to look at the financial aspect of the problem, namely the financing of this improvement. There have to be made huge investments before the network is of a high quality and these investments have to be earned back. This means it's important to have enough costumers who make use of this network and can pay the price of the telecom services. In this way the following research question is extracted:

How can the Telecommunication Operators Association of Zimbabwe realize a high quality network in Harare, without making the telecom services unaffordable for the inhabitants/companies at Harare?

To answer this question the sub-questions mentioned in chapter "Plan of Action" should be researched.

3.5 Research methods:

How can the government be involved in developing a high quality network?
Use the system diagram in Annex (..) to explain to the Minister of ICT where the problems are and negotiate on the possibilities.

How can the communication network of Harare meet up with the future telecommunication demand?

- *Model:*
  System Dynamics, in this way the population growth can be modeled and with some other factors the demand giving insights in the effect of population growth on the demand. It is then also possible to test different measures on the size of the network and the demand it serves.
- *Time Horizon:*
  It is about future demand, but it also depends on the growth of the economy, these things don't happen very quickly. Therefore a time horizon of 20 years seems appropriate: The babies that are born now are adults then and the economy has had enough time to change significantly.
- *Spatial:*
  Harare Zimbabwe
- *Level of aggregation:*
  Medium, it is necessary to not only know the basic structures but also the effect of certain policies to deal with the demand. These policies can influence factors that are part of a certain mechanism, thus it is needed to break these mechanisms apart is smaller factors.
- *Knowledge and data:* Data on population growth in the last few years, knowledge on the relation between demand and population growth (what is the precise rise in percentage of the demand when the population increases with 1%)more or less white box.
- *Process conditions:*
  Need for expertise on ICT measures to deal with large amounts of demand.

What is the optimal price for the telecom services, so the companies make the highest profit?

- *Model:*
  Linear Programming, optimization problem. Also a questionnaire amongst different income groups on how much they are willing to pay. Use this information to determine per income group the average they are willing to pay and determine with Linear programming what the optimal price is.
- *Time Horizon:* It is only considering the current income of the inhabitants and the most reasonable price.
- *Spatial:*
  Harare Zimbabwe
- *Level of aggregation:*
  High, it is necessary to get a representative amount of data from different income groups in Harare and then determine the average price per group. One needs a significant sized group to calculate the price.
- *Knowledge and data:*
  Retrieve data about average price per income group people are willing to pay.
- *Process conditions:*
  Population must be willing to answer the questionnaire.

What possibilities are there to keep the prices of the telecom services low?

This question can be answered by creating a causal loop diagram to understand the factors that determine the price of the telecom services. When this mechanism is known then certain policies can be implemented and there effect can be measured.

How can the Telecommunications Operators Association of Zimbabwe stimulate investments in the communication network of Harare to improve the quality of the network?

The causal diagram created in this paper already mentioned some factors concerning investments and the willingness to invest. This part of the causal could be taken as a starting point but should be more detailed and elaborated, than this should be implemented in a system diagram with criteria external factors and means of TOAZ to stimulate investments. The system diagram should focus more on the financial side and not so much on the technical side.
Some economical knowledge should come in handy since there are different theories on why people invest and how these behavior.

What are the investments needed to improve the network?

In this paper the criteria for a good quality network are determined on a high level in with a system diagram. For instance the criteria should be determined from the perspective of an engineer, then the value of these criteria can be compared with South-Africa and the difference can be measured. After this it must be researched what kind of equipment/knowledge is necessary to achieve the same level and how much money is needed for this.

Conclusion:

Zimbabwe has an inferior telecom network, due to the fact that the investments that need to be made to improve the network are to expensive. The network needs to be improved to improve the economy and to deal with the increasing demand in telecom services caused by urbanization. There needs to be done more research on how this can be done and how this can be financed. A research is proposed to investigate these questions and come up with solutions to solve these issues.

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Annex A: Objectives tree Telecommunication problem Harare

The goal of this objectives tree is to make the main goal of our client more concrete.
As one can see the main goal of TOAZ is the continuation of the telecom operator sector, which is a very broad goal.

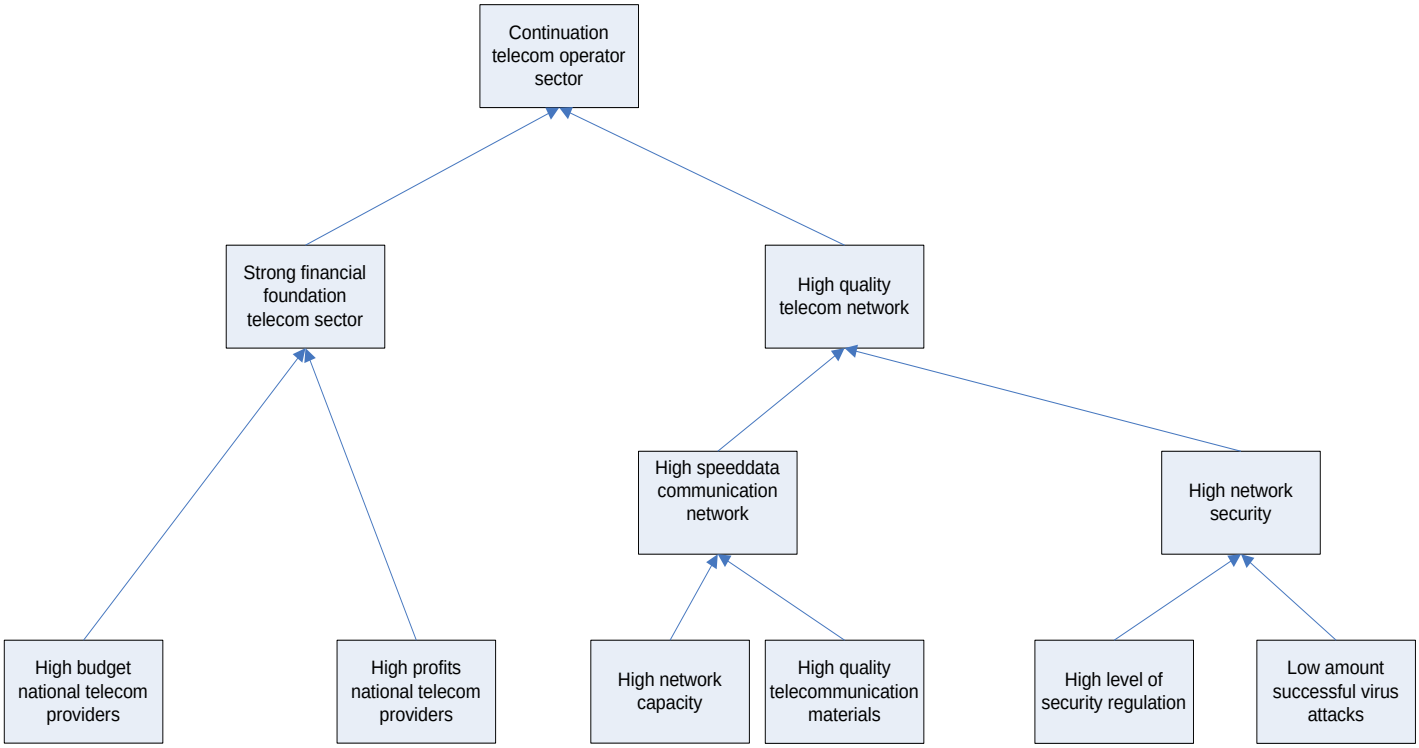


Figure 1: Objectives tree TOAZ

This goal has been split into 2 sub objectives:

- High quality of the telecom network: A high quality ensures that one delivers high quality services. One can build up a strong brand and bind costumers to this brand, ensuring the inflow of capital.
- Strong financial foundation telecom sector: In times of crisis the sector needs to have enough financial means to survive. They also need a strong foundation to improve the network.

The *High quality of the telecom network* factor has been split up into 2 objectives:

- High network security: When the security is high then the chance of network failures decreases. There is less change hackers succeed into breaking into the network and spreading malware. Furthermore, the users have more certainty that there privacy is ensured.
- High speed data-communication network: These days one of the key-features a network must have is that it is fast and that it can cope with huge amounts of data.

