The Upgrading of `Izbet Khayrallah

Financial and Social Cost – Benefit Analysis

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Executive Summary

This report presents findings from the Financial Cost Benefit Analysis (FCBA) and the Social Cost Benefit Analysis (SCBA) of the `Izbet Khayrallah urban upgrading project. The project is being proposed by Takween Integrated Community Development, an urban development company that addresses challenges like affordable housing and public utility upgrades through environmentally, culturally and socially responsive urban design solutions in Cairo, Egypt. `Izbet Khayrallah is an informal settlement on the outskirts of Cairo and is home to more than 200,000 low-income residents. The upgrading project would provide infrastructure improvements, upgrades to building facades, extension of social services, and the regularization of land tenure arrangements.

The FCBA analyzes the financial viability of two alternative upgrading scenarios-Standard Planning Criteria (SPC) scenario and Feasible Intervention (FI) scenario, relative to a base scenario of no intervention, and estimates the financing requirements for each. The Standard Planning Criteria scenario, hereafter referred to as "SPC," is an ideal scenario in which the upgrades are done according to the standard urban planning criteria used for the development of new communities in Egypt. In the SPC, the neighborhood is transformed into a place where residents are much less crowded; essentially converted into a lower middle-class area. The Feasible Intervention scenario, hereafter referred to as "FI," would be more modest and realistic in its goals. While providing a better standard of public services and infrastructure, this scenario takes into consideration the space and density of the current settlement. It aims to achieve a standard of living in `Izbet Khayrallah that is comparable to that in other prominent informal settlements that have benefitted from upgrading in Egypt in the past, such as Manshiet Nasser.

The analyses we present here assume that the upgrading intervention will yield a higher rate of population and economic growth in the settlement relative to the "no intervention" scenario as `Izbet Khayrallah becomes a more attractive place to live and establish businesses. Ultimately, we assumed an overall higher rate of population growth in FI scenario than SPC based on the assumption that the former will yield a higher quantity of available housing compared to SPC because the land requirements for services is reduced and densities are thus higher. More information is provided in the "Assumptions" portion of this report.

The summary results of our analysis for the two scenarios under consideration are shown in Table E1. The upgrading of `Izbet Khayrallah is not going to be profitable in a financial sense for the Cairo municipality. The total net investment in the community over a fifty-year period will amount to EGP 9.6 billion and EGP 9.1 billion for the SPC and FI scenarios respectively. These amounts are in present value terms and in 2016 constant prices. The investment requirements in the first 3 years of implementation are EGP 2 billion and EGP 1.4 billion for the SPC and FI scenarios respectively. The net annual expenditures of public funds thereafter are nearly EGP 400 million per year, mostly for the provision of public services such as education and health and for maintaining and upgrading public facilities.

Table E1: Summary Results of Financial and Social Cost Benefit Analysis under Baseline Assumptions (in 2016 constant prices)

Line Item	Unit	Financial Cost Benefit		Social Cost Benefit	
Scenario		SPC	FI	SPC	FI
Present value of Costs	LE Billion	10.466	9.834	9.988	9.323
Present value of Benefits	LE Billion	0.874	0.874	12.065	19.733
Net Present of Project (NPV)	LE Billion	(9.592)	(9.146)	2.077	10.410
Benefit Cost Ratio (BCR)	Ratio	0.084	0.089	1.208	2.117
Internal Rate of Return (IRR)	%	n.a.	n.a.	5.45%	15.75%
Investments Required in first 3 years	LE Billion	2.059	1.386	2.410	1.586
Average annual cash flow thereafter	LE Billion	(0.378)	(0.378)	0.183	0.535

The results of the social cost benefit analysis (SCBA) reveal the true societal benefits from implementing this project. Our analysis reveals the clear superiority of the Feasible Intervention over both the Standard Planning Criteria and the "No Intervention" scenario, which is the counterfactual everything is being compared to. Under the FI scenario, net social benefits amount to EGP 10.4 billion in present value terms, as compared to EGP 2.1 billion under the SPC scenario. The benefit-cost ratio of the intervention (BCR) is 2.1 under the FI scenario, which means that net social benefits are more than double the net social costs under this scenario. This compares to a BCR of only 1.2 under the SPC scenario. Similarly, the internal rate of return (IRR) of investing in the FI scenario is nearly 16% in real terms, which is very attractive compared to other social investments. The IRR of the SPS scenario would be much lower at approximately 5.5%. Another advantage of the FI scenario is its lower initial investment cost, which amounts to EGP 1.6 billion in the first three years of the project.

Introduction

Background

Over the past century, migrants from other parts of Egypt have steadily trickled and settled into the marginal lands on the outskirts of Cairo to take advantage of the city's economic opportunities, and over the decades have converted ramshackle settlements into complex and densely packed communities. These communities often lack basic services like sewage systems, schools, and hospitals. It is estimated that around 63% of the greater Cairo metropolitan region is comprised of these sorts of extralegal and informal communities (Sims 2010)[1]. With such a large percentage of Cairo organized informally and unaccounted for, it is imperative that the city have a plan

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[1] David Sims, *Understanding Cairo: The Logic of a City out of Control.* (Cairo and New York: The American University in Cairo Press, 2010).

for more fully integrating these communities by officially recognizing them and by providing them with the services their population deserves.

