

Understanding the drivers of Public Health in Slums

Keywords: Health equity, urbanization, infectious diseases, slum dwellers.

1. Introduction

The sprawling slums areas jeopardize the health of its inhabitants and the surroundings settlements around thereof.

On December 10, 1948 the General Assembly of the United Nations adopted and proclaimed The Human Declaration of Human Rights. The Member countries were then compelled to honour these articles to all inhabitants within their countries; in particular the articles 25 encompassed the Health issue, setting a general commitment from the government towards the inhabitants [1]. Moreover in September 2000, 189 Heads of State adopted the UN Millennium Declaration, setting out goals to be reached by 2015, where three out of the eight goals and eight of the 18 targets relate directly to health [2]. The fulfilment of these targets is influenced by the unstoppable trend to urbanization specially noted in developing countries, generating important challenges for planners and Governments. In 2005, among the 20 mega-cities (cities with more than 10 million residents) in the world, 15 were located in less developed regions [3]. The urbanization pace has passed a demographic milestone; more people live in and around the city than in the rural areas [4].

Along with the urbanization gradient, the health threat is greatest for a billion people living in unhealthy, life-threatening conditions in informal settlements or “slums” [5]. Among the urban poor, contagious diseases are a constant concern, while emerging acute ailments threaten the population at large. Concerted effort is urgently needed to assess health burden and determinants of infectious diseases among slum residents at the community level.

The World Health Organization (WHO) is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards [5]. It works closely with the research sector, provides technical support and assesses the global health.

Insufficient recognition of the human dimension in health and of the need to tailor the health service's response to the specific communes and individual situation represent major shortcomings in the current healthcare systems [6]. This ends up in health inequality and misunderstanding of values and perception of the slum dwellers enhance the probability of outbreak of infectious diseases.

The present document covers the problem exploration in chapter 2. In chapter 3, a plan of action with the reformulation of the problem is presented. The information is supported by an extended reference listed in chapter 4. The annexes encompass a description of the assumption and some methods to give insight of the complex problem.

2. Problem exploration

2.1. System delineation

The health issue is considered from the WHO standpoint, who is interested in “improve the people’s health everywhere”. This interest encompasses a wide range of societal sectors in which the focus of the following papers is the most prone sector where the infectious diseases can more easily spread among them, i.e. the slum dwellers in an urban environment. This consideration is based on grounds that the conditions on slums directly and indirectly modify the health status of the urban inhabitants.

The health problem undertakes mental, infectious and social diseases. From which the infectious diseases is the priority, especially in low-income countries where in recent years, many of the central government health programs targets this field to meet the MDGs [2].

The geographical demarcation is the developing countries, in particular those ones who experience a high urbanization rate where a big societal difference between citizens and slum dwellers are evident. The perception of the problem and the system boundaries are regarded in Annex B. The present document tries to cover a wide range of actors (see Annex E) in order to design methods to support problem formulation (see Annex A, B, C, D and F).

2.2. Health transition trajectory

The health transition trajectory regards the different way to enhance the public health in slums.

The slums are characterized by a lack of basic municipal services (e.g. water, sanitation, and waste recollection), school, clinics and hospitals [5]. This situation jeopardize the health inside the slums, and affect indirectly to the rest of the cities which are next by or around thereof. There exist evidently a clear difference between the slums’ condition and the city’s condition, however there does not exist a specific data on the slums.

The transition from the current unhealthy situation towards a better (subjective to the observer) is a continuous effort. When shall we say we reach this optimal state? The answer is uncertain and will depend on the comparison of acceptable human requirements. The diverse nature of slums creates the latent existence of them. The aim in the present paper is to tackle the health perspective, hence it could be used some MDGs as references when measuring the infectious diseases. This constant improvement need to be backed up with sustainable programs which decreases the problem in the short and long term. In 2015 the MDGs the 189 countries which signed the agreement, will be assessed regarding their progress to meet the targets. This step most probably will be followed by other targets regarding among other the slum upgrading covering especially health issues.

The government have being aware of the slums proliferation long time ago, however their tactics to face the slums problem have being diverse. These tactics influenced directly in the health status within these settlements.

One response to prevent augmenting urban poverty involved the relocation of residents to resettlement sites that were usually outside of the city [8]. A second approach was clearance and redevelopment. It meant temporarily moving the slum residents, clearing the land and building new housing for them on the same site [8].

Although this used tactics solved the problem in the short term, they failed in the long term. They were not accompanied with education and mostly lacked of sense of ownership, i.e. the slum dweller did not feel as their possession the new amenities (because it was for free). This tactics encountered many problems, like sewerage systems were blocked because dwellers used as a rubbish bin; destroying the social network which is one of the determinants of health.

Therefore instead of tearing down houses or relocating people, Slum Upgrading could be one of the appropriate strategies to solve the slum problem (and the public health in slums). Slum Upgrading consists of improving the existing infrastructure, e.g. water reticulation, sanitation, storm drainage and electricity, up to a satisfactory standard [8] along with a physical, social, economic and environmental improvements undertaken with the commitment among citizens, community groups

businesses and local governments. This sequence of actions has to engage slum dwellers themselves that has the interest in the upgrading by taking initiative to form a society to promote the upgrading, like solid waste collection with its positive impact on health. The aim of such project is improvement of the actual situation in term of health and living environment without displacing the people. Experience has shown that slum upgrading projects are associated with social and economic benefits that are particularly high. For example in a recently upgraded area of El Mezquital, Guatemala, infant mortality rates fell by 90 percent and crime by 43 percent. [9]. The benefit of this strategy is aimed to address equity gaps in health that can be defined with many determinants which among them are access to safe water and hygienic sanitation.

2.3. Actor and network analysis

The public health problem is a complex multi-actor problem. The WHO is not the only or an isolated actor in this matter. He is part of an intertwined network, in which many actors have different interest or despite their common interest, their opinion the problem, the cause and the solution is different (see Annex E). The main actors who directly or indirectly influence the problems situation were identified and grouped by their function that they play in the public health problem, namely providers, payers, consumers and employers.

The relation and the actors involved in the decision making process is dynamic. The power that they exert over the others may change in time and new actors could appear caused by some dramatic event, e.g. the UN was founded as a successor of the League of Nations which was considered to be ineffective to prevent World War II [i1].

Primarily there exist hierarchical relationships among actors, in which the WHO, a specialized agency of the United Nations (UN) that acts as a coordinating authority on international public health [i2], through norms and standards steers the Pharmacological industry and the Research and Development in Health issues actors. The WHO enthusiastic on respecting the Human Rights, through the Millennium Development Goals (MDGs), oversees it implementation in the member's states of the UN (see Figure E.1).

The Citizens and Local Government could form an alliance against the process given that they share to some extent, the same perception of the causes of the problem. Therefore the WHO should try to integrate and internalize the Slum Dwellers health issue into the objectives of these actors through a multi-issue agenda (see Section 2.4). Although the Pharmacological industry has the blocking power, the WHO has the hierarchy power to impose medicine policies to ensure the availability, affordability and rational use of essential medicines.

The actor analysis and the awareness that WHO need some means to meet his target from other actors (see Annex D), result in a set of joint criteria where the main critical actors, namely the Hospitals, clinics and practitioners, Research and Development in Health issues, Slum dwellers, Ministry of Health, Citizens and the Local Government can reflect its interest in some points (see Annex A). By working with these set of criteria, the research method will be accepted and interesting for all the actors (see Section 3.4).

2.4. Multi-issue agenda

If the approach were one-issue decision making, i.e. the public health in slums, the common question from the different actors (see table E.1) would be 'What's in it for me? Probably many actors would find "nothing" as a response, for example the citizens who see the slum dwellers as the problem cause would not have any incentive to treat the health of the problem. Therefore creating several issues on the agenda makes attractive for actors to participate in the decision making process [7].

The decision making process should attract the different actors with the expectation that they will gain something, hence creation of a win-win situation. For instance the local government should be aware that working with the slums, will in the medium-term provide them of additional labour force.

This could attract different industries to invest in factories, increasing the funds raised by the local governments.

The agenda should raise the complexity of the problem which leads to the actor cooperation in health matters in slums. Some proposals that might be covered are:

- Economic growth using the slum dwellers as working force, creating economies of scale.
- Economical signal to the private sector to invest in Public-Private Partnership (PPP) by increasing the rate of return or giving more freedom to manage the infrastructures.
- Funds to local governments to invest in infrastructures in slums.
- Allocation of fund in Research and Development regarding health issues.
- Incentives to promote the industry around and inside the slums by decreasing the industrial taxes.
- Creation of educational centres such as elementary schools, vocational schools which impart skills to perform as a carpenter, plumber and so on.
- Increasing the rural health care system involving the citizens and the slum dwellers.