Factor	Unit	Reasoning
Low amount successful virus attacks	Virus attack/day	
High level security regulations	# of regulations	Assumed is that when there are a lot of regulations on network security, that this is improving the network security.
High quality telecommunication material	Mb/s	High quality means in this context, the amount of data can be transmitted/ received/transported by a piece of equipment
High network capacity	Mb/s	Amount of data the network can handle.
High profits national telecom providers	ZWB/year*	
High budget national telecom providers	ZWB/year*	

Table 1: Factor overview Objectives Tree TOAZ

For the *Strong financial foundation telecom sector* factor is directly translated in concrete objectives
The sub-objectives from the *High quality of the telecom network* factor have been split into lower level objectives which are more concrete, they are measureable.

* ZWB = Zimbabwean Dollar, the local currency.

There is the need for some explanation between the last two last factors. Here there has been made a distinction between profit and budget.
Profit is seen as the money that is left when all costs are covered. This profit can be turned out partly to stakeholders or can be invested into the network or other related products.
Budget is the money that is reserved before-hand to invest into the company. In this case the budget of this year will contain a part of the profit made the previously.

The factors in the table above will be used as the criteria in our system diagram. In this way we can measure the effects of the factors/means in the system.

Annex B: Causal Loop Diagram Telecommunication problem Harare:

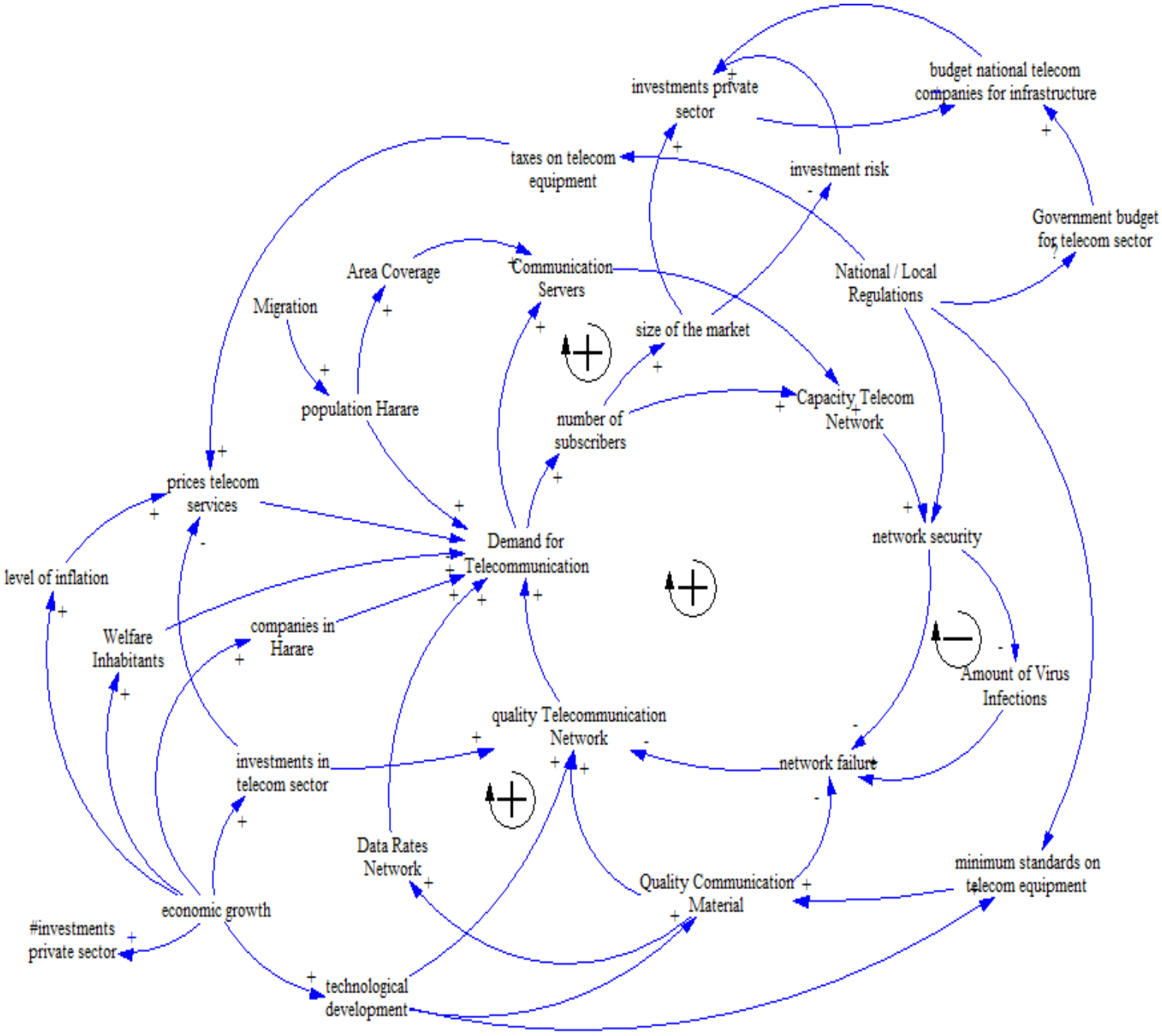


Figure 2: Causal loop diagram telecommunication network Harare

A causal loop diagram is used for mapping the relations between different factors. The diagram creates an overview how factors have effect on each other and the whole system. It determines the feedback loops in the system. Negative relations/feedbacks are represented by an –, and positive relation/feedbacks by and +. In the case of telecommunication in Harare there are a couple of feedback loops identified which will be briefly discussed. This causal loop diagram is an detailed overview of the current situation in Harare.

Lets start at the demand for telecommunication. When the demand for telecommunication grows the amount of subscribers on the communication network will grow. This increase in subscribers will let the capacity of the telecom network. When the capacity increases the security of the network should also increase to guarantee a safe use of the communication network. When the security increases the amount of virus infections and therefore also the network failure will decrease. This will improve the quality of the telecommunication network, which will increase the demand for telecommunication.

The population of Harare is growing. When the population grows the demand for telecommunication will increase, but also the area coverage of the telecommunication network. Because of the more people in the area will use the telecommunication services, the network should also cover these users. When the area coverage is increasing the number of communication servers should also increase. When the number of communication servers increase, the capacity of the telecom network also increases. Then the loop discussed above will continue.

The quality of the communication material have also some important influence on other factors. When the quality of the material will increase the quality of the communication network will increase, but also it causes less network failures. And because of better quality communication material higher data rate in the network are available, which will increase the demand for telecommunication.

Some important factors that influences the causal loop diagram are the technological development and the economic growth. When the technological developments increase this will improve the quality of the communication material and the quality of the communication network, what will let the loop works.

The economic growth of the city of Harare will influence the investments in the communication network. The better the economic position of Harare, the more room is available to make investments in the communication network and in technological developments.

When the subscribers increase the size of the market also increases. The larger the amount of users the higher the value of the market. Large markets have a high value and makes it interesting to invest in. Therefore the investments of the private sector will increase, and also limits the investment risks. Because it is a growing market with a high value network the risk of earning the investment back is lower. When the economic is growing this will also stimulate the private investments. When the private investments increase the total budget for investments in the telecom sector will increase.

The national/local government has influence on the security of the network, but also on the investments in the network. The government has a certain budget available to invest in the communication network. The effect on this budget is not really clear, because the government doesn’t state his investments in the telecom network anywhere. But this governmental budget has influence on the total investment budget in the telecom network.

Annex C: System Diagram Telecommunication Problem Harare

A system diagram is an overview of the complete analyze system. It represents the different components that are involved in the project. The system diagram can be used for further analyze of the system. The system diagram is explained with all its components, and also different uses of the system diagram in further analyses are evaluated.

Factors

The system diagram 1 shows which factors are influencing the criteria determined in the objectives tree. In the system diagram a more general version of the causal loop diagram discussed in annex B is used. On the left one can see the external criteria, which cannot be influenced.

On the top right there is the external factor *population growth*. This factor influences the demand for telecommunication: When the population of Harare increases than the demand for communication will increase.
At the demand factor we see a negative loop between this factor and the number of subscribers. If the demand is increasing then the number of subscribers will increase, causing the demand to shrink because the demand is satisfied. This number of subscribers is then again also influenced by another external factor, namely economic growth.
When the economy of Harare is increasing, then we can assume that the welfare in the city also increases: People get a higher salary or at least a job and thus more people can afford some sort of telecom services.