`Izbet Khayrallah is one such neighborhood. Originally founded as an informal migrant community, the neighborhood has grown into a bustling bastion of the working class in Cairo. Efforts to formalize land tenure in Khayrallah began in 1986 with lawsuits from community leaders demanding the right to purchase the state-owned land. After over a decade of legal wrangling, the Supreme Administrative Court ruled that the government must sell the land. It took another decade for the government to begin providing basic amenities. For instance, basic sewage services began in 2007 (Izbit 2013).[2] Finally, the residents of `Izbet Khayrallah are poised to secure their land tenure, and multiple project stakeholders are now trying to do the hard work of pricing out what is actually required.

Takween Integrated Community Development is one such project stakeholder. Working in collaboration with a multitude of local, national, and international stakeholders, Takween, through its contact with Dr. Ragui Assaad, brought on board the University of Minnesota to help provide an array of cost benefit analyses and planning options for `Izbet Khayrallah's future. The effort to legitimize land tenure in `Izbet Khayrallah is a massive undertaking with incredibly high stakes. In order for Takween to most effectively lead this effort it must be provided with accurate and comprehensive quantitative data analyses. It is within this context that we present the following paper and our own recommendations.

Financial Cost Benefit Analysis

Methodology

The data used for this analysis was provided by Takween following extensive surveys conducted in `Izbet Khayrallah, and a set of assumptions and inferences were made to examine the different projected scenarios to create as accurate and comprehensive a view of the project as possible.

This project will not provide the city with net revenues, nor will it be possible to finance the ongoing project operations with revenues earned from the intervention because the proposed project provides multiple free or subsidized services to a low-income community. The project is expected to be supported indefinitely by tax revenues.

It is necessary to determine the financial viability of this project by considering and analyzing different intervention scenarios. As stated earlier, the FCBA is conducted on two different scenarios, the Standard Planning Criteria (SPC) and Feasible Intervention (FI). For this analysis, we used the FCBA to calculate assumptions and parameters laid out in the SPC and FI scenarios over the project's 50 year lifespan[3]. To effectively measure the financial feasibility of the project, we used two indicators: the Net Present Value (NPV) and the Benefit Cost Ratio (BCR). Since benefits accrued are meant to be more social than financial, we did not put much emphasis on the Internal Rate of Return (IRR) for the project. The NPV

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[2] " الخليفة -Tadamun." Tadamun. December 23, 2013. Accessed August 12, 2016. http://www.tadamun.info/?post_type=city.

[3] The 50-year lifespan does not mean that `Izbet Khayrallah will cease to exist. It was used so that we would not calculate costs ad-infinitum.

estimates the cost of the intervention over its lifetime in current Egyptian Pounds (EGP) by discounting future costs and benefits into current EGP. The NPV uses the discount factor: $D_t = 1/(1 + r)^t$.

The BCR was used to measure performance of the project and calculates the ratio of returns by taking annual costs and benefits (discounted back into current EGP) and divides them to give a ratio: BCR = PVB/PVC where PVB = Present Value of Benefits and PVC = Present Value Costs. The BCR shows the returns for every pound invested into a project. The FCBA only looks at the financial benefits of the project, which in this case would be the tax from buildings and money from land sales.

Working on the premise that the project will actively begin in 2017, all the NPVs included in this report are representative of the costs and benefits for the project from 2017 (referred to as year 1) onwards. We calculated the anticipated capital and operating costs over an assumed 50-year lifetime of the project based on an exhaustive list of assumptions, specifically for the FCBA.

Assumptions on Operating costs

As of 2016, the population of `Izbet Khayrallah is estimated at 209,378. The population growth rate for the feasible scenario is greater than that of the standard scenario. For assumptions and equations governing these diverging growth rates, see Appendix 1.

The number of students from age 5 - 17 is expected to increase, while education operating costs remain stagnant. These operating costs are calculated with the expected durability of the 50 year project with an upgrading frequency of 5 years in both secondary and basic education.

Health service facilities include family health units, central hospital, and family health centers. Under the standard scenario, it is expected that health units will serve 20,000 individuals; this is assumed to be double under the feasible intervention. Each type of health service facility will cost 5000 EGP per square mile. Per-person operating costs rise according to the size of the health facility; these are assumed at 18.05 EGP/person for health units, 20.06 EGP/person for health centers, and 51.58 EGP/person for the central hospital. Health centers have a lifetime of 50 years, with upgrades occurring every five years.

An important part of this project is expanding government-provided services and facilities within `Izbet Khayrallah. Government facilities in the settlement will include libraries, cultural spaces, police stations and outposts, fire stations, post offices, social services, and youth centers. The operating costs of all these facilities are higher in the standard scenario than in the feasible scenario, due to a larger number of constructed units.

The infrastructure of the project will include the construction of new buildings and the reconstruction of existing housing. To make way for the addition of hospitals, schools, and government offices, houses will be razed and rebuilt on the outskirts of the settlement. Each building will have six stories. One storey will have two units. The ground floor of each building will be available for business rental; the remaining stories are reserved for housing. Therefore, each building will contain two business units, and 10 housing units. Rental fees for the business units will be more than the residential units. It is assumed that housing rental rates will remain constant through all fifty years. The business rent rate is 120% of housing rent. The landowners are expected to save

5% of rent, which is 22.5 EGP. This will be used for development purposes to increase the number of the floors to a maximum of six.

Assumptions on Capital Costs

On capital cost, a one-time expense will be incurred by the municipality when buying materials, equipment and getting the labor needed. This will be a fixed cost because it is the total cost needed to bring the project to commercially operable status. Therefore for this project to begin, the municipal government needs a capital cost breakdown of all line items involved. Sale of the land to residents of `Izbet Khayrallah will generate revenues, but not enough to offset the costs. We assume that the Cairo Governorate and the municipality will fund the project, using labor primarily from the settlement itself.