Another aspect in the multi-issue approach is it changes the coalition against the decision making package. It is foreseen an alliance between Citizens and Local Government (see Annex E) that will probably block the process. Within a multi-issue framework, future coupling among the actors with the Slum Dwellers will be preserved, resulting in cooperative behaviour.

The actors will moderately behave when dealing with the health issue in slums because they do not want to harm the future cooperation. These actors will respect the other interests giving and taking in goals.

The actors who do not agree will be seen as the one who failed; hence a great incentive to approve the public health in slums will be generated in a multi-issue approach.

2.5. Uncertainty about public health in slums' problem

There exist many uncertain factors which influence the public health in slums problem (see Section F). These factors cannot be controlled given that they depend on many other factors, situations and they do not follow a rule. Such factors are denominated as "Contextual Factor".

There exist great uncertainties in the degree of "**Investment**" in the slum public health system. Different countries have different politics on the wage of investment in these areas, moreover the opinion of the percentage of funds in health change with politic parties, history, country Gross Domestic Product GDP and so on. Most of the times the private sector is called to invest through Public-Private Partnership (PPP) or rich countries donate poor countries through Non Profit Organization (NPOs) but the variable situation of the markets and the random economical situation, affects this factor.

Unknown illness or virus mutations historically have appeared, killing many inhabitants around the world. Their prediction is impossible, as well the effect on human society. Epidemics and pandemics can take place suddenly in any region in the world. This environmental conditions are measured after they outbreak by WHO indicator, named "**Phases**", which go from 1 to 6. Phases 1-3 indicates predominantly animal infectious, few human infections. Phase 4 implies sustained human to human transmission. Phase 5-6 specify the existence of a pandemic, a widespread human infection. Post phases involve possibility of recurrent events and disease at seasonal levels [i3].

The Citizens' reaction is measured to the policies launch by the government can be assessed just once the policy is being implemented. There cannot be a benchmarking or comparison of reaction because the "**Support**" is a dynamic state that depends of state of the economy, values, background, and so on. Though these factors can be assessed, no rule can be applied to foresee the reaction of humans.

2.6. Alternative solution

Previous analysis has been focused only on the actors related to health issues; however there are other alternatives that affect other actors (see Annex E.) which must be considered.

In the health slum issues alternative strategies were proposed that were effective in a short term but not in a long term.

- 1) Slum demolition and relocation of slum population was often used as a solution for the improvement of health in slum areas. This strategy cannot work as it destroys the social network of the slum dwellers and is only moving the problem to other areas instead of treating the real problem that encompasses socioeconomic factors and more [9].
- 2) Slum upgrading appeared to be considerably cheaper than other alternatives but these initiatives exist in isolation from both local government and citizens. Local Government did not follow through with services, communities did not maintain the facilities and governance structure disappeared once the international experts were gone [10].
- 3) Urban poor through urban primary health care is a project that provides primary health care to slum population while reporting and providing special and targeted interventions to meet health and social needs at the primary level. Hence this initiative must be followed in alliance with strengthening the health equity with the internalization of the health slum issues in the agenda of local government.

With the support of the previous considerations a new problem statement becomes: **How can we maintain a sustainable health of slum dwellers in accordance with the MDGs targets without increasing social inequalities and spatial segregation in urban cities?**

3. Plan of action

3.1. Reformulation of the problem

Non access to safe facilities that leads to the creation of infectious diseases is not the real problem of the slum urban population.

Indeed, slums settlements tend to be fetid and diseases ridden due to the bad physical conditions where they live. Hence if we consider it as the main problem, we would narrow the spectrum of alternatives, rather slums are the consequences of urban poverty, social exclusion and inappropriate government policies that are not internalizing the problem. The exclusion from the attribute of urban life that remain for the privileged citizens that have access to secure good quality of housing, good education, health services and adequate incomes proper to a full citizenship.

The importance of inclusion of slum dwellers as part of the urban population with access to proper facilities and equity in health is a key factor that reduces the infectious diseases cases. One of the criterion that can be considered as an indicator of slum health is the Health Equity Index. This index needs data that are lacking in the slum urban population and many other indicators that differ among countries. Hence, the HEI is a good assessment of disparities among urban population as it is assessed by health outcomes indicators and health determinant indicators. These determinants should be researched.

3.2. Involvement of important actors

It is important to acknowledge with option they will support based on historical behaviour and their interest (see Annex E). Therefore the most important actors should be closely consulted, in particular: (a) Hospitals, clinics and practitioners, (b) Research and Development in Health issues, (c) Slum dwellers and (d) Ministry of Health. The influence of these actors in the decision making process is:

- (a) This actor directly applies the treatments, medicines developed by the (b) to the slum dweller. Some encountered problem is the rules when providing health care is that the patients need to have some registration in the surrounding region, however frequently slum dwellers do have neither fixed residence nor legal documentation. The policy formulation must contemplate its perspective of the best way to treat the patients.

(b) The effectiveness how infectious diseases are prevented and treated depends on this actor. The understanding and the insight of the best way to tackle depends largely in the amount of funds. A policy should involve this sector, taking into account their opinion especially prevent infectious diseases in slums before they are spread in the area.

(c) The characteristics of the slum dwellers in not constant. The slums conglomerate dweller coming from different sectors of the society, e.g. people from the city who can afford the pay a dwelling, rural inhabitant who come to the city with the ideas to find better quality of life, immigrants from different regions or countries, and so forth. This situation is boosted by the diverse moral, religion and values of the slum dweller.

The success of the policies will rely upon the effect on this actor, which must be fully understood to formulate a suited policy in each particular slum case.

(d) Because its interest is to provide heal to all the inhabitants of the country, urbanization gives him an advantage. Provide health care in rural areas in developing countries is a real challenge because the atomized distribution of the settlements, difficult access, lack of practitioners willing to work in rural areas and so on. Hence they will support the policies to enhance the health in the slums more enthusiastically than policies to enhance the health in rural areas.

3.3. Reduction of uncertainty in knowledge

There are still many factors of uncertainty (See Annex C) that cause health inequalities between citizens and slum of the urban area. Therefore research questions can be formulated to bridge these gaps. The main question is:

a) What are the key data and research needs that must be addressed for the determinants of Health Equity Index (HEI)? From this main question lie other research questions, namely:

b) What are the determinants of infectious diseases in slum population?

c) What are the underlying political, economic, and social forces that create and perpetuate health inequality in slum population?

a) Many research [US and Canada] introduce the HEI as a main driver to reduce the health disparities between slums and citizens in adverse health status and outcomes through social, economic, environmental and political processes. The measurement of key variables in HEI can provide quantitative techniques for interpreting and presenting health equity data and the application of these techniques in the analysis of equity in health care utilization and health care spending [9].

b) Little is known about the determinants of illnesses in slum communities that give rise to infectious diseases not likely to be detected by the formal sector health services until they result in complications or deaths. The importance of knowing these determinants leads to alternatives that can reduce the burden of infectious diseases in slums. In fact, in many countries, most diseases or mortality information on slum dwellers is largely based on clinic, hospital, or national mortality registry data. This type of information is not sufficient to plan health care expenditures, and grossly underestimates and limits the ability of officials to detect health threats or misdirects the health care resource allocation needs.

c) Health by definition is determined by social and physical environment, hence these determinants are included within a global scheme that incorporate politics, economic and culture, resulting in health inequality and consequently in health status of slum dwellers.

3.4. Research methods

In order to answer the main research question a) referred in Section 3.1, a Delphi methodology can be used which is based on a multi-round survey that permits a diverse panel of health and related health people, selected for their expertise to interact on the definition of the HEI. Policy Delphi is a very flexible methodology as it combines both quantitative and qualitative elements and can be adapted to suit different research objectives [11].

The questions b) can be assessed by a survey (questionnaires, interviews including on site ones, etc) and surveillance method. Continuous collection of information by semester for the surveillance is needed to assess the changes on the health while related to infectious diseases.