If the number of subscribers increases then the size of the network also has to increase to remain at the same quality. The number of servers need to increase, causing two effects: One is that the total capacity of the network increases, more servers higher data loads.
Secondly, the size of the network increases which has an effect on the security of the network.
When a network increases in size it the security of the network should also increase. Big networks are attractive for hackers to spread malware etc. So when the network becomes bigger the level of security should also increase.
Some elaboration on this factor is necessary since a reasonable question is how one will measure this level. The network security level is measured by the methods that are used to prevent attacks from computer viruses: Firewalls, authorization, passwords etc. When there are a lot of these methods then the level of security is high. It is considered that for a medium sized network to have a good level of security when it has an authorization method, firewall and anti-virus software.
The network security is not only determined by these software approaches, but also on some regulations and protocols that ensure that people use the software in the right way and change there behavior concerning surfing on the Net.

If the level of network security increases then the amount of successful attacks on the network decreases, and the number of regulations increases. The assumption here is that as your network security increases, the number of regulations also increases which is an indicator of secure network.

Back to the external factors. Another external factor is *economic growth*, thus if the economy of Harare is growing or shrinking. If the economy is growing it was already stated that the number of subscribers increases. But when the number of subscribers increases the profit of the telecom sector will also increase.
When the number of subscribers increases the size of the market will also increase and this causes the risk to invest to decrease. A sector serving big market is less vulnerable for a crisis, because when there is a crisis and the market shrinks one still has a large market. When a market is small and it shrinks then one sees a big difference in its profits.

When the market increases, the telecom sector can decrease he price of its services. This has two reasons:

- A telecom service is usually established by big investments that need to be earned back. When there is a big market this happens faster and the prices can go down.
- Secondly, the telecom sector consists of telecom companies who are competing for costumers. When the market is big then there are less people who are not subscribed for a certain service at a provider. The different companies need to lower the prices and try to take costumers from there competitors.

A bigger market also has a positive effect on the investments of the private sector. Private investors see a big potential and want to take advantage of this potential. The will invest in the sector (a certain company) and try to create an advantage over the other companies. Of course there will be more investors investing in other companies within the sector, so the overall budget of the sector will increase.
This budget also increases as a cause of investments done by the government. These investments depend on the regulations: Every year the total budget of the government is divided amongst different posts (Education, Infrastructure etc.) so it is not immediately clear what the effect will be, the budget can increase or decrease.
These regulations also have an effect on the minimum standards for the equipment the companies must use. One must think about certain standards that prevent the use of equipment which transmit to much radiation for example. These standards are also influenced by the technological developments in the telecom sector worldwide: If there is better equipment then government might decide to set higher standards. As an effect these standards determine the quality of the equipment that is used in the sector.

To finish this description: The difference between budget and profits is already explained at the objectives tree, but in the causal it also should be mentioned that the profit will contribute for next years profit (at least a part of it). This has not been modeled into the causal, to keep things simple (other wise one must look what certain effect may have in the nearby future and in the far future), but it is important to keep this in mind.

Means

At the bottom of system diagram 1 are the means the Telecom Operators Association of Zimbabwe can use to influence the system. These means were found in the end-means diagram and in the system diagram 1 is shown which factors of the system are influenced by these means.
On the right there is the mean, this Develop counter-hack educational programs mean increases the network security level. Operators can attend these programs to learn more about network security and how to prevent network attacks.

The second mean is also influencing the network security. This mean, *Develop security protocols* tries to set up some standards on security by the development of protocols for the telecom sector. The companies can use these protocols to organize their network security program.

Third mean is that TOAZ *creates a financial plan for the telecom sector*. This means that TOAZ writes an advisory plan how the companies should manage their finances. For example, the companies must use 20% of their profits for investments and 30% to create a financial buffer for times of financial crisis. In this way they have a financial plan for the future, which decreases the investment risk and will attract more investors.

Fourth mean is to *lobby for governmental support* and in this system we focus on the financial part of support. If this lobbying is successful the government will increase the budget for the improvement of the telecom sector and will eventually lead to a higher budget for the telecom sector.

Finally, TOAZ must try to cooperate with a big multinational in the telecom sector. They have a lot of knowledge how to organize a telecom network and which standards must be used. What's not in the system diagram 1 is the fact that their knowledge also increases the effect of the different other means, because we already showed that in the end-means diagram.

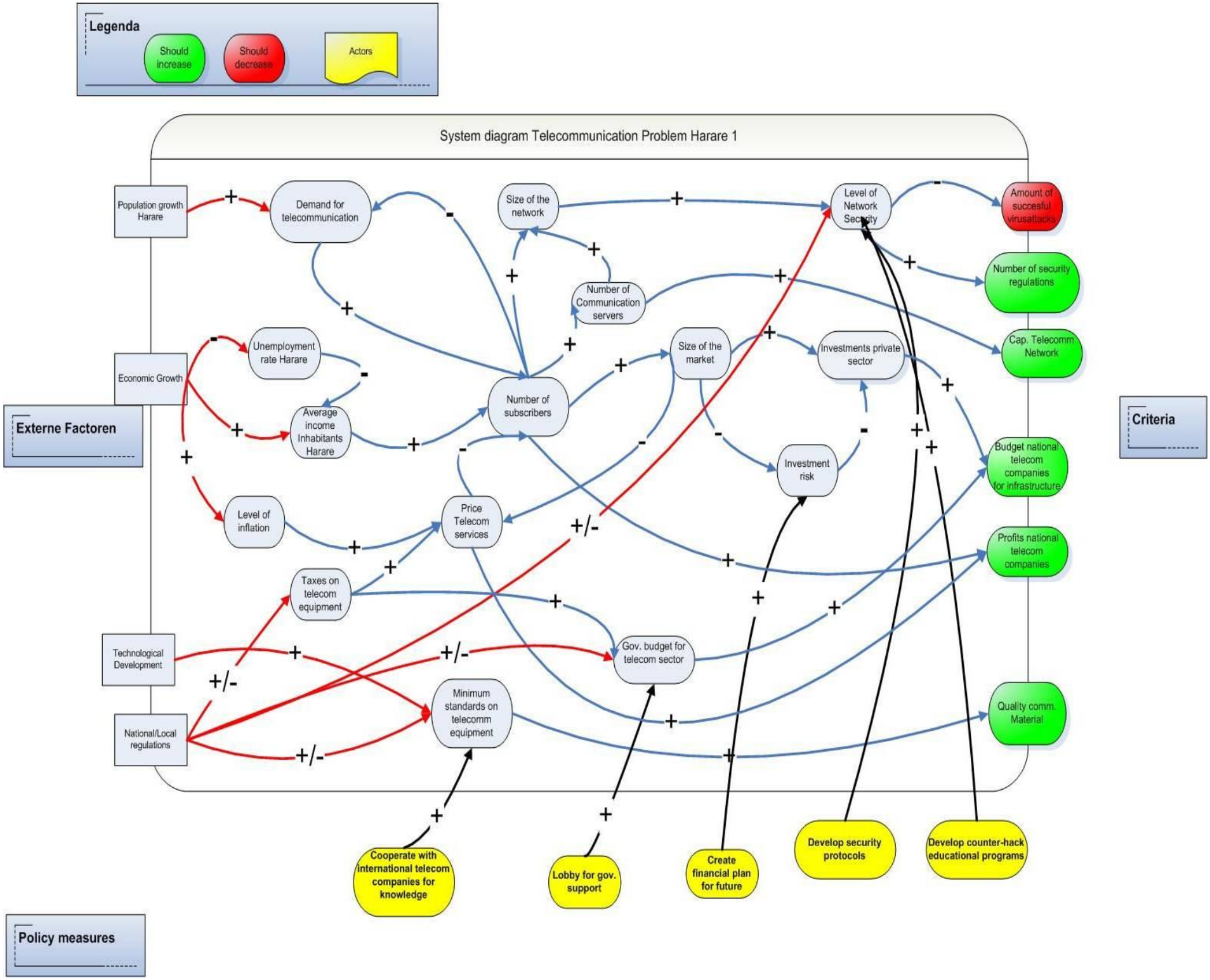


Figure 3: System diagram 1 telecommunication problem Harare

Actors within the system diagram

In the system diagram 2 are also some actors of the system displayed. These actors have a certain interest in the system. In the actor analysis it is analyzed what their interests are and how important they are in the system.
In the system diagram 2 their interests in the system are shown and will be discussed shortly here.