To facilitate clean calculations, housing facade upgrades are entered every three years. The cost of each unit is expected to be 100 EGP in both standard and feasible scenarios. Utilities will also be improved as part of the intervention, with an upgrading frequency of three years. The thirty year mark does not indicate the lifespan of the upgrades.

The initial intervention will take place over the course of three years. In the first year of the intervention (2016, referred to as year 0), 50% of the project will be completed, and 50% of the costs will be incurred. The remaining work will be completed in the next two years; 25% will be completed and 25% of the costs incurred in years 1 and 2. All costs and benefits are expressed in constant 2016 Egyptian pounds (EGP) to prevent confusion with inflation. A 3% discount rate is assumed. The newly constructed infrastructure is expected to have a 50-year lifespan, with upgrades every 5 years. The upgrading cost will be 20% of the actual cost of the investment of the project. For a complete list of assumptions, see Appendix 1.

Findings

Using the Net Present Value as a performance indicator, the FI would net a negative EGP 9,145,577,416 NPV after taking into account the modest revenues from land sales and building taxes. If the municipality decided to use the SPC scenario, with the assumption that the rate of decline of unused capacity is slightly less in the FI, the NPV paints a similar picture where the project runs a deficit of EGP 9,591,733,433. Generally, using the FCBA as a model, the governorate would need to generate between EGP 9,145,577,416 and EGP 9,591,733,433 to finance the project over its 50-year lifetime.

Table 1: FCBA NPV and BCRs by Scenario

FCBA	Standard	Feasible
Net Present Value	- 9.6 billion	- 9.1 billion

Benefit Cost Ratio	0.084	0.089

In both the standard and feasible scenarios, the BCRs are below 10%, and the difference between the NPV estimates is negligible. For either scenario, the intervention is projected to return an estimated .08 EGP for every 1 EGP invested in the project. Stated another way, for each Egyptian Pound spent, the project will lose roughly 0.92 EGP in both the standard and feasible scenarios. As both scenarios result in an equivalent BCR, the standard intervention is preferable to the feasible scenario, as it gives the same financial return for a more expansive intervention.

Table 2: Components of NPV by Scenario

FCBA	Standard (in EGP)	Feasible (in EGP)
Total Cost (NPV)	10.465 billion	9.834 billion
Total Revenue (NPV)	0.874 billion	0.874 billion
Resource Flow (NPV)	(9.591 billion)	(9.145 billion)

Social Cost Benefit Analysis

Methodology

The value of the `Izbet Khayrallah intervention to society cannot be measured based on its financial return. Rather, it is necessary to examine the net social value of the initiative to determine whether or not the money invested in the project will positively benefit the people in and around `Izbet Khayrallah. Examples of desired social outcomes for this project include improved transit, a revitalized urban space, enhanced

public safety, income growth, and better access to education and healthcare. Many of these outcomes will be realized from private investments into the community that will follow infrastructural improvements.

The SCBA is distinct from the FCBA. An FCBA is concerned exclusively with the monetary return on investment, whereas the SCBA takes into account social benefits that result from the intervention. The SCBA involves assigning shadow prices to both operating and capital cost inputs as a means of measuring the impact of the intervention on social welfare. This accounts for the market's inability to consider positive and negative externalities, or opportunity cost. The SCBA considers the market values assigned to specific externalities produced by the project and will help Takween and the municipal government to decide whether or not the benefits of the intervention are worth the heavy financial burden.

Analyzing the opportunity cost allows us to analyze what is lost when money is invested in this project rather than in other possible projects. Current market prices fail to capture the domestic opportunity cost of allocating resources to any given project, for two primary reasons. First, the exchange rate may be overvalued such that the price of non-tradable goods is artificially distorted relative to the price of tradable goods. Second, tariffs and import restrictions may further distort the price of imports and import-substitute goods relative to exported and non-tradable goods. These distortions typically function to make the prices of goods more expensive.

Using values provided by Takween, shadow prices were factored into project costs and revenues to observe how the consideration of market distortions and opportunity costs affect the project's bottom line. This makes a contrast between the bottom lines in the FCBA and SCBA possible. The benefits considered in these calculations are the impacts in income, house rent income, business rent income, benefits accruing to future residents, benefits of increased education, reduced cost of health services, and the reduced commuting time.

Assumptions

Shadow Prices: Shadow price conversion factors were calculated for capital and fixed costs using the following equation:

$$Conversion\ Factor = (F*1.05)+(N*1)+(LU*0.5)+(LS*1)+(T*0)$$

where *F, N, LU, LS,* and *T* represent the percentages of foreign exchange, non-tradables, unskilled and skilled labor, and transfers, as components of each item (totaling 1). The numbers by which they are multiplied represent uniform conversion factors for the relative nonmarket value of the five components. Social benefits are categorized as 100% non-tradables (conversion factor 1), so no additional conversions are applied to them. Revenue items represent transfers, and so are de facto omitted from analysis when using shadow prices. These calculated conversion factors were then multiplied by the NPV for each item and summed.

Benefits: Impact in income is designed to express the increases in resident incomes from investments in education. To calculate impact in income, we find the percentage of men and women of working age who are productive in the labor force for a given year's population estimate. Once calculated, this number of engaged workers is

multiplied by the change in educational capacity over the course of the year. The product is then multiplied by our assumption for the return on education and the existing wages at average education. The outcome of this equation expresses the change in incomes of the working population over time as it increases from better access to education.

Finding the house business rent income begins by considering the typical building planned for the intervention. As in the FCBA, each building will have six stories with two units on each floor, giving us a total of twelve units per building. The first floor of each building will be rented out to businesses, making available two units for business per building. The remaining 10 units will be for residential purposes.

