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Innovative Financing for Housing in Sustainable Growth

Modeling Incremental Financing Strategies in Housing

Dr. Peter A. Makachia

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Working Paper Series

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Innovative Financing for Housing in Sustainable Growth

By Dr. Peter A. Makachia

February 2015

Abstract

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Introduction

Economic development will greatly be boosted by supporting housing for urban dwellers in the country. Indeed, a well housed population will only advance other investments in more productive sectors like industry and agriculture. However, access to appropriate affordable housing has been and remains a mirage for the majority urban dwellers in the middle and low income brackets[1] in Kenya.

The housing demand, real and effective[2], remains high despite efforts by both mainstream real estate developers and the government. The gap between this demand and supply is thus huge and is unsustainable for economic and human development. Although the biggest culprit to affordability has been cited as building materials and services, the paper takes the position that access to appropriate finance is equally culpable. As a deviation from the conventional, the paper roots for flexibility in access, lending and credit systems for the middle and low-income groups in our urban design projects.

Parallel to the mainstream real estate developers are small-scale community-based developers and individuals that unilaterally develop dwellings without mainstream financial support. This occurs in space available in existing formal neighbourhoods in housing estates and is often referred to as Dweller-Initiated Transformations (DITs) in housing. The largely un-documented housing production suffers from lack of recognition and therefore attracts minimal financial support from mainstream banking institutions and instruments. This in turn leads to poor physical environments as the activities remain shrouded in illegality. This is in spite of their legitimacy as alternative

1 Middle Income is between KShs. 25,000-140,000; low-income is below
2 'Real' demand is the actual; while 'effective' demand is that supported by affordability

housing production models for urban areas. Despite the conspicuous physical environmental depravity documented in existing neighbourhoods in which DITs are dominant (Makachia, 2012), the financial innovativeness by individual to develop and reshape the urban landscape cannot be ignored. Instead, it can be the basis for developing and investing new housing in the Kenyan and other third world towns. The paper develops this thesis in developing new housing schemes.

It posits that, in order to respond to the immense housing needs posed by the ever-bulging urban populations in the developing world, reliance on existing systems for mobilising and accessing housing finance and other economic resources has proved unsustainable. It is therefore opportune to develop alternative systems through financial engineering that rely on incremental housing development. This alternative ought to mobilize formal and informal resources to spur savings, incremental growth, renting and re-investing in housing. This is suited to individuals and the small-scale developers like *chamas*, housing cooperatives, and other micro-financiers. The proposed model assumes the house as serving beyond a social good but an economic resource for economic emancipation of the dweller and general sustainability.

In 'putting banking at the centre of economy's sustainable growth' in the area of focus of 'housing and real estate', the paper roots for the use of locally available resources, including: labour, materials capital that is recycled locally through innovative financial systems. 'Green' development is therefore seen as local sourcing of these resources to save on carbon miles enshrined in high-import-content alternatives. It is also sustainable in the utilisation of local labour to redress the un-employment scenario prevalent in the urban areas and the entire republic. If mainstreamed, incremental housing development can assume many aspects of sustainable growth, encompassing the physical environment, economy and society. A green economy is necessarily about economic development and growth that is sustainable. This pedestal for the same in housing and real estate and is founded on the three underlying themes of the physical, social and economic environment, as tenets of sustainability in the built environment.

The research strategy was three-fold; literature review, collection of empirical data in housing estates, and development of the financial simulation models based on Microsoft Excel© programme. The empirical[3] work aimed to establish the prevalence and understand the phenomena of housing transformations by individual dwellers in otherwise formal housing. However, central to all the discussions

3 Discussions of the fieldwork are captured in other publications (Makachia, 2011; 2011; 2010; 2012). This however, was limited to only 100 randomly adminsterred questionaires and used predominantnly for descriptive statistics

is the underlying economic motive in transformations. In this vein, the cost of transformations and the rental returns[4] were investigated too. This understanding is extrapolated to encompass possible scenarios in new housing on a virgin land. This, in turn, is developed in the hypothetical simulation models that informs the paper.

It should be noted that technical and architectural solutions are not the focus here. The financial simulations, however, are based on a hypothetical but realistic architectural housing models and also informed the extensions in formal housing unearthed in the empirical work. The architectural technology, central to sustainability[5], is also only mentioned perfunctorily. The theme, therefore remains, innovative financing for self-managed building process witnessed in incremental housing.

4 There is however need to develop, in the country, a more reliable generalized index to include hedonic values to housing consumption. This would appreciate architectural and other spatial qualities are contributory to the housing and rent prices. Currently, the index by Hass consultants (Hassconsult, 2014) (HassConsult Real Estate, 2014) is narrow as it represents only a fractional sector of the housing market. It is also based on 'repeated sales' values and not the qualitative aspects of housing. Further, to broaden the index, it is necessary to include bank and mortgage housing sources and other real estate consultants in the market, in its derivation.

5 Most sustainable solutions for housing like Francis Kere's Award-winning teachers' housing in Gando, Burkina Faso (Kere, 2011; Contal & Revedin, 2011) relied on adaptive and appropriate technology as well as innovative and contextual climatic design. They however, offered no direct tangible direction with regard to innovative financing.