The questions d) can be assessed by an impact analysis. The model is implemented with the following properties:

- Type of model: System Dynamics (Migration dynamics and poverty in informal settlement Dynamic interaction between different key forces and health of slum dwellers as a result of negative and positive feedback loops)
- Time: Dynamic (The input variables change over time); Continuous (demographic and health events).
- Spatial: Same slum households on megacities and developing countries in urban areas
- Aggregation: High (key factors like social, political, economical and physical are considered)
- Required data: All the factors used in Annex C, including socio-economic variables (marriage, education, livelihood, and birth history information, social network, social capital and social support, household income [12]), health variables (infectious disease cases, morbidity, pregnancy related morbidity, vaccination, etc), cultural variables, demographic variables (births, deaths and migration, etc.), political variables (municipal services, regulated activities that affect health, government policies [12]) as well as housing characteristics.
- Knowledge: The model is supported by the social and medicine science. Rich data available on slums and health issues. Lack of data in the slum urban area, as only data in the urban population as a whole are available, however these data can be obtained as the same way for the urban population, thus focusing only on the slum urban population
- Process: Elaborated, Modeling expert. Model is intended to be used for plan of actions and gain insight.

The advantage of the combination of system dynamics with impact method enables evaluating the impact of targeted interventions designed to improve the health status and thus health inequity of the urban slum population. The outcomes of the System dynamics will list the uncertain factors on which policies will be implemented and hence impact on health inequity and consequently on health status of slum population. The outcome of this research method can be used in measuring the Health Equity Index.

3.5. Conclusion

A further study is recommended to research to answer the knowledge gaps. The analysis involves many different actors with different interest. Especially the dedicated actors will play an important role. This study will give important insides about the causes of health inequality to give a clear insight to the World Health Organization (WHO) of public health in slums.

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Annex A – Objective tree

The interest the World Health Organization (WHO) is to “Improve people’s health everywhere”, however as it was stated in Section 2.1, the scope of this complex problem will be focused in the urban areas which covers the slum population. Therefore the superior objective is “High quality urban public health”. This encompasses the Slum dwellers and the Citizens (division done to expose the difference in health equity). The branch regarding the slum dweller will be further regarded. Moreover, as it was stated in Section 3.3, the healthy equity should be estimated to accurately assess problem context. The sustainable slum dwellers health objective covers the investment in amenities, the existence of water and sanitation infrastructure and the diseases which jeopardize the inhabitant. The investment in amenities is regarded as the funds allocation in healthcare facilities (hospitals, clinics) and the proper specialized treatment provided involving research of the medicines used to safeguard the health of the patients.

With respect the diseases; they are divided into mental, social and infectious diseases. However the infectious diseases will be covered giving its importance in the system (see Section 2.1). The WHO objective tree is depicted in Figure A.1.

The actor analysis (see Annex E) and the means-end diagram (see Annex D) reveals that the WHO needs some means that other actors possess to meet its superior objective. The objectives of the important actors, which will be involved in the decision making process (see Section 3.2), influence the objective tree. This will end up in a joint objective tree where the important actors feel interest in some points taken into account.

The Hospitals, clinics and practitioner; and the Research and Development in Health issues actor are highly interested in the score of the investment per slum sector. Because the greater the comfort, i.e. amenities, the more the investment in the well-being of the slum dwellers. This is investment, among others, in research to tackle the infectious diseases, and in the healthcare facilities and practitioners.

The slum dwellers will be interest in the score of investment per slum sector and in number of water and sanitation infrastructure per slum dweller.

The Ministry of Health is keen on the number of Millennium Development Goals (MDGs) that are met, because of the commitment to meet this target in 2015.

The WHO besides previous criteria exposed, is interest in the value of the Health equity. The value will put into context the real slum situation (see Section 3.3).

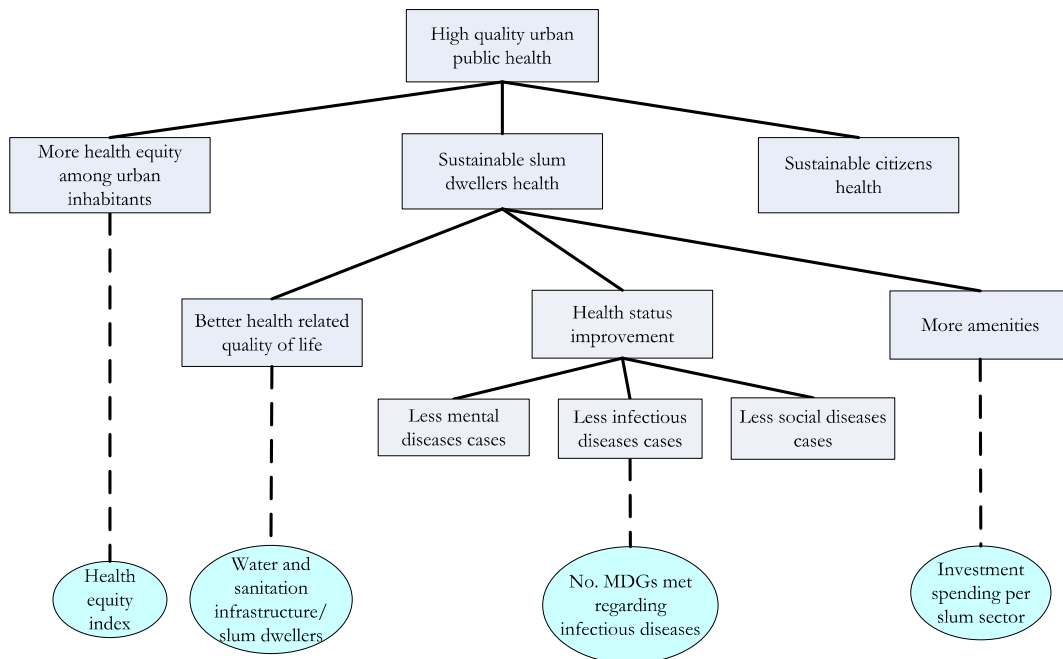
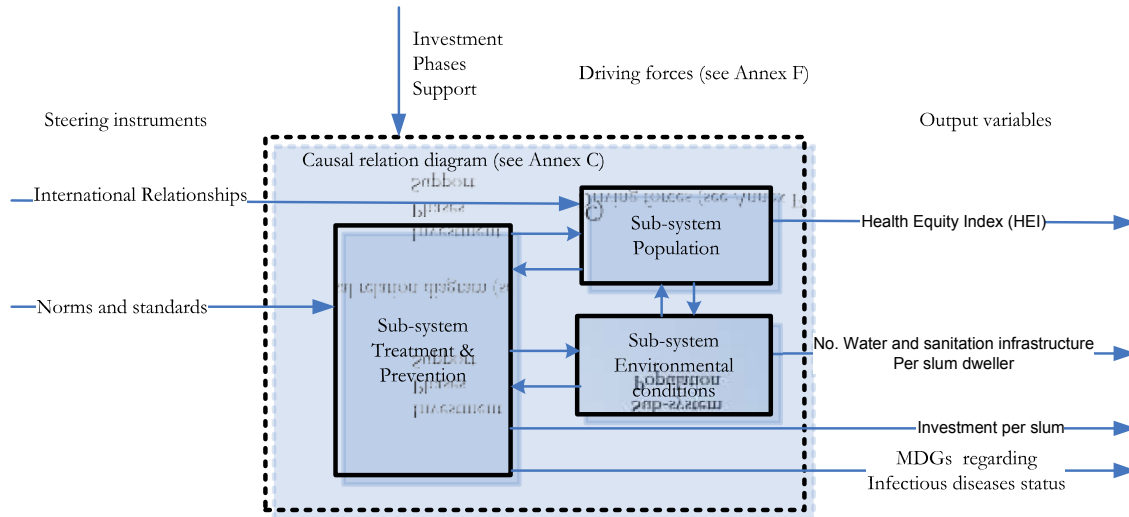


Figure A.1: Objective tree of the World Health Organization (WHO).

Annex B – System diagram

The system below is a delineation of the problem perception with its steering instruments of the problem owner acquired from the means-end diagram (see Annex D), the contextual factors and output variables that are criteria.



Legend

Dashed line = system boundary of pollution problem in Santiago

Solid line = system boundary of subsystems described in Annex C

The system does not include the political and economical factors that might prevail in the health issues. The system analysis has come up with factors related to the actors (see Annex E) as they have influence on the decision-making processes.

Annex C – Causal relation diagram

The subsystems schemed in the previous section are detailed in this annex. The factors that are included in a black circle are the common factors of the subsystems.

An arrow from factor A to B means that A has a causal influence on B, in a sense of if factor A changes, as a result, factor B changes.

A link between two factors A and B is considered positive (+) when:

- An increase in factor A causes B to rise above what it would have been otherwise;
- A decrease in factor A causes B to fall below what it would have been otherwise.