Telecom manufacturers: This actor is responsible for the technological innovations in the telecom sector. New innovations can lead to new standards, because new products can be more efficient or less damaging for public health.

Government Zimbabwe: Minister of ICT/ Local government of Harare:
Decides the national regulations which might contain certain standards on the quality of the equipment of the telecom network. Furthermore, the security of the network is important to this actors since the government is also a big user of the telecommunication network (especially the Internet). They want to be sure that confidential information isn't easy to extract from the network.
The national government is also very interested in the economy of Harare, it is the business capital of Zimbabwe and most of the capital flows in from this city. Since Zimbabwe is in a economic crisis it is very important that the economy of Harare will flourish.
In the diagram there is only one arrow from the local government to the regulations, but of course they are interested in the same factors as the national government. This has not been displayed in the diagram to keep it "readable".

Hackers: This actor only interested in the level of the network security, so it can take advantage of the network for criminal activities.

External Telecom companies: These are big multinational companies which could be interested in investing in the telecom network of Harare and even in the ret of Zimbabwe.
They are very interested in the demand for telecom, this gives them a indication of how big the potential of the market is and thus how much money they could earn.
They're also very interested in the investment risk ,if the investment risk is low then there is more initiative to invest in the telecom sector.

Inhabitants/companies Harare: This group is of course very happy with a better telecom network, but what is more important for this group is the price of the services. One can have a nice network, but if it's to expensive then it is only useful for the rich.

Environmentalists/Health care groups: They are interested in the size of the network, because a big network has a lots of masts and more radiation. Furthermore, they are interested in the minimum standards for telecom equipment. When this standard is too low concerning the radiation equipment is allowed to emit the will use their informal powers to change things.

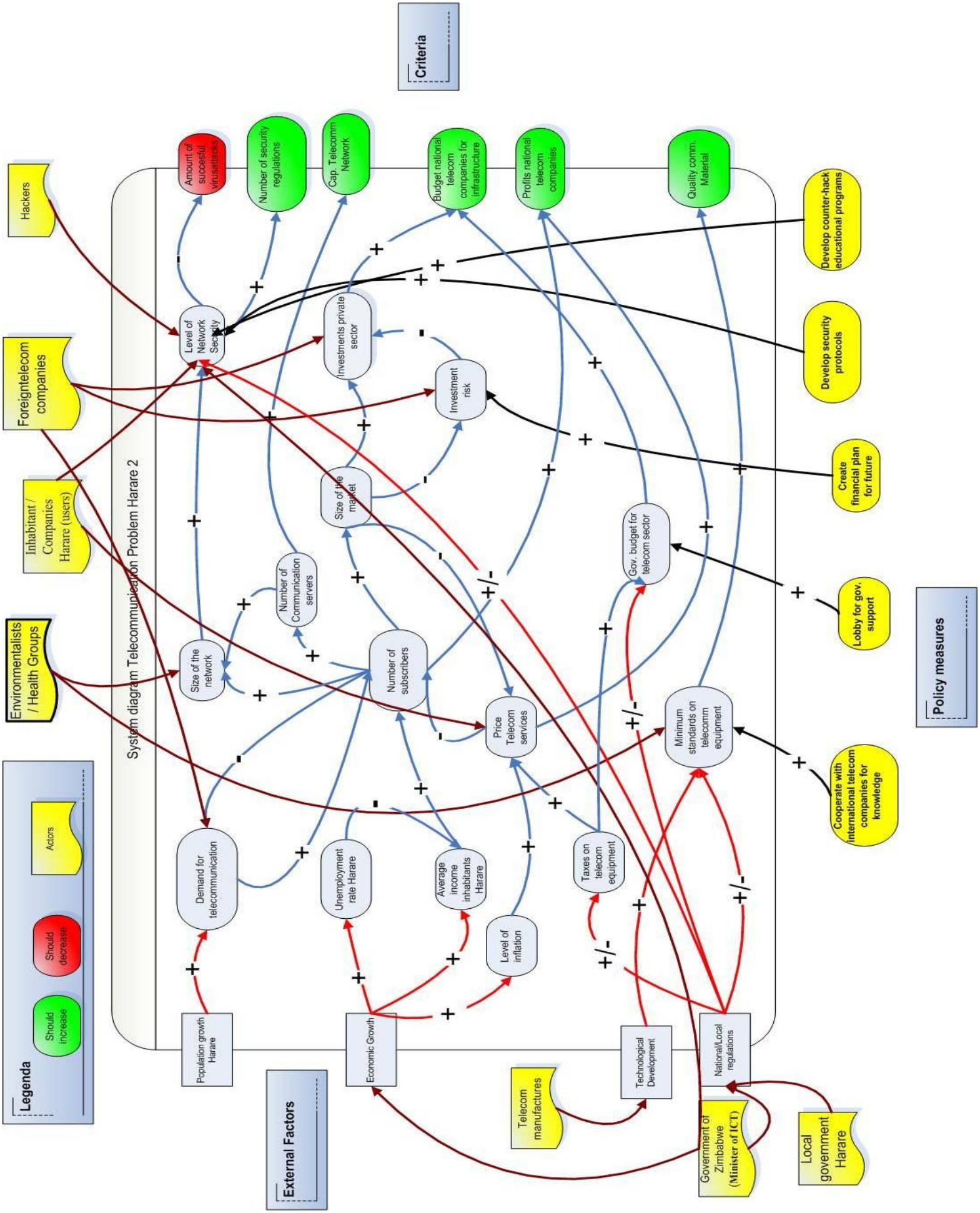


Figure 4: System Diagram 2 Telecommunication problem Harare

Interests Actors

System diagram 3 contains the means of other actors which can be used to influence the system. Only the means are mentioned that influence the criteria.
It is quite clear what the means are and why they influence the certain factors., but still there might be a few means that are a little bit vague.

To start with the mean of the telecom manufacturer. This actor wants to sell as much of equipment to the city of Harare to make profits. The telecom sector doesn't have the money to pay for the high tech equipment (high inflations make the currency useless internationally seen). So when the telecom manufactures give a discount on the older equipment, they loose their stock of inferior equipment and earn money out of it.

Second mean that needs some explanation is the *Cooperate with local telecom sector to gain a market share.* In this way the company invests in the telecom sector of Zimbabwe and they will also deliver some high quality equipment to increase the quality of the network. In this way they will invest in the market en try to get a share out of it.

The means of the government are quite clear, they want a save network: Save for the community and safe for use, so the regulate these things on a legal basis.