For testing, the developed model used inputs based on contemporary and contextual information and data on finance, the construction industry and the economy in general. However, it is flexible, sufficiently to respond to changed scenarios over time, in the country and elsewhere. It also transcends income brackets, although it is more amenable to middle and low-income groups. This is so, mainly because, the empirical data and evidence of self-generated housing was in the said income brackets. It is assumed that the more affluent are more likely to change residences rather transform them (through incremental development) if they are uncomfortable with the houses and homes they presently occupy.

The structure of the paper is based on the research strategy with, first, a review of literature of theory and empirical experiences, globally, on sustainable housing. The second discusses housing finance in Kenya, with studies are based, largely, on public housing strategies. Public housing strategies are often preferred as 'social housing' because they aim to satisfy a broader economic profile of dwellers, and not just the affluent. 'Social housing' is therefore more constrained (and more accountable in the use of limited public capital) in access to economic resources and offer more valid discussions on economically sustainable solutions. In the third and main section, the model is presented with discussions of the input data and implications of the output scenarios.

Sustainability in housing

The principle of sustainability which was borrowed from an approach to forestry management 'which guaranteed biological diversity, productivity, vitality and the ability to regenerate in a way which endangered no other eco-system' (Contal & Revedin, 2011, p.11) is seamlessly transferable to the architecture of housing in urban settlements.

It is an approach in housing and architecture that involves the citizenry and connects them to the city at large and not just the single housing object. Sustainable development is about the creation of lasting values in the human condition that are well embodied in the discipline of architecture. It is also an ethical approach since the discipline is often guilty of regularly selling out to market forces with the advent of any new civilisations in human history.

Sustainability is a socio-political responsibility that is not restricted exclusively to technological standards. It is perceived as all-encompassing to include aspects of development that pursue human dignity in, particularly, housing development for the urban majority. This is aptly captured in the writings by Egyptian architect and reformer, Hassan Fathy: "One's design must serve the humble everyday needs of men. Indeed, if these designs are true to their materials, their environment and their daily job they must necessarily be beautiful' (Fathy, 1973).

Physical environment

The physical environmental considerations are always at the core of the global discussions on the sustainable development. The definition of sustainable development is anchored on the use of physical resources. Thus, sustainable development is one, "... that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development (WCED), 1987)[6] . The concept is broader and addresses needs of people over time and the systems that sustain them.

6 Commonly referred to as the Brundtlund Report

In housing, sustainability concerns the use of materials and other resources that do not harm the physical environment. In traditional society this was through the use of local materials that were mostly biodegradable. In addition, the lifecycles of the communities then suited this temporal existence. Although, some aspects of modern lifestyle may possess temporal layers[7] (Brand, 1994), buildings nowadays ordinarily span a long time and a commensurate durable 'structure'.

Physical sustainability, therefore, has a broader implication and veers into sourcing of the materials and the means thereof. In the sourcing, the concern is of replenishing the raw materials to least harm the environment. Since construction of buildings is extractive, the means of the processes is often weighed against the impact on the global environment including emission of 'green house' gases like carbon dioxide. A corollary of this is the energy expended in the process; and the impact of transportation on the physical environment measured through 'carbon miles'. The double effect locally is the concern of the 'import content' of the materials and construction technologies which measure both the impact on environment and the contribution to local economy. Sustainability, will therefore be about keeping low the 'import content' to lower the 'carbon miles' and aid in employment generation as a socio-economic residual.

'Passive' design

Another sustainability concept in building design will engage the use of 'passive design' in the architectural

7 E.g. finishes and moveable 'stuff' like furniture and interior details (Brand, 1994).

Figure 1: Sustainable housing in Gando, Burkina Faso by Krancis Kere (2011) - uses earth bricks and large roof overhangs for thermal comfort in the houses.

product. This is reliant on the morphology and specifications of the built-form (Makachia, 1998). Francis Kere uses this model in the design of houses for teachers in Burkina Faso, West Africa, by employing laterite blocks and self-ventilating roofing and walling systems (Contal & Revedin, 2011, pp. 60-63). In this Award-Winning project, he uses locally sourced earth reinforced for durability and weather-resistance. By using earth, he also re-introduces the concept of 'recycling earth' akin to traditional architecture (Fig.1).

Recycling

Recycling of waste is another aspect of the physical environment that is of concern to urban housing. Whereas organic waste is mostly recycled through urban agricultural practices in cities like Nairobi (Foeken & Mwangi, 1998), the inorganic pose a different problem (largely related to the social and governance of urban areas) as these continue to litter the urban space.

Urban housing design is also tasked to address aspects of water harvesting and management to harness underutilised rain water in the midst of dysfunctional urban service provision by public corporate organs governments. The same applies to alternative domestic (and other non-domestic energy used during the construction process) energy sources to best utilise solar, wind and other inorganic, non-fossil-based energy sources.