A link between two factors A and B is considered negative (-) when:

- An increase in factor A causes B to fall below what it would have been otherwise;
- A decrease in factor A causes B to rise above what it would have been otherwise.

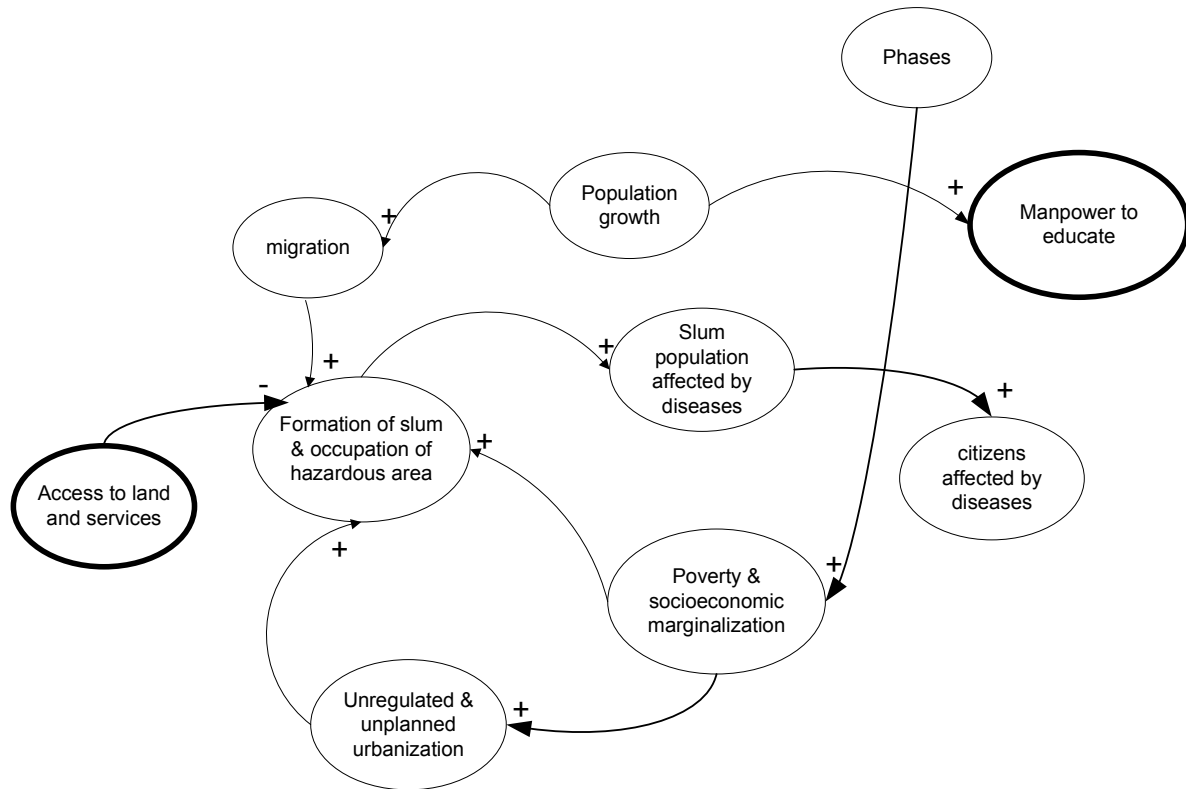


Figure 1. Causal relations diagram subsystem “Population”

The inputs of this causal relation diagram “population” are population growth and phases.

The outputs are Manpower to educate and citizens affected by diseases. In this relation diagram we can see the causal relations between slums and citizens.

The poverty and socioeconomic marginalization is measured by HEI index.

Factors with bold circle are part of other subsystems.

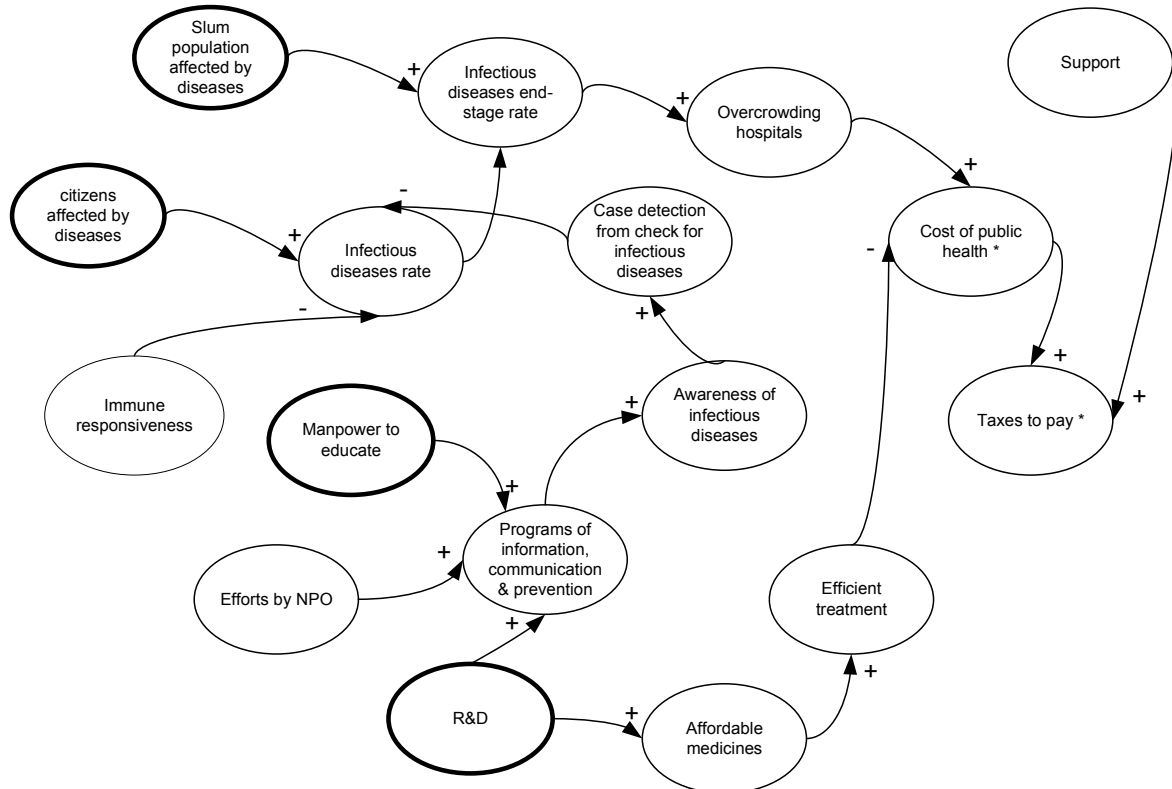


Figure 2. Causal relations diagram subsystem “Treatment & Prevention”

Input: Manpower to educate, efforts by NPO

Outputs: Infectious diseases rate

Factors with * are not related to the problem owner.

From this causal relation, we can see that it is important to have the support of the citizens that are willing or not to pay for taxes to internalize the slum as problem of the urban city.