The house rent income item estimates the social benefits gained and the revenue earned from residential rent for each new housing unit constructed for this project. The first step is to calculate the net benefit of each additional housing unit (which takes into consideration the cost of construction). This is found by multiplying the cost of construction (2,500 EGP/m^2) by the size of each building (12 units; 1 unit is 50 m^2). The net benefit is found by multiplying rent (450 EGP/month) by the number of housing units in each building.

This is further modified as additional units are constructed each year, adding to accrued social benefits. The number of additional housing units needed is found by dividing a given year's projected increase in population by the average household size in `Izbet Khayrallah in 2016, assumed to be 3.8 persons per home.

Calculating business rent income is similar to calculating house rent income. The calculation begins by looking at the net benefit of each additional unit after construction costs. As the buildings do not need to be finished for the first floor businesses to begin operating, the cost considered is half of the entire cost for building construction. Furthermore, commercial rent is computed at 120% of residential rent. The added benefit from additional business units is found by first calculating the number of new business units constructed since the previous year. This is the difference of units constructed under the intervention less the business units this year if the intervention had not happened. This difference is then divided by the 2016 average household size, giving us the rental income from business units.

Another measure used to calculate benefits in the SCBA is the Benefit Accruing to Future Residents. This benefit places a monetary value on the positive externality of `Izbet Khayrallah developing overall. Benefits accrue to future residents because renters are living in properties that are higher in quality than the price they are paying for them. Put another way, they are moving up the demand curve. The benefit is calculated by multiplying the increase of the population due to the project, by the rental benefits obtained by the new residents. The total benefit is calculated by multiplying the increase in number of households and the present value of total rent. The rental benefit of 5% is an assumed value that will accrue to renters.

The reduction in out-of-pocket medical costs was derived from the population of `Izbet Khayrallah multiplied by the per capita out of pocket costs by the case reduction factor. According to the World Development Indicators, the Egyptian per capita cost for healthcare (for the most recently reported year, 2013) was 151 EGP at current prices. We used the Consumer Price Index for that year as a base to convert that into constant prices for the individual out-of-pocket costs, which was 58%. We assume that the improvements in the local environment and infrastructure will reduce the cost of out-of-pocket medical expenses by 15%. We challenge this assumption in our sensitivity analysis as it is somewhat tenuous.

Benefits, as a result of reduced commute times, are expected results of this intervention. New infrastructure will be more conducive for commuting as interlocked

paving will be constructed to allow for easier transportation and improve accessibility to the Ring Road (which is currently not easily accessed). The time saved in commuting accrues as a benefit in our SCBA model because it results in more time performing paid work. To calculate the benefit of reduced commuting time, we took the population of each scenario (SPC and FI) and multiplied by the labor force participation rate (for both males and females) by the yearly wage saved (using average age at that year's level of education).

Findings

The externalities are calculated into positive outcomes for market and social values in both scenarios. Under the SPC scenario, the Market NPV benefits due to the intervention result in a benefit of EGP 1,262,559,605.29, and Social NPV as EGP 2,076,600,335.79 (see Table 3). The BCR values are 1.12 for Market and 1.21 for Shadow, meaning that every EGP invested in the Market and Shadow (Social) SPC scenario would result in 1.12 and 1.21 return in benefits respectively. Under the FI scenario, higher values for the NPV at EGP 9,703,389,901.31 Market and EGP 10,410,270,223.48 Social are observed, as expected. The BCR values are calculated as 1.97 Market and 2.12 Social.

Table 3: Market and Social (Shadow Price) NPV and BCR by Scenario

SCBA	Standard Planning Criteria	Feasible Intervention
Net Present Value, Social	2.08 billion	10.41 billion
Benefit Cost Ratio, Social	1.21	2.12

Under both scenarios, positive NPV values and values of BCR that are greater than 1 express positive social benefits from the intervention. The feasible intervention appears to be the preferable option; observed are very high BCRs indicative of a strong social return on investment. After accounting for the positive externalities as benefits in both scenarios, the FI has a much larger effect on the benefits in every one of our categories. For a breakdown by benefit type between the scenarios, see Table 3.

The societal benefits that come from impact in income, house rent income, business rent income, benefits accruing to future residence, reduced cost of health services, and benefit of reduced commuting time have dramatically different effects in the FI and SPC scenarios. The largest differences between the scenarios come from the house rent income, business rent income and benefits accruing to future residence where the difference is nearly double the SPC scenario. The differences are attributable to the growing population of the neighborhood where the FI scenario expects an increase as more services are available.

Table 4: Social (Shadow Price) NPV Components by Scenario

SCBA	Standard Planning Criteria	Feasible
Total Cost (NPV)	9.99 billion	9.32 billion
Total Benefit (NPV)	12.06 billion	19.73 billion
Net Benefit Flow (NPV)	2.08 billion	10.41 billion

Sensitivity Analysis: Financial and Social Cost Benefit Analyses

This report also used sensitivity analysis to estimate the variances in the costs and benefits of the project for both of the SPC and FI scenarios. Much of the assumptions of this project depend on other factors and our sensitivity analyses show the major items that can either be a liability or a major asset for social returns on the investment.

Housing, Business and Rent Benefit

Variations in social benefits were found to be particularly sensitive to changes in housing rent (see Figure A1). With the initial assumed rental rates at 450 EGP, house rent income was expected to generate 5 billion EGP under the SPC and 9 billion EGP under the FI; this results in NPV values of 2 billion and 10.5 billion, respectively. Important in this analysis is the business rent factor. When varying housing rent, business rents are also impacted, given that business rents are 120% of housing rent. The social benefits appear to increase as rent goes up; furthermore, benefits increase at a higher rate under FI.