The physical environmental aspects of sustainability in buildings, homes and neighbourhoods are rated in most advanced countries (e.g. the US) using systems developed like LEED (Leadership in Energy and Environmental Design) (Wikipedia, 2014). These aim guide green building in design, construction, operation and maintenance. In Kenya, no standards are yet in place but some architects have used these standards in some of their buildings and have sought accreditation.

Socio-economic sustainability

Clearly all physical environment alternatives also bear a socio-economic effect. And this is central to the sustainability in housing for Kenya. Colonial and early post-colonial housing strategies were based on modernist development paradigms by providing housing units without considerations of the broader effect on the social and economic environment. This, not only produced inadequate numbers of housing, but also generated poor physical environmental qualities. One other outcome was the dweller-initiated transformations (DITs) that also introduced un-envisaged functions within neighbourhoods (Makachia, 2010; 2012). The sustainable approach would involve the users at design, construction and management of the housing (Makachia, 2014).

The positive lessons from these failed strategies include the capacity of individual dwellers to mobilise resources to initiate their own housing solutions in the

transformations. It is also their capacity to balance between their incomes, access to social loans from informal sources, savings and construction cost of transformations. It is also noteworthy that is usually weighed against rental returns when sub-letting was the objective of the transformation. The economic rewards include mobilising labour and material resources locally and, broadly, in the industry if scaled upwards. This informs the thesis of the present paper.

It however opportune to unravel the genesis of the trend as catalysed by existing public housing financial strategies as used in the country.

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Housing finance in Kenya

Housing finance has historically been reliant on the government and the prevalent policy orthodoxy. The early orthodoxy was of rental housing viewed housing as a social rather than an economic good. With the aim of creating a stable urban population, ownership succeeded the early approach that presumed a transitory urban population.

The reality of the moment is however different as private renting is the norm. In effect, a new entrepreneur class dominates urban housing that is emerging in the form of tenement apartments. Financing must therefore embrace this private rental reality in addition to the revered ownership strategy.

Public rental housing

In early years of urbanisation of Kenya, housing was mostly rental provided by the then African housing agency, the Central Housing Board (CHB) (c.1960). This was during the British colonial era, where local authorities were advanced finance through this CHB. Rental housing loans had long repayment periods (40 years) at low interest rates. These had more social objectives than economic ones, and mimicked European post-war social housing (Power, 1993). In African cities, however, the social standard was pre-defined as it was based on these European spatial templates.

From a design angle, these were based on modern architecture (Frampton, 1992) strategies developed in 20th century. They presumed a dormant non-participative dweller and housing was thus defined as a 'product' (Hamdi, 1991) and economically defined to match the dwellers spatial needs. In reality, observed in present-day, informal transformations are the norm. Since the ownership of the dwellings is still bestowed with the city authorities, the physical quality of the extensions is often poor. The dwellers cite the lack of tenure as the reason for not investing in better quality houses and hence the slum condition

impending. The rental financing strategy assumed a static situation with dwellers confined to formal employment, and thus never envisaged the informal economy now prevailing in these neighbourhoods.

The environment in public rental housing confounds many, as it retains the official 'tenants' but now through informal transformations also 'landlords' in their own right. The informal transformations serve the 'sub-tenants' but also house added activities including business. The drive to add space is seemingly legitimate even if the additions are illegal. Legalisation through enhanced or granting of tenure rights is likely to spur dweller-driven incremental housing, expected to be of a higher standard.

Rental housing is now mainly restricted to 'uniformed' public servants like the military, police and National Youth Service. As a social housing solution for the general public, no new efforts are being considered in policies by the central and county governments. Rentals built by private employers[8] are also hardly considered as most employers pay consolidated salaries and expect employees to seek privately-sourced housing or owner-built accommodation[9].

Tenant-Purchase housing

The post-colonial government adopted the same rental housing policy until it became unsustainable economically in the late 1970s. However, there was an advancement of the rental strategy that encouraged tenants to purchase the houses in a medium-term period (15-25 years) repayment periods at low interest rates. This is another socially-driven approach. The strategy is to encourage home-ownership. Dubbed Tenant-Purchase (TP) housing, this has been applied in complete houses and partially developed units[10] or serviced plots[11] as alternatives. TP housing schemes have been mainly[12] through the National Housing Corporation (NHC), a post-colonial parastatal that succeeded the CHB.

The principle of TP housing is that the land and house remain assets of the government until the repayments are concluded when land transfers can be facilitated.[13] In principle, the house remains government property and (on paper) the TP Agreement even prohibits transfers until after 5 years of occupancy. These soft conditions make TP houses attractive to all, including speculators who remain responsible for 'down raiding' by higher-income dwellers in low cost schemes countrywide.