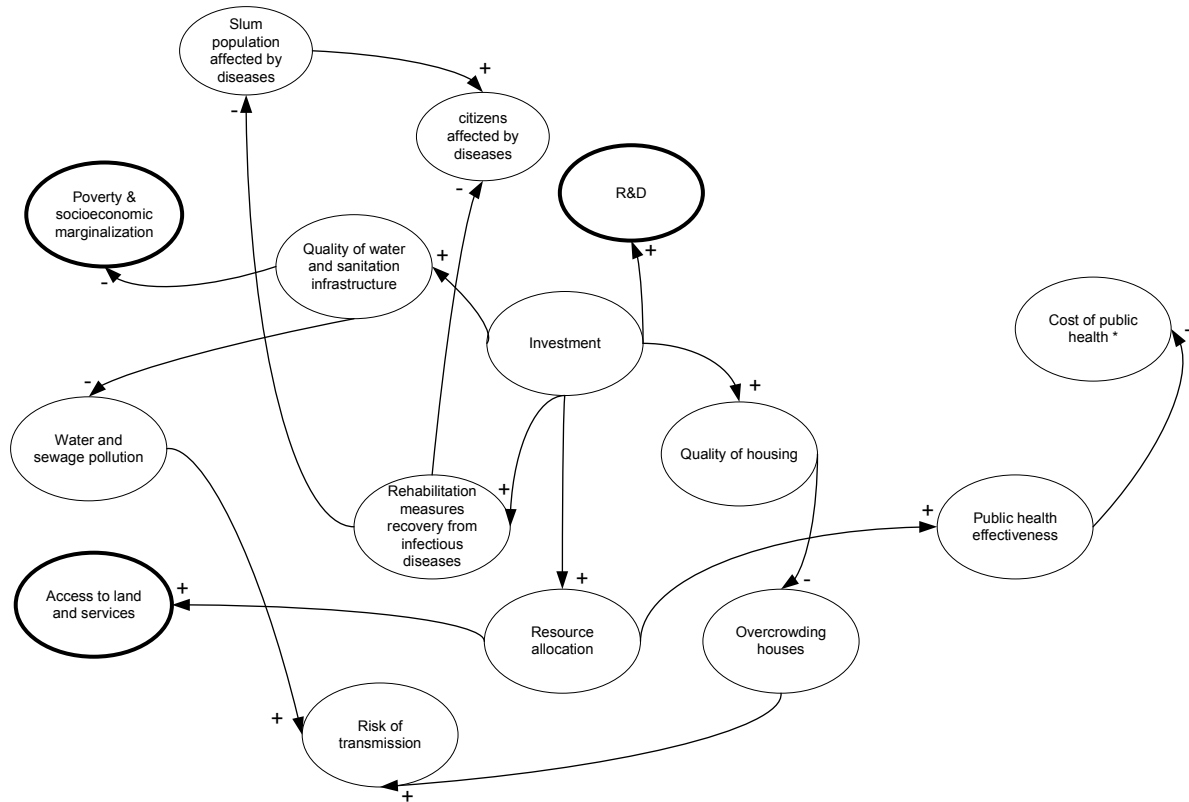


Figure 3. Causal relations diagram subsystem “Environment”

This causal diagram deals with the physical condition of the slum dwellers and the link with any investment reallocated to them.

Input: Investment

Outputs: Effectiveness of public health, Resource allocation (investments done on water and sanitation infrastructure per slum dwellers and other services to improve the well-being)

Annex D – Means-end diagram

The means-end diagram illustrates the necessary means to meet the WHO’s main objective, see Figure D.1. The objective “Sustainable health slum dwellers” relates to the objective identified in Annex A. The World Health Organization (WHO) means are indicated in blue boxes. The other actors’ means (see Annex E) are shown in cyan boxes.

It is concluded that in order to successfully meet the objective, the WHO needs the involvement and the cooperation actors (see Section 3.2).

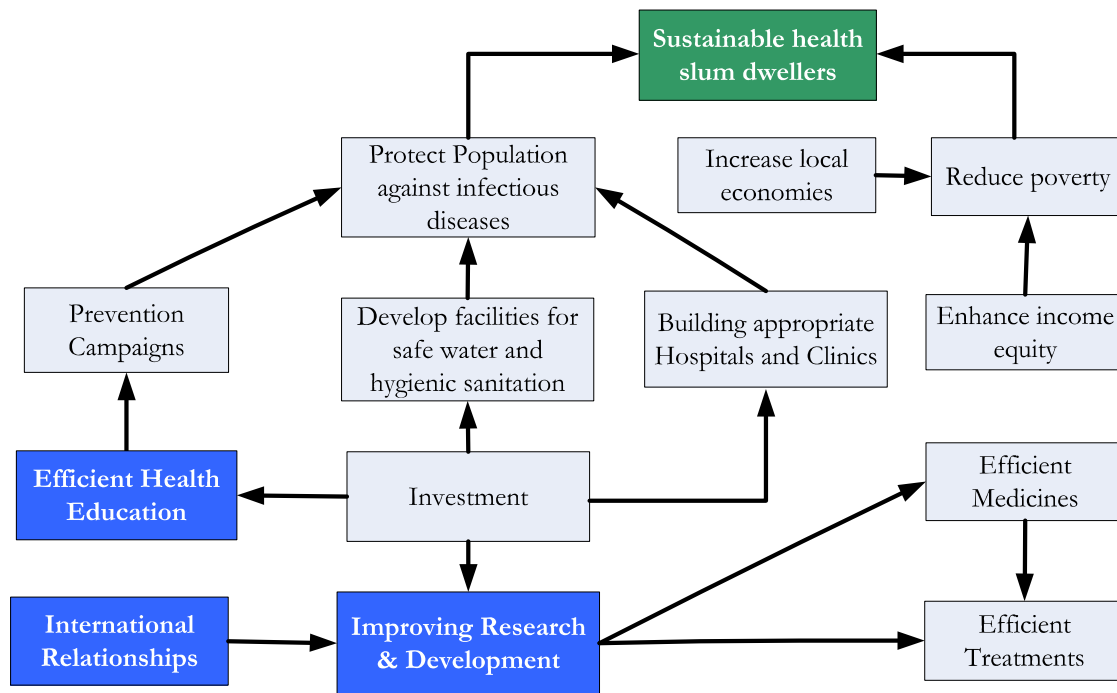


Figure D.1: Means-end diagram of the World Health Organization (WHO).

Annex E – Actor-network analysis

The health problem encompasses a great amount of actors; these actors are highly interconnected creating a complex network with many redundancy relations. The dynamic relation among the actors and their resources will influence the course of solution. The dependency on actors will play an important input to state a suited strategy (see Section 2.5) involving the critical actors while informing non-critical actors (see Section 3.2).

The fundamental objective of the slum dwellers is the “quality of life”, which covers a wide range of aspects, where WHO cares for the health part, in other words his interest is to “improve health and well-being in the country”. However many other actors might have as interest the quality of life, they might tend to exclude other actors e.g. local authorities demolished slums dwelling without citizen rejection [f].

The main actors who directly or indirectly influence the problems situation were identified based on the participation inside the health system.

These groups of actors are (1) Providers, (2) Financers, (3) Consumers and (4) Employers.

- (1) Tend to view the health problem in a technical sense, with accuracy of diagnosis, appropriateness of therapy, health aspects information, diseases comprehension and so forth. Though the interest among them is not the same. Much public health care today is organized around them however they put little attention to understanding of what is important for their consumers.

Within this set we find different actors, namely the Hospitals clinics and practitioners, Health educators, Pharmacological industry and Research and Development (R&D) in Health issues.

- (2) Provide monetary resources to be invested in health projects. Their concern is to obtain sustainable infrastructures and the best utilization of them by the providers, though their interest vary among them.

Within this set we find different actors, namely the Ministry of finance, Non-profit organizations (NPOs) and Private borrowers.

- (3) The actors in this group have a common interest, “better quality of life” nevertheless the citizens feel that an increase in the welfare of the slums (by investing in infrastructure) will affect their particular welfare because they will assume the cost through taxes given that the slum dwellers do not pay taxes, at least in the short term.

Within this set we find different actors, namely the Slum Dwellers and Citizens.

- (4) Directly decide the health care system which will be carried on with the finance of the Financers.

Within this set we find different actors, namely the World Health Organization (WHO), Ministry of Health, Ministry of infrastructure and the Local Government.

In the figure E.1 it is depicted the position and relation of the actors previously identified. Where the World Health Organization (WHO) has the hierarchy power over the Pharmacological industry by setting the medicine policy on the production of the medicines, defining which vaccines and medicines should be produced giving the burden of diseases and its possible spread around the humans. As well the WHO establishes the research agenda that the research community should follow [i5] to develop accurate medicine to tackle the illness. Other WHO's function is to set the health norms, with which the Health Educators establish their tactics to inform the inhabitant through campaigns about health topics, such as hygiene, proper condom use, maternity education and so forth. Moreover the WHO is empowered with the support of the United Nations (UN) to coordinate on international public health with Ministries of health through the Millennium Development Goals (MDGs).

The Research and Development in Health issues actor, coordinates its improvement with the Pharmacological Industry to jointly overcome to offer accurate medicines to treat and prevent diseases.

The Central Government devoid of monetary resources and management issues is eager to create partnerships with the private sector, for example in public-private partnerships (PPP). The private sector is enthusiastic to invest in infrastructure so as to generate attractive return on its investments [i6]. The

Central Government has more power than the Local Government; mostly the latter are partly or wholly funded and steered by the former through formal authority.

The Local Government impose laws and standardization of procedure to the Hospitals, Clinics and practitioners through the legislation setting out the modus operandi in some extent to treat the inhabitants in the region. The treatment that the Hospitals, Clinics and Practitioners provide to the inhabitants uses the medicine supplied by the Pharmacological Industry.

The Non-Profit Organizations (NPOs) administrates the money from donation and charity investing in Health education campaigns. As well with the construction and provision of basic amenities such as water supply, waste water recollection, toilets, rubbish recollection and so forth. Although this task should be performed by the Local Authorities, generally the later actor neglects the slums as their problem.