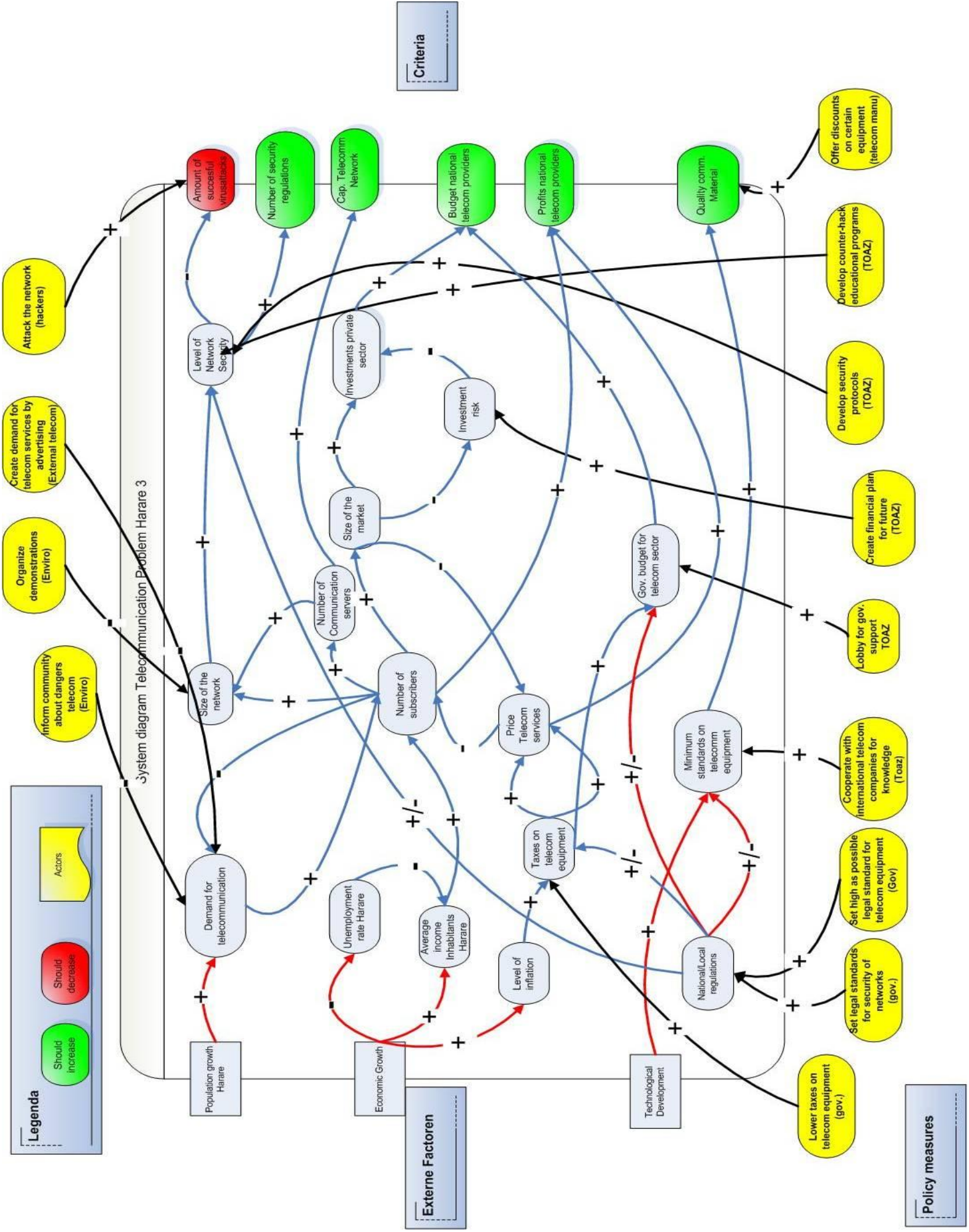


figure 5: System diagram 3 Telecommunication Problem Harare

Annex D: End-Means Diagram Telecommunication problem Harare

The end-means diagram is meant to analyze how the main objective of the client can be reached. Or in other words, what means does our client have to reach the objective.

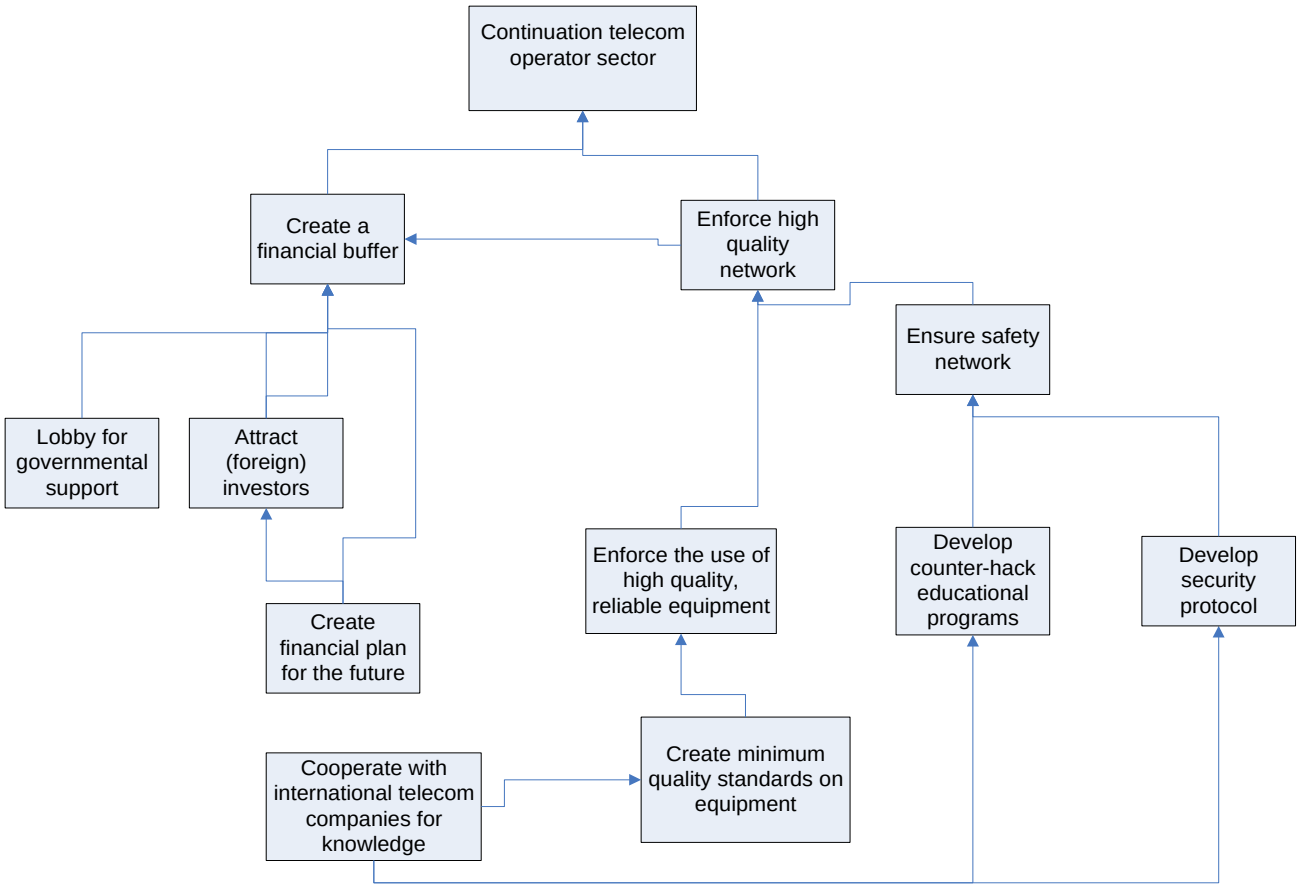


Figure 6: End Means diagram TOAZ

As one can see there are two means identified to reach the objective:

- Enforce high quality for services: High quality service enables one to establish a strong brand. A strong brand binds costumers and ensures inputs of capital.
- Create a financial buffer: This way the sector can survive crisis situations where the market might shrink and inflow of capital diminishes.

The diagram is quite straightforward but there are some things that need some extra explanation.

First there is the fact that high quality services are achieved by creating educational programs for operators and this is supported by cooperating with foreign telecom companies. It is about raising the knowledge level of the operators so they can cope with new technologies, understand new programming techniques and network maintenance. In this way the network quality increases and thus the quality of the services it provides increase (think about Internet, mobile phone communication etc.)

Secondly, on the left side of the diagram a mean is to create a financial buffer and this is achieved by attract foreign investors and Lobbying for governmental support. To start with the first one, if the telecom sector achieves to attract a lot of foreign investors than they have a higher budget to invest into the network but they van also use more of there “own money” to create a financial buffer. These foreign investors are more interested in investing when the sector can reduce the risk of investing in the sector. With this risk it is meant that chance that the investors doesn’t get a positive return on its investments. If there is a strong financial plan than the investor knows that when

Annex E: Actor Analyses Telecommunication problem Harare:

Why actor analyses?

- Improves insight into the field of forces (perceptions, interests, means, etc.) and contributes to a better approach to a solution
- Reduces the chance that important values or risks are forgotten (due to systematic character)
- Increases the chance that different stakeholders are willing to lend their co-operation to solving the problem.

Problem Formulation:

How can the Telecommunication Operators Association of Zimbabwe create a sustainable Telecommunication network that copes with the growing demand for Telecommunication, while facing the growing urbanisation in Harare.