Following the variation in housing rent, we analyzed the impact on NPV variation in the business rent factor (see Figure A2). This is an alternative to increasing the financial burden to renters due to an increase in housing rental rate. The impact of a variation on business rent factor only registers when the factor is changed by a large percentage. We do observe a notable increase in social benefits under both scenarios when increasing the business rent factor. Decreasing the factor does not provide any notable savings and decreases social benefits. In spite of this, it is not advisable that the business rental factor be increased sharply; an increase of 200% implies a business rental rate of 1,620 EGP.

Other variables in the project were tested for sensitivity, but were found to have much smaller impacts.

- Rental Benefits: increased percentage results in positive, but small

social benefit returns
• Health Care Reduction: reduction in clinics results in small decrease in benefits; increased hospital capacity lead to increased social benefits
• Time Saved Factor: benefits increase, but are limited
• Male and Female Labor Force Participation: increased participation has low impact
• Existing Wage at Current Education: benefits rise to match percentage raise in wages
• Decline in Unused Capacity: benefits increase at a much lower rate than the decline in unused capacity
• Education Operating Costs: increased operating costs only lead to lower social benefits

Recommendations

Recommendation 1: Implement Feasible Intervention Scenario

We recommend implementing the FI scenario which produces more social benefit at a lower financial cost. Although the SPC scenario would be more desirable in terms of amenities and compliance, FI produces more social benefit in terms of gains from higher levels of education, rental benefit, time and cost saved. Therefore, to create a more socially affluent neighborhood, FI scenario should be implemented.

Recommendation 2: Drive Demand of Housing and Business Rental Units

We recommend that planners anticipate the strong influence that housing and business rental rates have on social outcomes. Income from housing and business rent provides a large portion of the intervention's expected social benefits, and NPVs are sensitive to smaller variations. Even a 5% increase in housing rental rate results in a 76% increase in NPV under the SPC, and returns are even greater under the FI. The governorate cannot directly influence rental rates, but can prioritize building completion and infrastructural improvements.

Completion of buildings will drive up supply, and extend the period of time that owners are receiving rental payments. The governorate can also exert pressure on rental rates with improvement of infrastructure, especially items like facade improvement and interlock pavement, as these will increase desirability of spaces and drive up demand. Greater demand will give landlords the freedom to raise rental housing and businesses. These results will improve expected social returns on investment and positive results will come sooner.

Recommendation 3: De-prioritize Health Care Spending

Healthcare should be de-prioritized in the planning of both the FI and SPC scenarios. The reduction in healthcare costs, which is assumed to be 15%, is due to the increased access to public infrastructure in both roads and more hospitals within

the neighborhood. Since healthcare is free in public health centers, the benefits accrued are due to transportation to and from medical centers.

Our sensitivity analysis demonstrates that a 250% reduction in healthcare results in a 24% decrease in the net benefits. There are more social benefits to be realized with more efficiency in the central hospitals. Increasing the capacity of each hospital by 250% results in only a 3% negative change in financial burden but manages to increase the benefits to society by 14%. Reducing capital costs in terms of construction of hospitals, and investing in building the capacity of hospitals will be a more efficient use of resources. As the neighborhood develops, with more access to infrastructure, the costs associated with travel time will be reduced. One caveat to the reduction of healthcare capital spending is that the SCBA does not put a high enough value on health care benefits since the benefits are attributed to the cost of reducing transportation times and not in quality of life.

Recommendation 4: Ongoing Research

It is important that research continue into service levels in `Izbet Khayrallah. Data on public safety must be collected and then monetized. At present, government offices generate no benefits within the model, owing to a paucity of relevant data. Relevant metrics include total annual visits to a doctor, days absent from work due to sickness, daily expenditure on transportation, and levels of criminal activity per year. By quantifying these metrics, the government can prioritize the services that need to be offered immediately to the people and services that need to be planned within some time. Right now, all investment in government activity exists as a pure cost line item, and this must be rectified.

Appendix I

o Discount rate for all items is 3%.

o Values for operating costs and capital costs are modified by various operations, but all have assumed values located in sheets "1.Fixed Costs" and "2.Operating Costs" in the provided project worksheet. The Fixed Costs sheet includes a table of expected frequency of upgrades as well.

o Operating costs are derived from a combination of wages and other operating costs– these figures are presented in the relevant sector-specific sheets in the accompanying worksheet (e.g., "Healthcare.")

o The number of individuals served by a given service-related building type, as well as a standard land area for each, are assumed.

o Assume that for capital projects, regardless of lifetime or frequency of upgrading (a variable also provided on the fixed costs sheet, of the cost per upgrading cycle 50% will be invested in the first year, 25% in the two subsequent years.

o Assume that the depreciation in the last three years are basically zero and that we are able to salvage the entire initial investment costs.

o A business unit nets 20% more rental income than a residential unit's rent.