It should be noted that TP housing was and remains

8 In early years of the city, employers lie the Kenya Railways were tasked to provide employee rental housing

9 Possible through employee savings and association in Savings and Credit Cooperative Societies (SACCOS)

10 E.g. 'starter' units (Makachia, 1995) and 'core' housing in the 1980s and supported by USAID

11 In Site & Service Schemes (S&S) that was promoted by multi-lateral agencies like the World Bank in 1970s

12 Some local governments like that of Nairobi has been able develop such projects directly

13 This will mean payment statutory changes like rates, land rents, stamp duty and legal fees

largely a public sector model enabling the less rich access housing and own homes. No private sector investors deem it worthwhile ceding their assets to tenants through rent payments. This is probably economically justified but there exists a case for alternative thinking. This concerns the prevailing physical environment including maintenance and care in most rentals; public or also private. Without due care by the landlord, the tenants assume little or no responsibility of these issues that often lead to dereliction and inhabitable neighbourhoods. Public rentals are the guiltiest but similar conditions exist in private rentals. In the tenements (Huchzermeyer, 2006), for example, the neglected physical environments are aimed at retaining the low rents charged to the poor.

The physical deterioration often leads to slum neighbourhood conditions commonplace in Nairobi's low and middle-income settlements. The suggestion therefore is to encourage tenant-ownership of the rental units over stipulated sustained rent payments. This is as a way of promoting environmental care and responsibility by dwellers more common in owned estates (like gated cluster communities). Indeed, the evidence from City County of Nairobi (CCN) estates indicated care and responsibility lacked because the tenants lacked ownership rights.

TP housing for civil servants is one of the two social housing strategies the government still implements. Other than for enabling the public sector workers own their dwellings, it is unlikely to be implemented nor made available for the general public by both the central or county governments[14]. The obvious implication is that the strategy is heavily laced with subsidy and cannot be sustained in the long run.

Mortgage housing

The 'social' housing options have not yielded the outcome envisaged and most housing production is now reliant on market-driven financial strategies as in mortgage financing. Early on, for the government, it only offered guarantees for offshore funding, and left the bulk of housing development to the private sector through mortgage loans that were to be paid over 15 to 25 years (Anyamba, 2006, p. 168). These mortgage loans attracted market-driven interest rates and are often inflation-adjustable.

Mortgage finance relies on the asset being in the possession of the dweller. Thus, it can be applied on property on freehold title and leasehold deeds[15]. Mortgagors hold the ownership document as collateral that can only be released on loan payment. The additional qualification for the loan includes capacity to repay and this is often reduced to an employer's payslip.

Many mortgage-base estates are bedevilled with DITs (Fig. 2) that serve both to enhance and lower

14 Including the long repayment periods, the low interest rates and land that is usually public and hardly fully included in the pricing of the dwelling.

15 The duration of the lease is critical in determining one's qualification for the mortgage loan.

Figure 2: Buru Buru transformations (Makachia, 2010)

the values of the houses and neighbourhoods alike. The mortgage financing approach is preferred as the market strategy that ought to be reinforced and harnessed for dweller-driven housing that is the backbone of incremental housing.

Innovative[16] financing for housing

The models of housing finance in the market are traditional in approach as they; assume the long-time nature of housing as an asset, security of tenure, thus, finance depends on these values. These approaches therefore assume housing a tangible product and are therefore treated as an economic good subject to normal rules of trade and exchange at hand in the capitalist economy.

In the proposed innovative approach one needs to look beyond and relate to dynamics of housing occupancy in a contemporary city. This brings forward the use the unit is subjected to in the market economy of towns. Urbanisation brings with it urban services and creates room for formal and informal business and trade. The evidence from empirical studies indicate that housing create employment and enhance incomes (Wells, 1984; Wells, etal., 1993; Erkelens, 1991).

In the innovative approach, these qualities are exploited in various ways; first, that for the majority low and middle-income dwellers, housing is incremental and not fixed nor static in its uses. Incremental housing means that the initial products is expandable and in the process enhance its collateral value. Flexibility in use also means dwellers do sub-let, change use and enhance their incomes from the dwelling. These acts

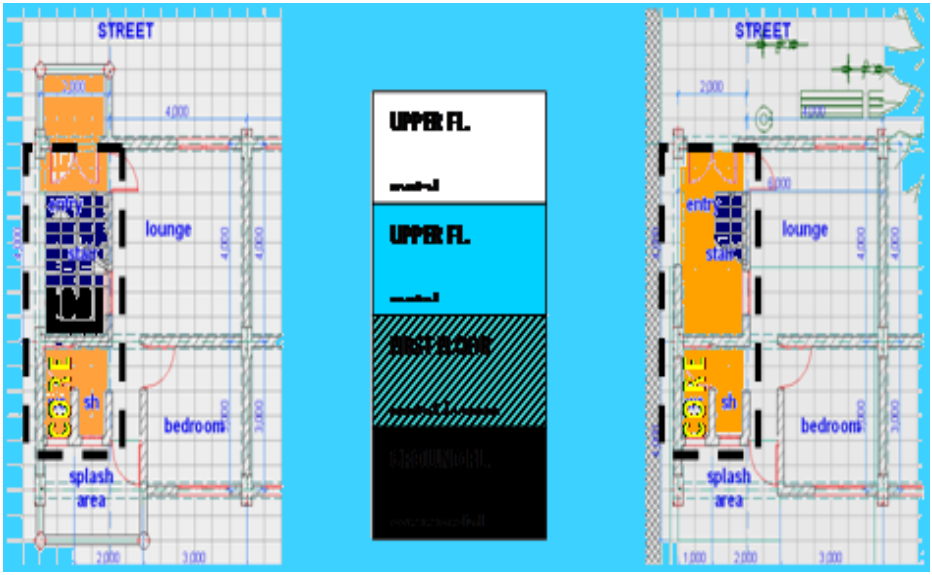
16 Similar models exist in Latin American examples but target mostly low-income housing (Stein & Castillo, 2003; Rodriguez & Astrand, 1996)

improve the repayment capacity of the dweller, and it is posited that such ought to form the basis for banks providing finance to the dwellership or those of lower income than current thresholds.