Different Actors in the system:

- The Telecommunications Operators Association of Zimbabwe
- Inhabitants Harare
- Companies
- Telecom-operators
- Government
- External Telecom companies
- Environmentalists / health groups
- Producing Firms of networks
- Local Government Harare

Composed actors:

- Government:
  Minister of Information Communication Technology (Nelson Chamisa), he is the one who deals with communication
- Inhabitants Harare; everyone. All the citizens of Harare should be able to use the communication network.
- Companies; every company, same as the citizens. All companies can use the communication network. The load is bigger than the citizens.
- Telecom-operators; everyone. They are the ones who will offer the communication service
- External Telecom Companies; only world wide top telecom companies like NTT and AT&T
- Environmentalists, like companies who want sufficient use for energy and healthcare for mobile communication
- Telecom manufacturers; the firms that develop and sell high tech equipment.
- Local Government Harare; the department of Information Communication Technology.

Mapping Formal Relations:

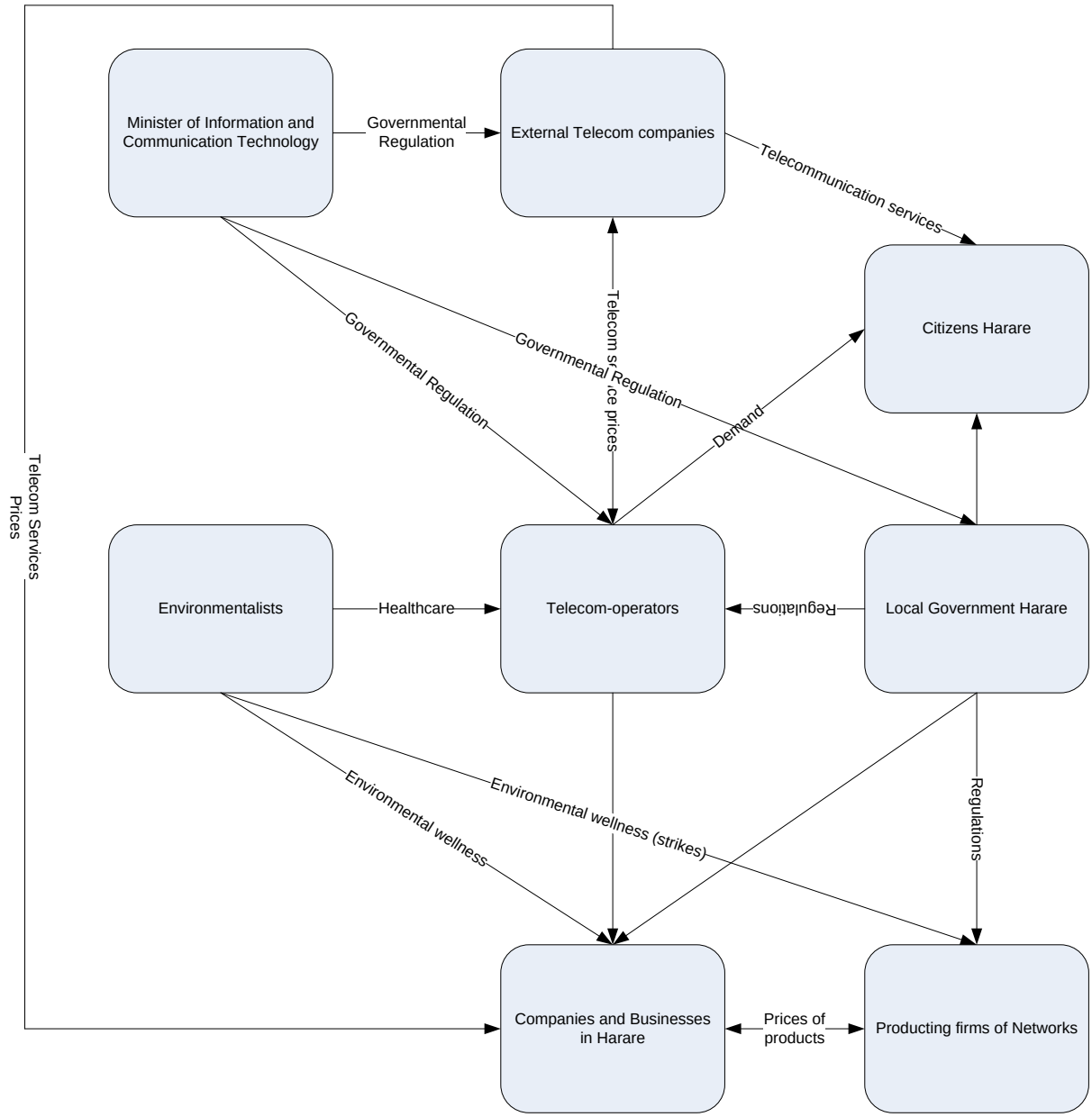


Figure 7: mapping formal relations

In the figure above the formal relations between the actors are displayed. This figure shows which actors are related to each other and how the actors can influence the relations. This figure also contains our client TOAZ to show its relation with the other actors.

Interests, objectives and perceptions:

Government: Minister of Information and Communication Technology:

The interest of the minister is that its country should increase their welfare. When Zimbabwe has a high quality communication network it can be more competitive in the world economy and is not so isolated as a country. Now there is an old communication network, which has its limits in communication within but also outside the country. So a better communication network will help the economy of Zimbabwe to grow. This is what the government wants. The Minister can make general laws about the quality of the communication network and can help with the investments of building the network. Because of the history it is shown that the Government hasn't done a lot to stimulate the innovation of the communication network. It is therefore a challenge to convince the government to participate.

The Minister determines certain standards concerning the minimum quality of the equipment used, so indirectly the Minister sets a standard for the quality of the network which makes him quite important.

Actor	**Government Zimbabwe: Minister of ICT**
Interest	A growing Welfare of the country Zimbabwe, competition with other countries,
Desired situation/goals	High GDP, High country welfare. High Economic Growth
Gap	Zimbabwe is poor country, underdeveloped technology
Causes	Strict national regulation, no support from government to invest in innovation and economy
Possible solutions	Deregulation, investments in technology
Resources	Research and development

Table 2: Actor Government Zimbabwe: Minister of ICT

Local Government Harare: Department of ICT

The objective of the local government is to increase the welfare of the city of Harare. By innovating the communication network the city of Harare will get a good communication within the city, but also outside the city and country. A high quality communication network will help the economy to grow, because companies and people can work better with each other. The communication business is also a new and innovative market, which will increase the welfare in Harare (creating jobs, attracting multinationals etc.).

Actor	**Local Government Harare: Department ICT**

Interest	Growing Welfare and Economy of the city of Harare
Desired situation/goals	High city Welfare, top position in innovation and city economy
Gap	Poor technological development, low city welfare
Causes	Strict national regulation, no money available for investments
Possible solutions	Deregulation, investments from outside, create own policies to increase welfare
Resources	Research and development

Table 3: Actor Local Government Harare: Department ICT

Foreign Telecom Companies:

These are the big international telecom operators. For them it is maybe a nice investment to start their business in Harare, and help to develop the communication network. Because Harare is a new market with open opportunities it is interesting for them to settle their business there. Their main objective is to make profits.

Actor	**Foreign Telecom Companies**
Interest	Continuity as a provider of telecom services $\Rightarrow$ profit
Desired situation/goals	High market share telecommunications in Zimbabwe, high demand, low costs services
Gap	Underdeveloped communication network, low communication possibilities and demand
Causes	Low investments in telecom innovations, low quality communication network, economic situation
Possible solutions	Governmental investments/support, own investments, create the demand for better communication technology
Resources	Technology and information, western possibilities

Table 4: Actor Foreign Telecom Companies

Telecom manufacturers:

Companies who produce equipment for telecommunication networks and can install these products. Most of the time they're also able to construct a telecom network, so it's in their interest that the city of Harare gets a high quality (see: expensive) telecom network. These companies are also the companies who develop new technologies and have a lot of knowledge about telecom networks.