Population Estimates/Capacity/Number of Buildings Constructed:

o Every storey has two units, and every 6-storey building has one business unit and five residential units. Units are assumed to be built up to the 6 storey maximum as demand increases.

o A common starting "maximum potential" 2016 population of 209,378 was calculated by multiplying the number of residential units by the average household size within three regionally-coded areas that comprise Khayrallah, assuming an occupancy rate of 78%. The resulting figure was multiplied by a growth factor of 1.5 to arrive at the maximum estimate.

o 209,378 was thus assumed to be the "used capacity" of Khayrallah in 2016. This was divided by 1.5 to arrive at an estimate of the used capacity in 2006, and was divided by 1.5 again arrive at a 1996 capacity use estimate. A "max capacity" of 496,304 for the area was calculated by multiplying the number of plots by the average household size (held at 3.8) and multiplied by 10 residential units per building.

o These back-calculated capacity values were used to calculate a rate of decline of unused capacity which took the following exponentiated functional form:

$$y = 409691e-0.017x$$

o The rate of decline of unused capacity therefore was calculated to be -1.7% for the base scenario (no intervention), -2.55% for the standard scenario, and -3.4%. The latter two were derived from assumed multiplicative factors of 1.5 and 2, respectively.

o This rate of decline was then used to calculate different yearly populations for the two scenarios using the following assumed functional form:

$$(MaxCapacity-UnusedCapacity2016)*eDeclineRate*t$$

o The values this formula produced for the year 2025 (268,217 for standard

and 285,015 for feasible) are used to calculate the number of each building type constructed, a critical variable in cost calculations.

Land:

o In calculating land sales, we assume an interest rate of 3% and a pay period of 15 years.

o We assume the land has a market value of 3000 EGP/m^2 and the selling price is 1000 EGP/m^2.

o The above two items generate a calculated yearly installment payment of 84 EGP/m^2.

o For total land area we are using the "built area" as of 2015 of the three official districts that contribute to Khayrallah's area: Athar El Naby, Kom Ghorab, and El Basateen El Gharbia. This totals 1,306,181 m^2.

o The yearly installment multiplied by the total area yields the sale of land per year, with payments ending after the assumed pay period.

Construction/Demolition:

o For each building unit type, the number of buildings needing to be demolished is calculated by dividing an assumed unit area (in spreadsheet) by an average plot area of 100 sq. m.

o For schools, a street widening factor of 1.5 is multiplied by this ratio.

o The number of buildings needing to be demolished is multiplied by a present average number of units of 4, a unit size of 50 sq. m. and a construction cost of 2500 EGP/m2 to derive compensation figures.

Education:

o Schools in the feasible scenario operate at twice the capacity of those in the standard scenario (2200 students in standard), but half the number are constructed.

o The age to go to school in Egypt is 5 to 19 but the project assumes only ages 5 to 17 are going to school.

o The number of girls and boys in the two age groups (5-14 and 15-17) were calculated using census data. For the 15-17 group a factor of 0.6 was additionally used.

o For the feasible scenario, the rate of increase of average years of schooling by extending the "convergence year" from which the rate was calculated in the standard scenario from 35 to 45 years, representing the fact that fewer students would ultimately be effectively served by schools operating at double capacity, with only a slightly higher total capacity, serving an increasingly larger total population.

Streets & Facades:

o Total street length assumed to be 79,700 m, with an average width of 5 m.

o The number of required lighting columns is taken as a ratio of these two variables.

o   No additional positive benefit was calculated from possible crime reduction owing to better lit streets, owing to data constraints, but such a benefit could well be present.
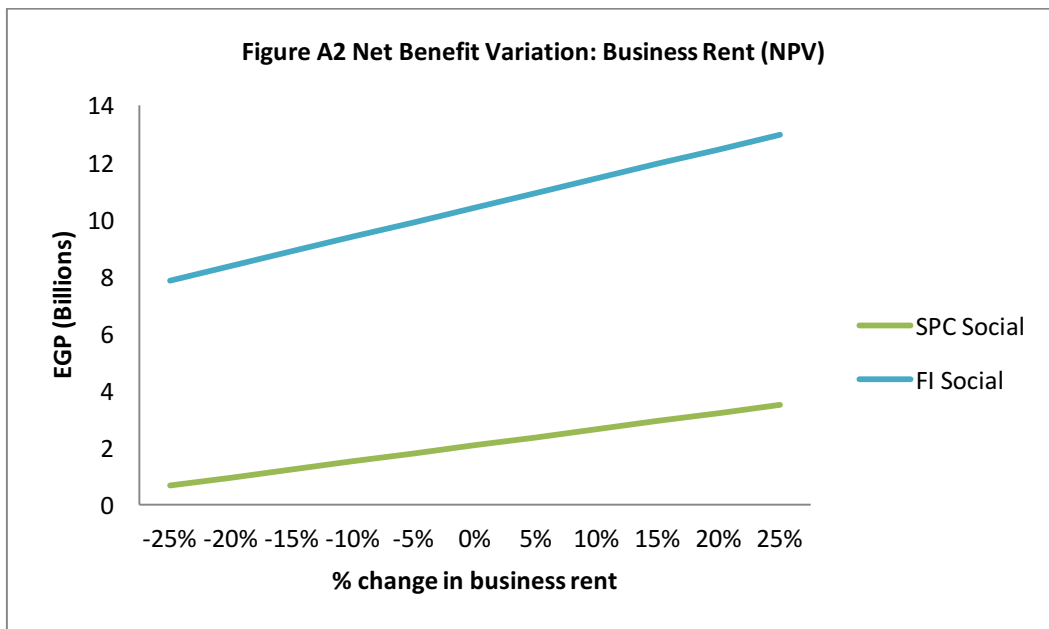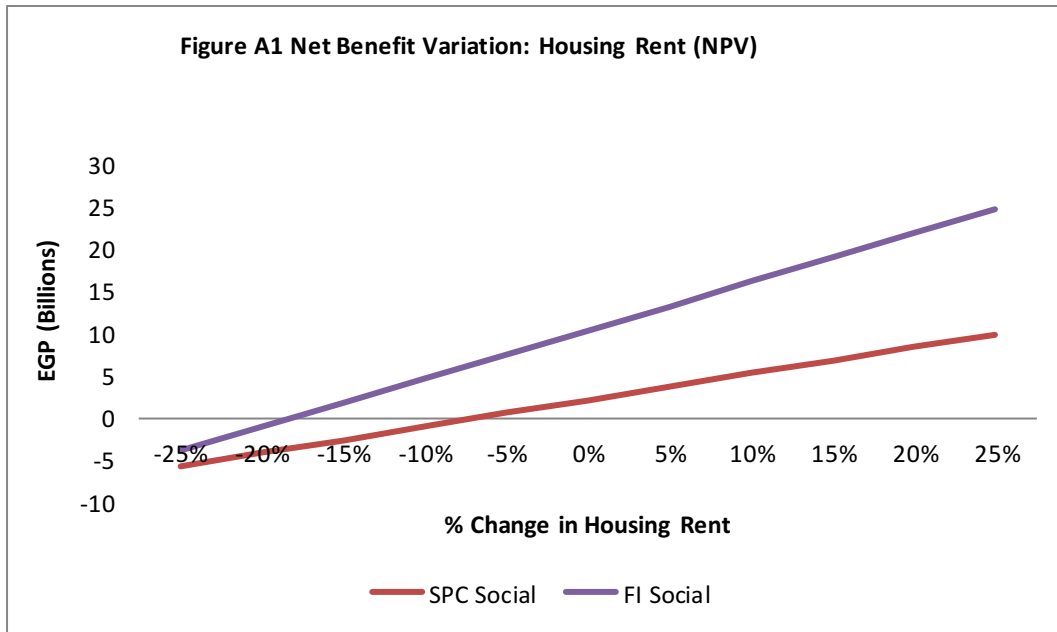o   Landscaping entails planting a tree along every 50 m of street.