Secondly, incremental approaches employ 'sweat equity' (Hall, 1990) through direct engagement of the users in various ways of building. These help in stemming costs of production and include: self-building, self-production and self-management (Erkelens, 1991). In addition, one can accord a higher premium to social and environmental quality to self-generated dwellings as is the case of incremental housing.

These were the argument enshrined in 'process-based' strategies (Makachia, 2011) like site and service (S&S) scheme and 'starter' unit housing (Makachia, 1995). However, the point of departure lies in the target group of higher and other income groups, unlike the low-income target of the 'process-based' strategies. Further, these earlier systems demanded the dwellers to adhere to the provided designs, something that will not be necessary. Indeed, the strategy invokes learned practices of using the dwelling for income through self-generated extensions.

It is located in either new or established existing self-regulated neighbourhoods so that the nature and



quality of the transformation is negotiated through Residents' Associations (RAs). In Organised Self-Help Housing (OSHH) (Makachia, 2005; Rodriguez & Astrand, 1996), the social, financial (Stein & Castillo, 2003) and technical strategies tally to create negotiated neighbourhoods that is the genesis of the proposal. While in existing neighbourhoods, it is about facilitating access to finance, as secondary or tertiary mortgages, for legitimate extensions. In new or future neighbourhoods, it aims to mainstream financing rooted in future spatial transformations and anticipated returns from rents, and their use for business when sub-let.

Description of the Model

The model was developed as part of studies in human settlements at KU Leuven's Post Graduate Centre for Human Settlements (De Troyer F. , 1990) and applied in the 'Swahili type' housing in Dar es Salaam, Tanzania (De Troyer & Allacker, 2004). The presented model has been further developed for the Kenyan context using transformation studies in formal housing estates in Nairobi (Makachia, 2005; 2010; 2012; 14-15 November 2013; 2005).

A conceptual hypothesis is that formal financing systems are inadequate in resolving deep-rooted housing demand for the cities, and financial institutions ought to innovate systems that take cognisance of the individual formal and informal savings, incremental growth, subletting and re-investing as alternatives. Its possible users include: architects, urban designers, project developers, financial institutions, and policy makers. The possibilities of the model include modelling saving and borrowing arrangements, incremental expansion, as well as differential growth of inflation, construction costs, and rents. It also models decisions concerning re-investment policy in real estate development totally or partially. It summits the consequences of delayed or incomplete rental payments in sub-let houses.

It can help one understand related questions of a revolving fund dedicated to housing development and its drying up due to construction cost inflation. It can utilised in related issues concerning maintenance, periodic repair and renewal. The model should help gauge administrative cost on loans for incremental development and banking services for the same real estate development.

Input parameters

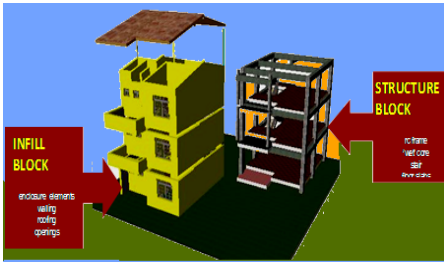
As already mentioned, the model is based on Excel® spreadsheets. The inputs include the technical, economic and financial parameters.

a) Technical parameters- project data

The first entries are technical and concern the design form and its specifications.

For the example, a one bed-roomed unit was used (Fig. 3 & 4). Its area was 26.25sq metres, the walling was 2.7metres high and it was to be developed incrementally upwards given the scarcity of affordable land. It assumes the incremental house will be phased to coincide with complete sub-lettable unit for occupation (Fig. 5). The building is sub-divided based on building elements (De Troyer F. , 1990) that are used to compute construction cost by inputting the cost rates. The elements considered include: site preparations, foundation, ground floor external walls, internal walls, suspended slab, roof, doors, windows, electrical and sanitary works. In Kenya, this would be done with the quantity surveyor and the rates information from the industry through the Architectural Association of Kenya (AAK)[17]. Table 1 illustrates an example the spreadsheet for unit rates', used in the simulation. The calculations generate costs for construction used later.