Actor	**Telecom manufacturers**

Interest	Continuity as a manufacturer of telecommunication products ⇒ profit
Desired situation/goals	Sell a lot of equipment to the telecom sector in Harare. Even upgrading the network.
Gap	Low orders from Zimbabwean telecom companies
Causes	High taxes on telecom equipment
Possible solutions	Involve and create the demand to improve communication network.
Resources	Research and development, information, communication products

Table 5: Actor Telecom Manufacturers

Inhabitants / Companies Harare:

They are the ones who eventually will use the communication network. For them it is important to communicate with each other. For the companies it will improve their business, because they can increase their business to other cities and companies. The inhabitants can communicate better with other people and make more use of the internet. It is important for them that the network is of high quality, so that they can make good use of it. They have to pay to gain access on the network, so they expect a high quality for the payment.
They want a good telecom network which is affordable for their standards.

Actor	**Inhabitant / Companies Harare (users)**
Interest	High Quality Communication available for social and business
Desired situation/goals	High Quality Communication Network that provides telecommunication services for an affordable price.
Gap	Low quality communication services
Causes	Old Communication network
Possible solutions	Show the demand for communication services to the government
Resources	Information, campaign for improvements

Table 6: Actor Inhabitant / Companies Harare

Environmentalists / health groups:

Environmentalists are worries about the environment. The communication network will use more energy. The environmentalists will demand that the communication network has to be efficient with energy use.
The health groups are more worried with the health of the inhabitants. Because of the growing communication network there will be more wireless communication. This will increase the use of frequencies, so the radiation will increase. Also the use of mobile phones will increase the radiation at which the inhabitants are being exposed to. This is already a discussion in the other countries, is this is damaging to the health of people. Health care groups will also want to be ensured that the communication network isn't effecting the health of the inhabitant of Harare.

Actor	**Environmentalists / Health Groups**

Interest	Keep the environment intact and create healthy environment for inhabitants of Harare
Desired situation/goals	A improved communication network with no damage to environment and inhabitants health
Gap	The building of the communication network will have a negative impact on the environment, more buildings. The communication will cause more radiation which can be damaging for the health of the inhabitants
Causes	More wireless communication which causes more radiation and more buildings
Possible solutions	Use existing network and components and do research to the damage of wireless communication
Resources	Strikes, Campaigns, information, research

Table 7: Actor Environmentalists / Health Groups

Hackers: They are only interested in abusing the network for criminal purposes.

Actor	**Hackers**
Interest	Earning money with (cyber)crime
Desired situation/goals	Take over the network of Harare. Spread malware on this network. Use network for free.
Gap	Low entrance in the network yet, but there already is some abuse of the mobile phone network
Causes	Network isn't so developed yet, not interesting enough. Network security is working properly.
Possible solutions	Get into the network, try to crack the security.
Resources	Knowledge about software, hack community.

Table 8: Actor Hackers

Interdependencies: resources and salience

Government	Determines the general laws and restrictions to the communication network. They also link the different actors to each other.
Local government	Has local laws and restrictions that determines the specifications of the communication network. They also link the different actors to each other
Telecom manufacturers	Determine the costs of the communication products they want to sell.
External telecom companies	Can determine certain standards concerning communication protocols, network safety etc.
Inhabitants	They can influence the prices of the telecom services. They determine the needs of the new communication network and if it eventually is used. Have lots of informal power on the prices
Environmentalist	Can influence the size of the network and the equipment used.
Hackers	Indirectly determine the level of security by their threat of taking abusing the network.

Table 9: Inventory of resources

Actors	**Important resources**	**Degree of replaceability**	**Dependency**	**Critical actor?**
National Government	Money, authority, legitimacy	limited	High	YES
Local Government	Money, authority, legitimacy	Limited	High	YES
Foreign Telecom Companies	Money, information, position, knowlegde	Great	Low	NO
Telecom manufacturers	Money, information, manpower, knowlegde	Great	Medium	NO
Inhabitants	Informal power,	Limited	High	YES
Environmentalists	Organisation, position	limited	Medium	NO
Hackers	Knowledge	N.A.	Low	NO

Table 10: Resource dependency

It is important to determine which actors involved in the system are critical actors. Critical actors are the actors which cannot be replaced (how does the system work when they are replaced) and where our actor is dependent on. If the replace ability is limited and the dependency is high it is a critical actor. These actors have much influence on the possible solution of the problem this analyze is about. The critical actor are:

- National Government; the government cannot be replaced. The TOAZ always have to deal with this specific actor. The government has the most formal power and is an

actors who will be heavily involved in the project of the telecommunication network in Harare. The TOAZ is dependent on the national government because they can set regulation regarding to the telecom sector.

- Local Government; Same for the local government as for the national government. The only difference is that the local government has more interests in the city of Harare itself. Therefore this actor is even more involved in the process than the national government.
- Inhabitants; TOAZ is dependent on the inhabitants of Harare because they are eventually the ones who pay for the telecom services and who create the demand. The inhabitants demand will eventually result in profits for the telecom operator. Therefore they cannot be replaced because then the telecom operators has no target group to get profits from.

	Dedicated actors		Non-dedicated actors	
	Critical	Non-critical	Critical	Non-critical
Similar / supportive interests and objective	Local Government National Government	Telecom manufacturers		Foreign Telecom Companies
Conflicting interests and objectives	Environmentlists	Hackers	Inhabitants / Companies	

Table 11: Overview table interdependencies

This table shows the dedicated and non-dedicated actors in the system. The dedicated actors are the actors who actively want to participate in the project, and if this interest can influence the project.

Annex F: Scenarios Telecommunication problem Harare:

A scenario analysis is a way of determining what the possible future can look like. The difference between scenario analysis and other methods is that scenario analysis doesn't focuses on predicting the future, scenario analysis describes all plausible and possible future situations. In this way the actor is aware and prepared for all kinds of scenarios. One important note about scenario analysis is that it is not about predicting the future, but describe the possible futures.

To perform an scenario analysis a sequence of steps for the design of contextual scenarios have to be performed. The following steps have to be performed:

1) Identification of the focal issue or decision;
2) Identification of the 'driving forces' (and trends) in the environment;
3) Ranking the 'driving forces' by importance and uncertainty;
4) Creation of scenario logic which is the basis for the scenarios;
5) Detailing the scenarios (writing a storyline);
6) Assessment of implications.

1) As already mentioned in chapter "Problem Fundamentals" the problem definition of the analyse is: *How can the Telecommunication Operators Association of Zimbabwe realize a high quality network in Harare, without making the telecom services unaffordable for the inhabitants/companies at Harare?* The telecommunication network in Harare is outdated and not sufficient to cope with the demand for telecommunication services in Harare. The TOAZ wants to realize a high quality network in Harare to cope with the growing demand, but also to generate new business for the telecom operators. An essential problem in generating new business and a continuation of the telecom operator sector is that the prices of the telecom services should be at an acceptable rate. If the prices for the services are to high, the demand for the telecom services will decrease.

2) The driving forces in the environment are the forces that have an influence on the system diagram and are crucial in determining if an project fails or is an success. When looking at the system diagram (annex C) some important driving forces which influence the system can be identified. These forces are:

- price telecom services; when eventually a new communication network is implemented the telecom services should be of a good quality and reasonable price. When the price of the telecom services is to high this will effect the demand for these services negatively.
- number of subscribers; the more people will sign up for telecom services at the telecom operator this will result in more profits for the telecom operators.
- national/local regulation; governments have lots of influence on the telecom sector in Zimbabwe. They can regulate or implement restrictions in the telecom sector that can influence the telecom market.
- technological development; new telecom services will be developed and also new communication materials (servers, antennes, mobile phones). These developments will influence the demand for certain telecom services but also the capability of the telecom network.
- economic growth; for implementing a high quality communication network high investments are needed. These investments can come from the public or private sector. When the economy of Zimbabwe is in a depression there will be no investors available to invest in the communication network. Also the inhabitant of Harare are less willing to pay for the telecom services because when the economy is in depression this will effect their welfare.
- population growth Harare; this factor has influence on the demand for telecom services. If the population in Harare is growing this will eventually lead to more people demanding the telecom services.