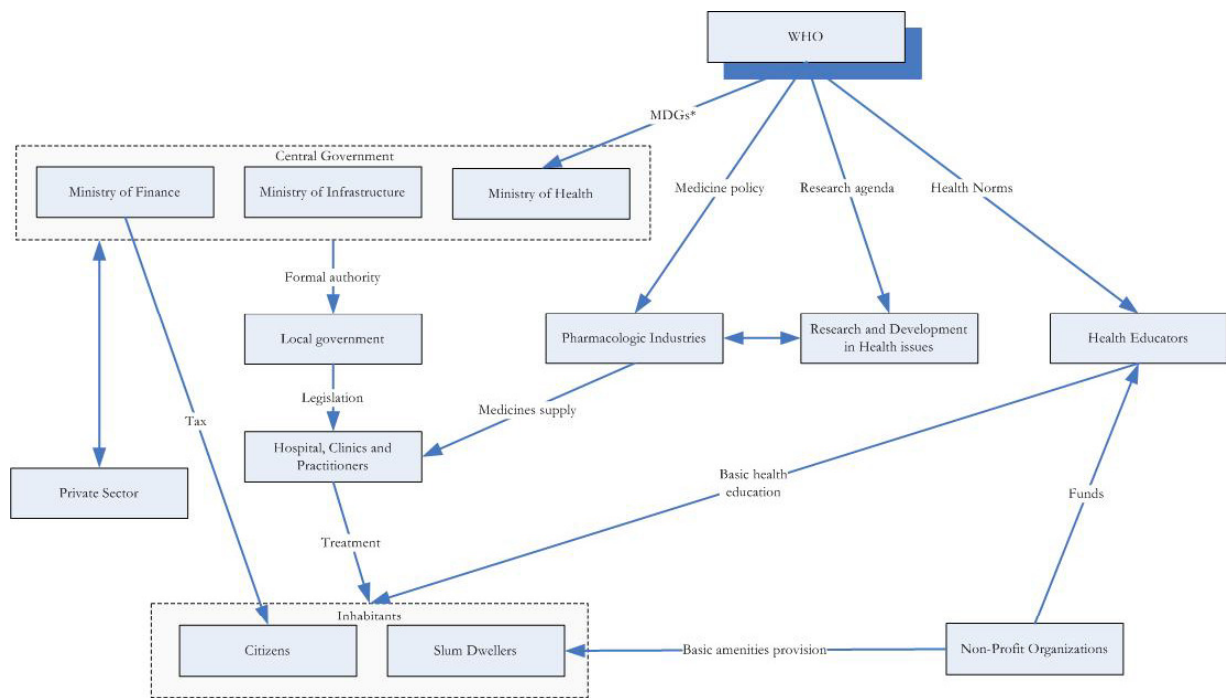


Figure E.1: Formal chart

Legend: single-side arrows indicate a hierarchical relationship; two-sided arrows indicate formal relationship.

*MDGs stand for Millennium Development Goals.

The table E.1 summarized the different problem formulation of each actor. This will expose the possibility to couple actors because they share an interest. Additionally the actors values and desires will be putted into context so as WHO takes into account when policies are been formulated (see Section 2.4).

Table E.1: Overview of problem formulation of actors.

Actors	Interest	Desired situation /objectives	Existing or expected situation/ gap	Causes	Possibilities to influence/ course of solution
World Health Organization (WHO)	Improve people's health everywhere	-Decreasing the infectious diseases cases in slums	-Increasing infectious diseases cases -Low slum dwellers participation	-Low number of prevention programs -Not enough research	-Incentive the participation and awareness of the actors -Increase the

			-Low investment in Health system	-Low allocation of funds into slums healthcare systems	research programs -Monitor the slum health improvement
Hospitals, clinics and practitioners	-Provide specialized patient treatment	-Appropriate resource utilization to cope with patients	-Overcrowded facilities and/or insufficient practitioners to treat sprawling patients	-Lack of illness prevention -Not enough healthcare facilities	-More health slum prevention programs -Enlarge healthcare system -Increase number of practitioners
Pharmacological industry	-High profit -Ensure future medicine production	-More medicine sales -More medicine dependency -Lower medicine production cost	-Slum dwellers cannot afford to buy the medicines	-Low slum dwellers' purchase power -No medicine development	-Medicine subsidy by the public and/or the private sector -Increase the research
Research and Development in Health issues	-Develop accurate technology and treatments	-More financing -More research demand	-Lack of finance to meet research targets -Low amount of infectious disease research programs	-Lack of financial investment	-Subsidy by the public and/or the private sector
Health educators	-High hygiene education impact on society	-Increase inhabitants information -More prevention programs	-Low slum dwellers participation -Low financing of projects	-Lack of slum dwellers trust -No sufficient finance	-Implicate slum dwellers in the projects as mediators -Partnership with NPO
Ministry of finance	-Management of the government's treasury	-Invest in sustained healthcare system	-Budget deficit	-Large sunk cost on previous health projects	-Public Private Partnership projects
Non-profit organizations (NPOs)	Better quality of life for all dwellers	-Extent healthcare access by decreasing the infectious diseases cases -Administrate the donations in healthcare projects	-Low slums dwellers' benefits from donation -Low or none slum dweller participation in prevention programs	-Lack of government concern -Lack of slum dwellers trust -No sufficient donation	-Increase the partnership with third organizations
Private Sector	High rate of return	-More investment in infrastructure, research and educational programs	-Low amount of healthcare infrastructure	-Economic situation -Not enough government budget	-Public Private Partnership projects
Slum dwellers	Better quality of live	-Low or no cost of healthcare system and medicine -Health equity	-Non access to public health system -Low purchase power	-Lack of government concern -Unequal welfare distribution	-Slum upgrading -Create public healthcare infrastructure network access*
Citizens	Better quality	-Lower amount of	-Health threaten	-Lack of slum	-Slum relocation

	of life	slum dwellers -Fair healthcare cost -Lower taxes associated with health	by slum dwellers -Slum dwellers health subsidy	dwellers hygiene -Slum dwellers uneducated	
Ministry of Health	Improve health and well-being in the country	-Enlarge the public health infrastructure network ** -More public health facilities and practitioners	-Unprepared public health systems to cope with the sprawling slums	- Sprawling slum dwellers -Low number of prevention programs -Not enough government budget	-More health slum prevention programs -Public Private Partnership projects
Local Government	Improve health and well-being in its region	-Lower amount of slum dwellers	-Citizens' health threaten by slum dwellers -Overcrowded facilities and/or insufficient practitioners to treat sprawling patients	-Lack of slum dwellers hygiene -Slum dwellers uneducated - Sprawling slum dwellers	-Slum relocation
Ministry of infrastructure	High quality and well design public infrastructures	-Enlarge the public health infrastructure network * -Sustained public health infrastructures	Low investment in public health infrastructures	Low allocation of funds into health sector Sprawling slum dwellers	-Public Private Partnership projects

* Water and sewerage coverage; amount of hospitals and clinics

Based on the resources table E.2 describes the dependency between the WHO and the actors. The dependency will be measured based on the replaceability of the actors and the importance of the resources to meet the objective of the WHO. The critical actors are those who cannot be ignored due to their “power of realization” or for their “blocking power”. The Local authorities and Citizens are considered as critical giving their blocking power.

Table E.2: Overview determination of critical and non-critical actors.

Actors	Important resources	Degree of replaceability	Dependency	Critical actor?
World Health Organization (WHO)	-NATO's support -Authority over R&D and pharmacological industry	Irreplaceable	High	Yes
Hospitals, clinics and practitioners	-Knowledge and expertise regarding health treatments	Irreplaceable	High	Yes
Pharmacological industry	-Knowledge to produce medicines	Irreplaceable	High	Yes
Research and Development in Health issues	-Knowledge of accurate medicine for each disease	Irreplaceable	High	Yes
Health educators	-Information and communication among inhabitants	Irreplaceable	Medium	Yes
Ministry of finance	-Money investment decision	Replaceable	Limited	No
Citizens	-Money contribution to sustain health system	Irreplaceable	High	Yes

Non-profit organizations (NPOs)	-Money coming from donation	Replaceable	Limited	No
Private sector	-Money availability	Replaceable	Limited	No
Slum dwellers	-WHO's support	Irreplaceable	High	Yes
Ministry of Health	-Formal authority	Irreplaceable	High	Yes
Local Government	-Formal authority	Irreplaceable	High	Yes
Ministry of infrastructure	-Money to investment into infrastructure	Irreplaceable	Medium	No

In the table E.3 it is indicated the classification of interdependencies between WHO and the actors.