Figure 4: Illustrates 3D unit

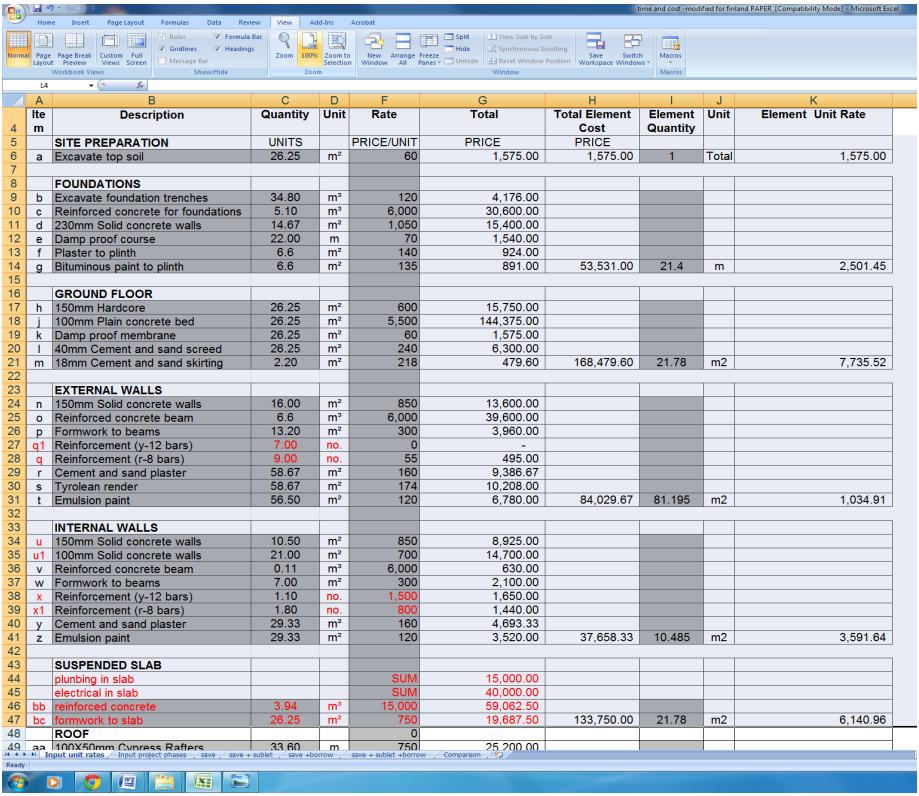


The other technical input parameters include the phasing of the incremental development. The first phase is the most expensive as it takes cares of foundations for the entire structure on completion. The subsequent phases may attract uniform costs that are inflation-adjusted. Figure 4 illustrates the unit broken down into its building elements, separating the structure and the concrete frame for illustration. The specification assume a concrete framed modern structure with basic finishes, plumbing accessories and roofed with a timber trussed tile or CGI finish.

17 E.g. The Joint Building Council (JBC) rates of basic building costs. Others include the Institute of Quantity Surveyors (IQSK) who regularly publish 'Current Construction Costs'.

Figure 5: Phasing scheme (Makachia, 14-15 November 2013)

Table 1: Input spreadsheet of 'unit rates' - example



Item	Description	Quantity	Unit	Rate	Total	Total Element Cost	Element Quantity	Unit	Element Unit Rate
	SITE PREPARATION	UNITS		PRICE/UNIT	PRICE	PRICE			
a	Excavate top soil	26.25	m²	60	1,575.00	1,575.00	1	Total	1,575.00
	FOUNDATIONS								
b	Excavate foundation trenches	34.80	m³	120	4,176.00				
c	Reinforced concrete for foundations	5.10	m³	6,000	30,600.00				
d	230mm Solid concrete walls	14.67	m²	1,050	15,400.00				
e	Damp proof course	22.00	m	70	1,540.00				
f	Plaster to plinth	6.6	m²	140	924.00				
g	Bituminous paint to plinth	6.6	m²	135	891.00	53,531.00	21.4	m	2,501.45
	GROUND FLOOR								
h	150mm Hardcore	26.25	m²	600	15,750.00				
j	100mm Plain concrete bed	26.25	m²	5,500	144,375.00				
k	Damp proof membrane	26.25	m²	60	1,575.00				
l	40mm Cement and sand screed	26.25	m²	240	6,300.00				
m	18mm Cement and sand skirting	2.20	m²	218	479.60	168,479.60	21.78	m2	7,735.52
	EXTERNAL WALLS								
n	150mm Solid concrete walls	16.00	m²	850	13,600.00				
o	Reinforced concrete beam	6.6	m³	6,000	39,600.00				
p	Formwork to beams	13.20	m²	300	3,960.00				
q1	Reinforcement (y-12 bars)	7.00	no.	0	-				
q	Reinforcement (r-8 bars)	9.00	no.	55	495.00				
r	Cement and sand plaster	58.67	m²	160	9,386.67				
s	Tyrolean render	58.67	m²	174	10,208.00				
t	Emulsion paint	56.50	m²	120	6,780.00	84,029.67	81.195	m2	1,034.91
	INTERNAL WALLS								
u	150mm Solid concrete walls	10.50	m²	850	8,925.00				
u1	100mm Solid concrete walls	21.00	m²	700	14,700.00				
v	Reinforced concrete beam	0.11	m³	6,000	630.00				
w	Formwork to beams	7.00	m²	300	2,100.00				
x	Reinforcement (y-12 bars)	1.10	no.	1,500	1,650.00				
x1	Reinforcement (r-8 bars)	1.80	no.	800	1,440.00				
y	Cement and sand plaster	29.33	m²	160	4,693.33				
z	Emulsion paint	29.33	m²	120	3,520.00	37,658.33	10.485	m2	3,591.64
	SUSPENDED SLAB								
	plunbing in slab			SUM	15,000.00				
	electrical in slab			SUM	40,000.00				
bb	reinforced concrete	3.94	m³	15,000	59,062.50				
bc	formwork to slab	26.25	m²	750	19,687.50	133,750.00	21.78	m2	6,140.96
	ROOF			0					
aa	100X50mm Cypress Rafters	33.60	m	750	25,200.00				