3) Now that the driving forces are identified it is important to select only the driving forces that are of high importance. This can be done by looking at the uncertainty and the impact these driving forces have. In the table below the important driving forces are identified:

Driving Force	**Uncertainty**	**Impact**
Price telecom services	Low	High
Number of subscribers	Low	High
National/local regulation	High	High
Technological development	High	High
Economic growth	High	High
Population growth Harare	Low	Low

Table 12: Driving Forces

The forces that score high on uncertainty and impact can be identified as the most important driving forces. These factors cannot be influenced by the actor involved and have a high impact on the system. The driving forces are:

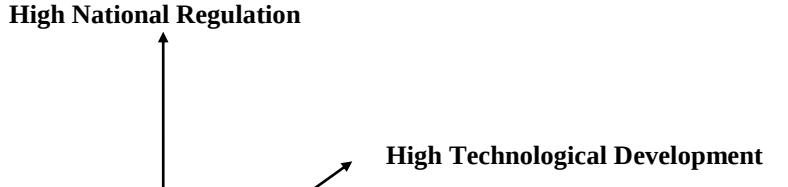
- Economic Growth Zimbabwe; The economic growth of Zimbabwe is something which cannot be influenced by the TOAZ. They can only contribute to the economic growth of the country, but there are many other factors that influence the ecomonic growth. Because it is dependent on many other factors, and it cannot be predicted how the economic growth will develop over time it is uncertain. The economic growth has a high impact because it determines the welfare of the population in Harare and also the willingness for investments.
- Technological Development; Technological development determines the equipment used in and around the communication network. New developments can influence the use and capability of telecom services. Therefore the technological development has a high influence on TOAZ. It determines the technological characteristic of the telecom network now a days and in the future. It is an uncertain factors because it is not sure what the technological developments are over time and what developments will lead to implementations in the communication sector.
- National Regulations Zimbabwe; The government has a high influence on the telecom sector. They can determine boundaries in the telecom sector by means of regulation. They have a lot of formal power, also because one of the telecom operators is governmental owned. The government hasn't shown much interest in the communication sector in the past, and this is also one of the reasons why it is in such a state now a days. Therefore the government has a high impact on the communication sector. It is also a very uncertain factors, because the government of Zimbabwe doesn't negotiate their decisions.

4) Now that the driving forces are determined the scenarios can be developed. With the 3 driving factors a total of 8 scenarios can be developed. Each factor influences a different scenario. First the different scenarios are determined:

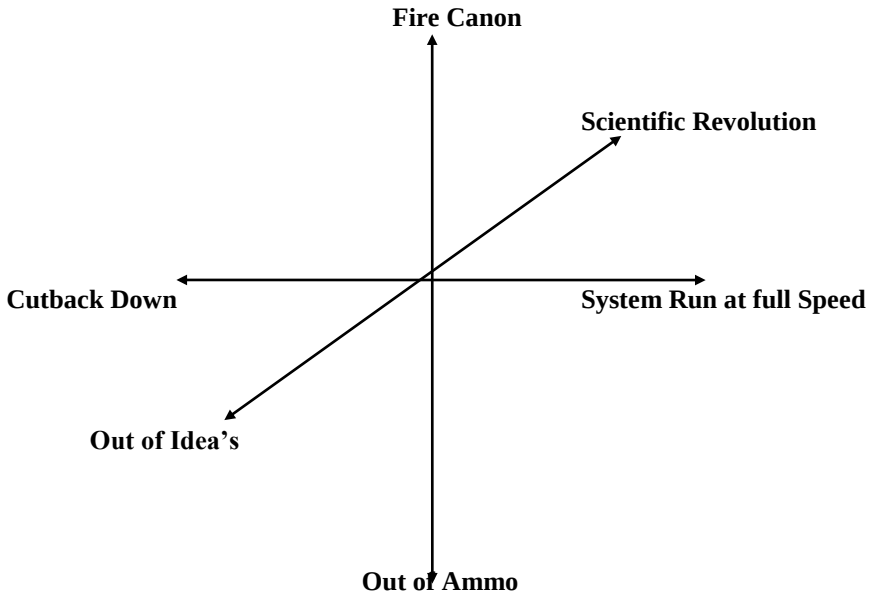
Driving Forces:	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**
Economic Growth Zimbabwe	Low	High	Low	High	Low	High	Low	High
Technological Development	Low	Low	High	High	Low	Low	High	High
National Regulations Zimbabwe	Low	Low	Low	Low	High	High	High	High

Table 13: Different Scenarios

These driving forces are implemented in a 3-axis graph. This represents the different possibilities of the driving forces in the scenarios. The graph looks as follow:



These different scenarios are given a suitable name which represents the driving force in a scenario. Therefore the new graph looks as follow:



Scenario Name	***National Regulation***	***Economic Development***	***Technological Development***
World On Hold	Out of Ammo (low)	Cutback Down (low)	Out of Idea's (low)
Surprisingly Good	Out of Ammo (low)	System Run at Full Speed (high)	Out of Idea's (low)

Brainpower	Out of Ammo (low)	Cutback Down (low)	Scientific Revolution (high)
MoneyMaker	Out of Ammo (low)	System Run at Full Speed (high)	Scientific Revolution (high)
Regulation	Fire Canon (high)	Cutback Down (low)	Out of Idea's (low)
Illustration	Fire Canon (high)	System Run at Full Speed (high)	Out of Idea's (low)
Contradiction	Fire Canon (high)	Cutback Down (low)	Scientific Revolution (high)
Booming Business	Fire Canon (high)	System Run at Full Speed (high)	Scientific Revolution (high)

Table 14: Overview Scenarios

5) The table above showns the different scenario possibilities. Three of the scenarios will be evaluated to get some more insight in the scenarios.

Scenario 1: World on Hold

This scenario represents that the developments in Harare are low. The economic developments are low because of the increasing urbanisation in the city. The welfare of the inhabitants is very low, the unemployment rate is high and the slum development is increasing dramatically. Because of the poor economic conditions the government of Zimbabwe they do something that they have never done before. They reduce the regulation in the hope that the market will resolve the problems by itself. But because the limited role of the government the technological developments are also on a hold. Investments for research are needed but because of the economic situation and the drawn back attitude of the government this is not possible. Without these investments the researches cannot be finished. This also effects the communication network in Harare. Because there are no investors the upgrade of the network is not possible. Also because of the low welfare situation of the inhabitants the demand for telecom services has decreased a lot. Telecom operators are going bankrupted because of this low demand.

Scenario 2: Regulation

The government isn't pleased with the current situation in Zimbabwe. Due to the fact that all the educated people in the country are emigrated to the western countries the economic development is on a hold. Firms are educated people are settling themselves in the western countries because there the can make more profits. Harare is also effected by this. The economic developments in the city are very low. Because of the high regulation of the government of Zimbabwe, they hope to reduce this emigration rate and let them settle a business in their own country. But the high regulations are effecting the innovation. Because of the high regulation the room for innovation decreased, which results in low technological developments. There is no room for investments and the researchers are controlled by the government. This effects the telecom network in Harare. There are no investments possible and the technological developments are low. The government puts more regulation on the quality and technological standard of the network. But because of the low economic and technologic developments this doesn't help the situation.

Scenario 3: Booming Business

The economy in Zimbabwe is booming. A goldmine has been found in an area near Harare. Harare takes this development in its advantage and a lot of new jobs are created in the goldmine. This increases the welfare of the city Harare. Because of the increase in welfare the demand for telecom services is increasing rapidly. Telecom operators are growing in high speeds and receive high profits. Because of this development the telecom operators are capable of investing in a new telecom network, what will eventually lead to more profits for them. Because of western influences the technological developments are also increasing rapidly. Because of the cooperation of Zimbabwe with Europe, Zimbabwe learns and takes over a lot of western technologies. Also in the telecom sector new technological developments are noticed. New mobile phones are available for the consumers, and the

demand for new telecom services are increasing. Because of the rapid increases in economy and technology the government of Zimbabwe feels they are loosing control. To gain more control over the situation they increase their regulation. They want to use their formal power to regulate the telecom sector and gain more profits for themselves of the economic growth by setting higher taxes.

6) The different scenarios describe a possible future. It is not said that these scenarios exactly take place, it is more to get some insight in the future possibilities. Therefore the scenarios give some insight in the future and the actor involved have knowledge about different situations. The actor has a change to adapt to these different scenarios in the future.