WHO should consider strongly involve the Hospitals, Clinics and Practitioners, the Research and Development in Health issues, the Slum Dwellers and the Ministry of Health in the decision making because they are potentially allies in the decision making process to find a solution of public health in slums. As well the Pharmacological industry, Citizens and the Local Government must be included in this process because the probability that they will exert their blocking power. The process could be done in a workshop (see Section 3.2) where the actors will be gathered in a multi-issue agenda where the problem formulation recognizes the key interest of critical and dedicated actors (see Section 2.4).

Table E.3: Overview actor's interdependencies classification.

	Dedicated actors		Non-dedicated actors	
	Critical actors	Non-critical actors	Critical actors	Non-critical actors
Similar/ supportive interest and objectives	- World Health Organization (WHO) - Hospitals, clinics and practitioners - Research and Development in Health issues - Slum dwellers - Ministry of Health	- Private sector	- Non-profit organizations (NPOs)	- Health educators - Ministry of infrastructure
Conflict interests and objectives	- Pharmacological industry - Citizens - Local Government	- Ministry of finance		

Annex F – Scenario logic and scenario stories

An exploration of the future with a qualitative nature insight will help to investigate the robustness of the policy proposed by the World Health Organization (WHO). These snapshots of the possible future represented in scenarios will be based on factor that the WHO cannot control, i.e. contextual factors.

With respect the public health in slums issues, given the rapid unstoppable urbanization trend (see Section 1), the time to influence the slum dwellers habits and citizens behaviour, it was defined a time horizon of twenty to thirty years. It will adopted 2030 as the target year of scenario assessment.

An extended list of contextual factors were identified based on the actor's characteristics and environment where they perform their function were clustered in eight driving forces, namely Economic environment, Pharmaceutical sector, Citizens' reaction, Research breakthrough, Slum dwellers behaviour, Infrastructure capabilities, Environmental conditions and International awareness.

These driving forces enclose important contextual factors described below:

- Economic environment
 - The financial crisis shift governmental investment priorities or even freezes project investment in health.
 - The purchase power decreases, mainly in low income dwellers, hampering the access to medicines, vaccines and health system.
- Environmental conditions
 - Unknown illness or a virus mutation would influence the inhabitant's vulnerability, especially to those ones who do not have an immediate access to health assistance. Epidemics and pandemics can take place suddenly, they expose existing weaknesses in these systems and, in addition to their morbidity and mortality, can disrupt economic activity and development [j].
 - Random atmospheric phenomena consequences, for example El Niño and La Niña, creates floods (fostering the insects proliferation) and dry seasons (hampering the normal water access).
- Research breakthrough
 - The reaction time to find a cure and/or vaccine to the new diseases and prevent its expansion among human society.
- Pharmaceutical sector
 - Medicine prices influenced by the outbreak of a disease, the availability of an accurate medicine to cure it and the consumers demand.
- Citizens' reaction
 - Reaction to a tax increase owing to an investment in health infrastructure for the slums.
- Slum dwellers behaviour
 - No sense of urgency with respect the public health measured by participation in campaigns.
 - Rejection to health education owing to policies is contrary to moral, religion and values of the slum dweller due to they might come from different backgrounds.
- Infrastructure capabilities
 - The extension and maintenance of the network infrastructure related to health, i.e. drinking water system, waste water recollection, rubbish recollection.
 - The willingness of the private sector to invest in health infrastructures evaluate by the economical situation and the political situation within a country.
- International awareness
 - Media coverage to worldwide expose the health inequalities, its importance in the society and the policies taken by the authorities to tackle the problem.

The identified driving forces are classified in the table F.1 below according to their impact and uncertainty on the system (see Annex B).

Table F.1: Classification of driving forces.

		Uncertainty	
		Low	High
Impact	Low	-International awareness	
	High	-Infrastructure capabilities -Research breakthrough -Pharmaceutical sector -Slum dwellers behaviour	-Economic environment -Environmental conditions -Citizens' reaction

The public health is highly depended on the infrastructure capabilities, the larger the network and its proper maintenance in slums, the lower the probability of a diseases cases. There exist low uncertainty due to the rate of return on investments and the schemes to involve the private sector through Public-Private Partnerships (PPP) are largely understood and defined.

The research breakthrough has a large impact on the prevention and treatment of infectious diseases, however the increasing advances in genetic engineering, the understanding of the diseases treatments and the boost in quest to find cures, reduces the its uncertainty of time response. This feature affects to the pharmaceutical sector which has a great impact in supplying the medicines and vaccines.

The slum dwellers clearly have a high impact on its own health situation and on the policy implantation success. This situation can be foreseen understanding the heterogeneity of values of the slum dwellers. Moreover the sense of urgency might be spread among them giving that their interest of a better quality of life relies largely upon the health statuses, implying a low uncertainty.

The international awareness could indirectly affect the problem status and giving the extended internet connectivity fosters the situation dissemination decreasing the uncertainty.

The economical environment has great uncertainty because a financial crisis cannot be predicted in advance; nonetheless it has huge implication on the inhabitants in the purchase of medicines and the basic services payment. Moreover the government will be forced to interrupt some ongoing and future health investments.

The global warming has unbalanced the atmospheric situations creating unpredictable effects on the precipitation and climate conditions. This spurs the propagation of for instance insects that had a temperature barrier, or the flood that contribute the propagation of mosquitoes. Furthermore the impossibility to avert a disease outbreak which could evolve to a pandemic for example the swine flu characterize this driving force as high uncertain and with a high impact on the problem.

Eventually any investment in public health in slums will have to be paid by the inhabitants through taxes, however this contribution is charged to the citizens with a major weight that to the slum dwellers that do not have the necessary monetary resources. This situation will certainly raise opposition among these actors if no internalization of the problem within them has taken place. However the degree that the problem has been internalized is highly uncertain, implying a great citizen's reaction uncertainty.

The driving forces which score high at uncertainty and impact, namely, Economic environment, Environmental conditions and Citizens' reaction are used to design scenario logic. The driven forces shape the axis of possible future scenarios. The possible future snapshots are a combination of the selected driving forces based on different assumption.

- The Economic environment is measured by the degree of **“Investment”** in the slum public health system. A low degree indicates low amount of health projects, whereas a medium exist when basic prevention projects are financed. A high investment will be the whole portfolio of investment in health infrastructure in prevention and treatment. The current investment situation is medium.
- The Environmental conditions are measured with the same WHO indicator, namely in **“Phases”**, which go from 1 to 6. Phases 1-3 indicates predominantly animal infectious, few human infections. Phase 4 implies sustained human to human transmission. Phase 5-6 specify the existence of a pandemic, a widespread human infection. Post phases involve possibility of recurrent events and disease at seasonal levels [j]. The current WHO phase of pandemic alert is 6 (June 2009).
- The Citizens’ reaction is measured in the **“Support”** from this actor backing up the policies and internalizing the problem. A low value will indicate rejection of the problem, situation widely encounter (see Annex E). A medium degree of support refers to as the restricted internalization of the problem, especially in the case of tax increase due to investment in public health in slums.

There exist 3 possible scenarios are described below in the Figures F.1 to F.3:

Scenario 1 – Sand castle

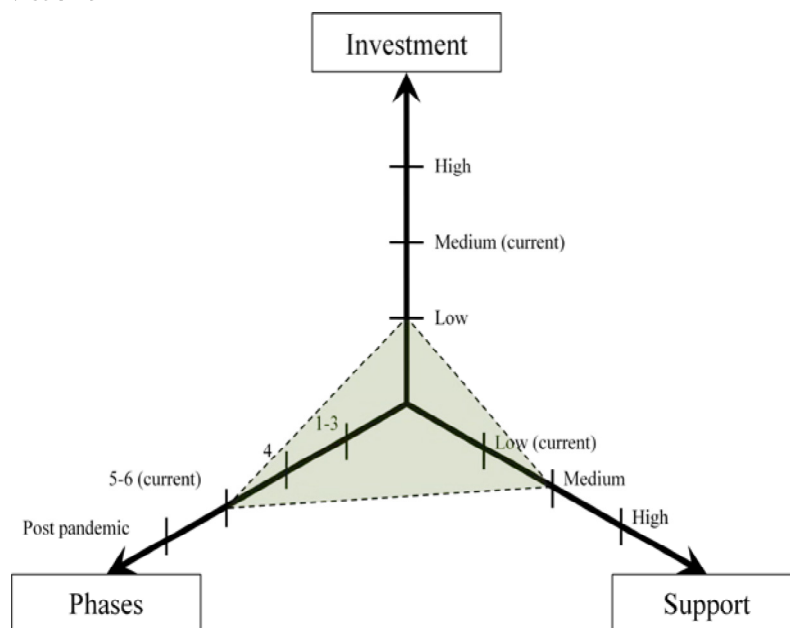


Figure F.1: Driving forces are phase 5-6, medium support, and low investment.