The order of the phases reflects the vertical sequencing of the extensions with the final inclusive of the roof. The first phase, consisting of the ground floor, would be the dearest given the erection of foundations meant to support the upper floors. Although the model shows up to 8 phases, reflecting the maximum number of storeys witnessed in the Buru-Buru case study, in reality only 3 levels are recommended for reasons of cost, functional / structural considerations and urban design. Each unit would be accessed via staircase on one side of the room, and this format would be replicated on each upper floor. For variety, internal sub-divisions are suggested to control costs.

In the sheet 'input project phases' (Table 2) for each consecutive phase the dimensional characteristics have to be entered. A standardise dimension of 3.5 metres by 7.5metres is used with commensurate areas and perimeter computations in sheet 'input phases'. Based on the element cost elaborated in a previous sheet, 'input unit rates' and geometry defined in this sheet the costs are calculated. Some inputs in the phases include: the width and depth of the unit, length of the internal walls, length of the foundation of the internal walls, wall height, window area and door area. On top of that you can also indicate if the owner himself will defray some of the costs through self-building and management of the construction or not. If so, then you can enter how much will be saved on construction costs based on the unit rates for the work sections. In the example 35% is the saving attributed to such a choice to the choice.

Table 2: Example of 'input of phases' spreadsheet

PROJECT TABLE: PHASE ONE

INPUT PARAMETERS		
Width	7.50	m
Depth	3.50	m
Internal wall	7	m
Int. wall with foundation	3.5	m
Wall height	3.00	m
Windows	3.00	m^2
Doors	6.50	m^2

Self Help	Yes
Saving by self project management	35%

INTERMEDIATE RESULTS	
Perimeter	22.00
Area	26.25

BUILDING PLOT		
Width	7.5	m
Depth	22.5	m
Perimeter	60.0	m
Area	168.8	m^2
Built-up area	84.4	m^2

COST CALCULATIONS

Code	Element	Price/Unit	Unit	Quantity	Ratio	Price/m^2 Floor	Total Price	%
1	**Site preparation**						1,575.00	0.1%
2	**Ground floor**	7,736	m^2	26.25	1.00	7,735.52	203,057.37	18.3%
3	**Foundation ext.**	2,501	m	22.00	0.84	2,096.45	55,031.87	5.0%
4	**Foundation int.**	2,501	m	3.50	0.13	333.53	8,755.07	0.8%
5	**External walls**	1,035	m^2	56.50	2.15	2,227.52	58,472.52	5.3%
6	**Internal walls**	3,592	m^2	21.00	0.80	2,873.31	75,424.42	6.8%
7	**Openings**	30,836	m^2	6.50	0.25	7,635.50	200,431.84	18.0%
8	**Sanitary**						236,000.00	21.2%
9	**Electrical works**						173,000.00	15.6%
10	**External Works**						100,000.00	9.0%
11	**suspended slab**	6141	m^2	26.25	1.00	6,140.96	161,200.07	14.5%
	TOTAL CONTRACTOR'S COST						**1,111,748.08**	100%

Table 3: economic input parameters

Yearly		Monthly	
Income (I)	1,200,000	Income (I)	100,000
Fraction (f)	15.0%	Fraction (f)	15%
Growth rate income (g_i)	5.0%	Growth rate (g_i)	0.41%
Growth rate construction cost (g_c)	10.0%	Growth rate (g_c)	0.80%
Growth rate subletting (g_{sl})	5.0%	Growth rate subletting (g_{sl})	0.41%

b) Economic parameters (Table 3).

These describe the economic situation in the country and as it affect the individual dweller. These are the income and its growth rate growth rate, as well as construction cost and its growth rate. Others relevant for the incremental housing include the rent and its growth rate. The example shows an income of KShs.100,000 monthly. For the model we also indicate the fraction of the income available for funding the additional unit. Monthly rates and yearly rates are used for flexible computations depending on the available data.

c) Financial Parameters (Table 4).

These relate to the interest rate on saving, interest rate on borrowing and the repayment period of the loan. For the model we use short-term loans of up to five years to reflect the small investments suitable for the incremental model. Yearly and monthly rates are computed as was the case for economic inputs.