Healthcare:

o   One family health unit can serve twice as many individuals in the standard than in the feasible scenario.
o   Number of health units on standard scenario are 14 but only 8 are built/ or in existence on the feasibility scenario.
o   Number of family health centers that one unit can serve is 40,000 on standard scenario but on feasibility scenario double that of 80,000 are served by the health center.
o   We estimate that the family health units will have a maximum of fifty years and an upgrading frequency of 5 years which would cost 10% of the actual cost in the standard and feasibility scenarios.
o   For healthcare benefits, a simple formula was employed: calculated out-of-pocket per-capita cost was multiplied by 15%, and this was multiplied by a given year's population to produce savings. The 15% reduction is tied to an assumption in the reduction of transport costs to healthcare centers.
o   A central hospital we assume it can serve 100,000 people but it serves 200,000 people on the feasibility scenario which is double the initial plan. It supposed to have 3 units but only two are built.

Additional Assumptions:

o   We assume that government offices will serve 20,000 people on the feasibility scenario but on the standard scenario is half of that. Where the lifetime year on the building is 50 years with an upgrading frequency of 5%, with cost at 10% where everyone can be calculated to around 29.01 Egyptian pounds.
o   We assume that that when the housing units are built, the rent price will increase by 5% overtime with a factor of 0.5.
o   We assume that 80% of the males are working, while the females working is at 20% of the productive working age.
o   Average number of units is 4 in a 6 floors building where the building will have two units and the ground floor will be purposeful for business unit.
o   5% of rent is being saved in this project. 5% of the specific rent of 450 is 22.5 Egyptian pound is saved which can be used for development purposes on increasing the number of floors up.
o   Rent for business units will be more than the rent of household units by a factor of 1.2.
o   Detailed assumptions for benefits are provided in the SCBA section of this report.
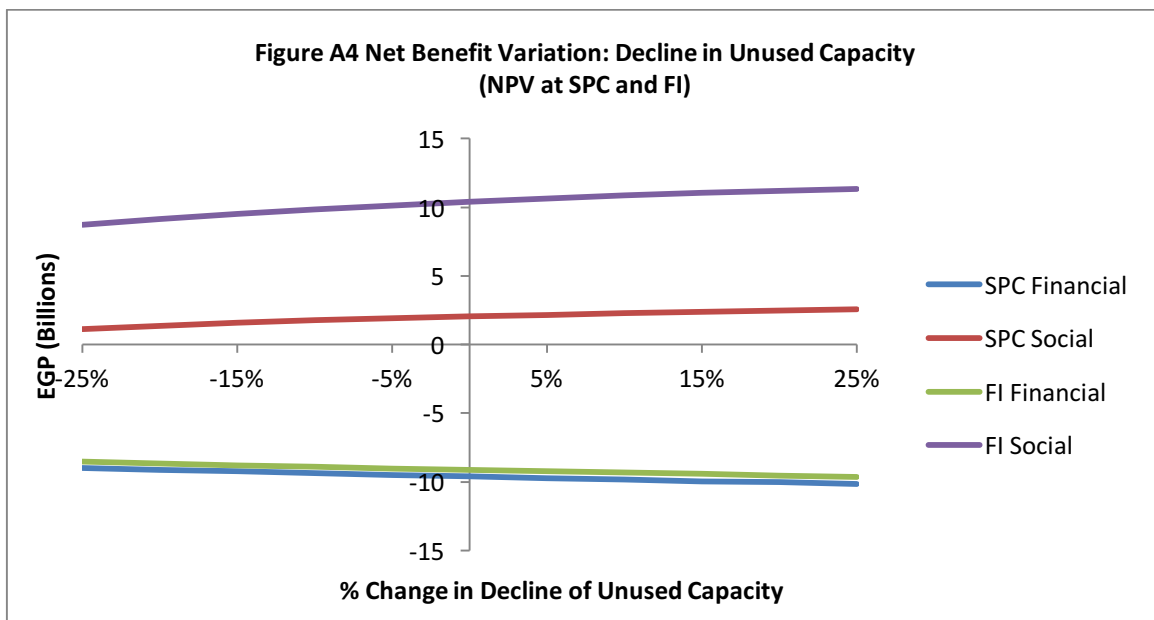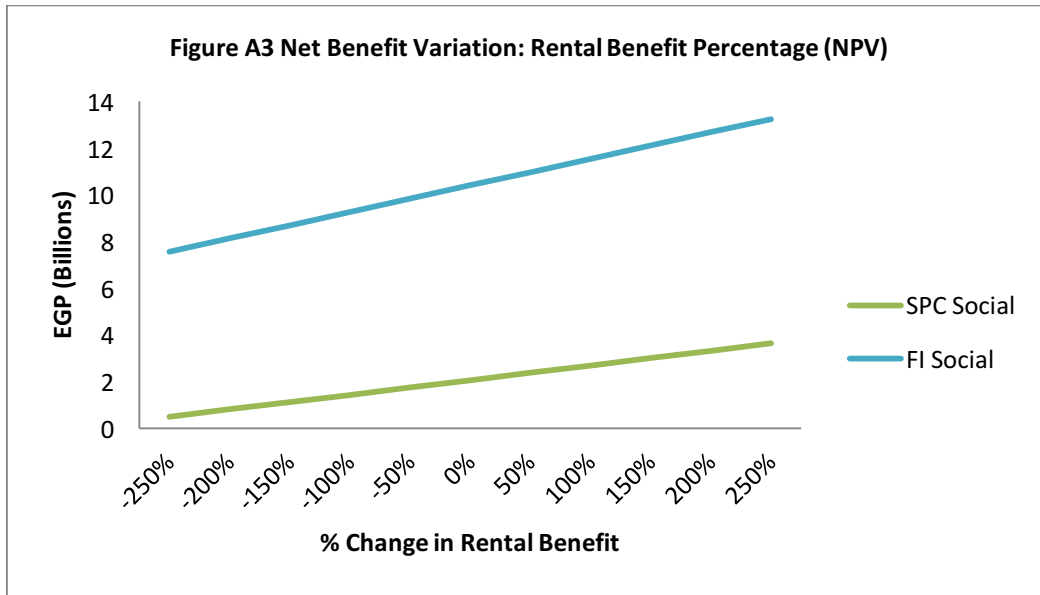
Appendix II: Figures