The financial crisis which started in 2008 had influenced in the reduction of investment in health. The banks and Non-Profit Organizations (NPOs) highly vulnerable to unexpected capital outflow where the first to collapse, boosted by a widespread panic. This ended up in a massive capital withdrawal, the governments all around the world pumped large amounts of money, nevertheless the situation was far away from his hand. The forthcoming situation was the sprawl of slums; inhabitants that could not pay a proper residence were forced to build its own dweller. Furthermore the resulted collapse of the financial market resulted in reducing the finance in the health sector. The Millennium Development Goals (MDGs) were not met, and in a 5-year extension asked by the countries, the targets were not much better. In 2025 the UN has set again the targets, but this time with no ambitious expectations.

It was decided that the HIV/AIDS campaigns were of primary importance, however the fumigation campaigns were decreased, fostering the vector propagation e.g. mosquitoes and rodents. Despite the fact that the swine flu spread was halted in 2012, a new mutation of an avian flu virus appeared at the beginning of 2030. These time the phase changed drastically from a phase of 1 to a phase of 6 in just 2 months. The first affected in these diseases were slum dwellers, it was hard to assess the number of affect due to there does not exist monitoring, the budget was stopped long time ago.

The inhabitants that still have purchase power cannot distinguish anymore where do the slums starts or ends, due to all around the city, unplanned settlements appeared. Its health is jeopardized not only by the surrounding slum dwellers diseases, but the lack of facilities to prevent and treat an illness.

Although a limited internalization of the problem in the past existed, this support seems to be shrinking. More and more the Citizens are blaming the slum dwellers of being the cause of the health insecurity. Now they are demanding from the local government to take some extreme actions, such as expelling the slum dweller out of the city's fringe.

Scenario 2 – Construction on quicksand

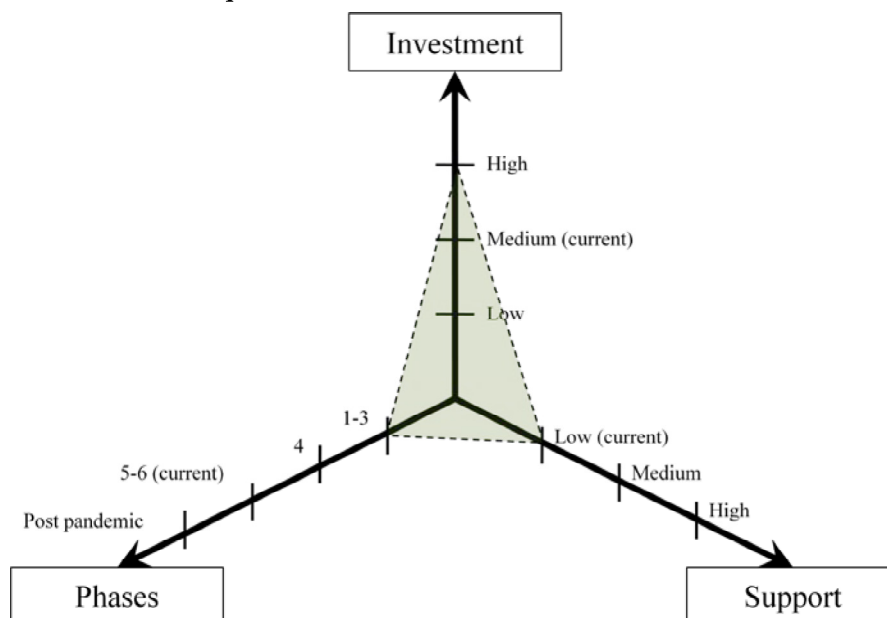


Figure F.2: Driving forces are phase 1-3, low support, and high investment.

The financial crisis was successfully overcome because a massive investment in infrastructure systems, among them in hospitals, water distribution, water treatment plants, sewerage collection and so forth. The developing countries made most their investments through loans, increasing the external debt to the private sector. Since the last pandemic declared in 2009, no other infectious disease have outbreak, moreover in 2015 a vaccine against HIV/AIDS was found. Though its price was quite elevated in the market, all the countries subsidised its distribution.

The slums have decrease in number however there still exist some of them around the world especially in developing countries which still struggle to allocate the resources in this segment. The Millennium Development Goals (MDGs) have largely being met but no additional targets were introduced.

The developing government expenditure in health infrastructure in slums, and subsidy of medicine has affected the citizens in terms of taxes; they are the one who should sooner or later pay this investment. Because there has not been an internalization of the problem in previous years, this expenditure in public health in slums is seen as waste of money that they should pay.

The dissatisfaction is gaining power and some riots already started at the beginning of 2028 in Africa. Now the situation is getting worse with the addition of South and Central America to the protest of elevated taxes. Although Asia has not yet shown its disapproval, it is expected that in the middle of 2030 a medium size protest will take place in Shanghai according to the British Broadcasting Corporation (BBC). The future of the system is in jeopardy, the governments are thinking about stopping some slum upgrading projects and other programs to enhance the public health in slums. Additional loans were rejected by the private sector because the elevated risk that the countries attain.

Scenario 3 – Stone framework

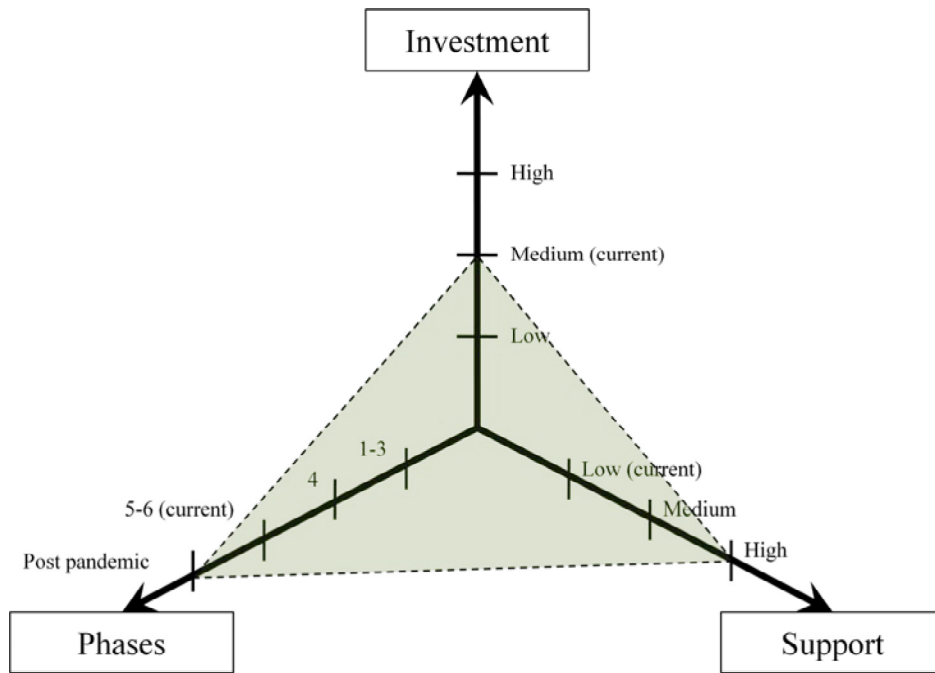


Figure F.3: Driving forces are phase 5-6, high support, and medium investment.

The central government continued slightly increment the investment in public health in slums, especially in prevention programs. This ended up in a better situation that the one found in 2009, although some of the Millennium Development Goals (MDGs) were no meet by some developing countries, they were fulfilled in 2020. In the same year, the UN proclaimed the Zero Health Inequality (0-HI) than in a 20-year period the total elimination of health inequality in the world. This ambitious plan was welcome by the citizens, who felt that eradicating slums will directly benefit them.

In 2029 there existed a pandemic outbreak, a Viral Hemorrhagic Fever unknown. The world reacted immediately however the system was not so robust. The health system had its shortcoming, but thanks to the common support from the citizens a large investment in reinforcing the system is been evaluated and will be approved by the end of 2030.