Figure A1 Net Benefit Variation: Housing Rent (NPV)

Figure A2 Net Benefit Variation: Business Rent (NPV)

Figure A3 Net Benefit Variation: Rental Benefit Percentage (NPV)

Figure A4 Net Benefit Variation: Decline in Unused Capacity (NPV at SPC and FI)

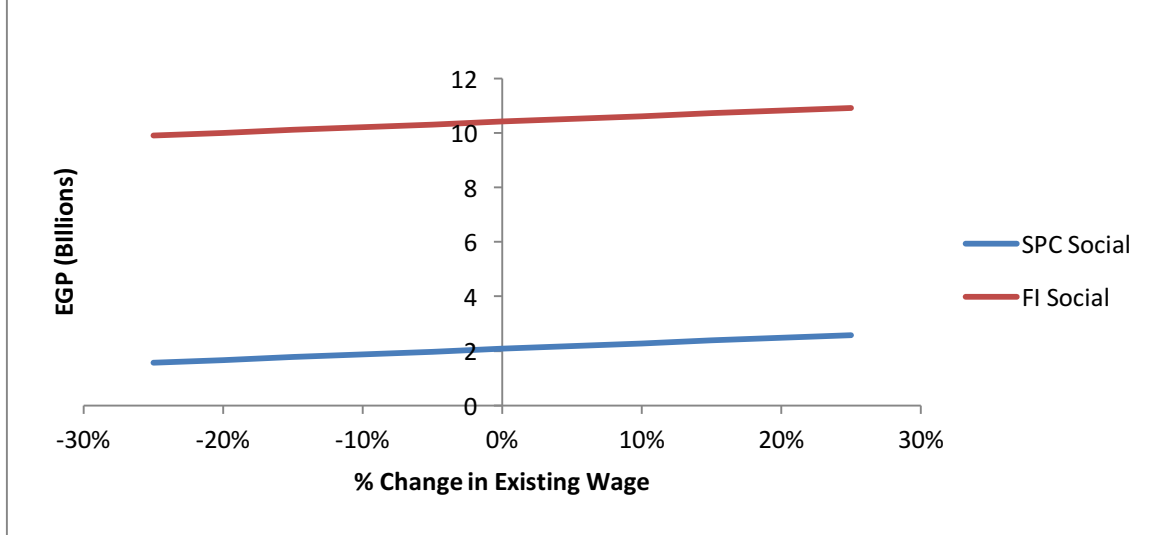**Figure A5 Net Benefit Variation: Existing Wage at Current Education (NPV at SPC & FI)**

Figure A6 Net Benefit Variation: Labor Force Participation Rate

Figure A7 Net Benefit Variation: Education Operating Costs (NPV)

Figure A8 Net Benefit Variation: Time Save Factor (NPV)

Figure A9 Net Benefit Variation: Central Hospital Capcity (NPV)

Figure A10 Net Benefit Variation: Healthcare Cost Reduction (NPV)