Table 4: Input of Financial parameters

Yearly		Monthly	
Interest rate saving (r_{sav})	5.0%	Interest rate (r_{sav})	0.41%
Interest rate borrowing (r_b)	15.0%	Interest rate (r_b)	1.17%
Period of loan (n_b)	5	Period of borrowing (n_b)	60

d) Technical parameters for expansion (Table 5)

In this part the phasing of the project is indicated. Further, one can indicate when sub-letting for the added unit can begin to attract rent or stopped if need be. It is assumed subletting only begins after the unit is constructed. For the calculation here it is assumed this will begin immediately (during the first month) the unit ready for occupation. Estimated construction costs are generated in part (a). Anticipated rent is also indicated. Finally, one has to indicate if there is need for a loan or not.

Table 5: Phasing, loan and rent inputs

	Possible start subletting	Last month of subletting	Costs now	Rent now/ period
Phase 1	1	120	889,398	18,529
Phase 2	1	251	453,777	9,454
Phase 3	1	251	453,777	7,563
Phase 4	1	251	453,777	7,563
Phase 5	1	251	453,777	7,563
Phase 6	1	251	453,777	7,563
Phase 7	1	251	453,777	7,563
Phase 8	1	251	410,687	6,845

Output scenarios

The following sections illustrate four possible scenarios only, using the inputs indicated in Tables 1-4.

a) Save to build (Table 5 & Fig. 6)

In this case, only savings are used for the extension and sub-letting income is not considered. The first expansion takes more than five years to realise. Later additions are regular at between 3 to 4 years, but only possible up the fourth unit only.

b) Save and sublet (Table 6 & Fig. 7)

In this case the income from subletting is used to spur expansions. No loans are envisaged at this stage. The rate extension somewhat speeded up and the maximum expansion is increase marginally.

Table 6: expansion intervals with only savings

Expansion	1	2	3	4	5	6	7	8
Period in months	62	98	140	192	#N/A	#N/A	#N/A	#N/A
Period in years	5.2	8.2	11.7	16.0	#N/A	#N/A	#N/A	#N/A
	interval in year	3.0	3.5	4.3	#N/A	#N/A	#N/A	#N/A

Figure 6: Expansion graph with only savings

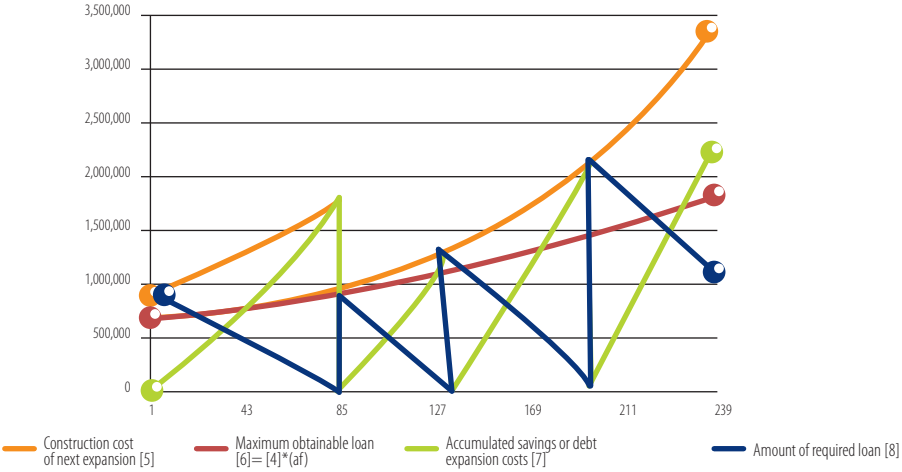
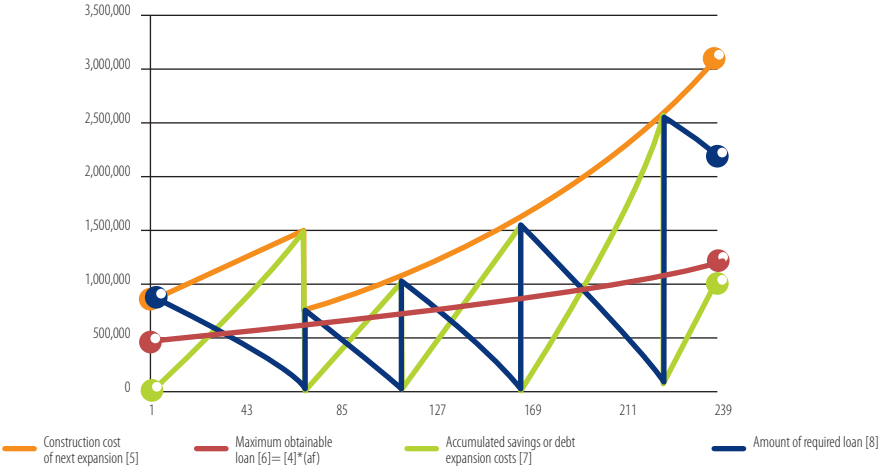


Table 7: Expansion intervals with savings and sub-letting

Expansion	1	2	3	4	5	6	7	8
Period in months	54	86	123	166	218	#N/A	#N/A	#N/A
Period in years	4.5	7.2	10.3	13.8	18.2	#N/A	#N/A	#N/A
	Interval in year	2.7	3.1	3.6	4.3	#N/A	#N/A	#N/A

Figure 7: Expansion graph with savings and sub-letting



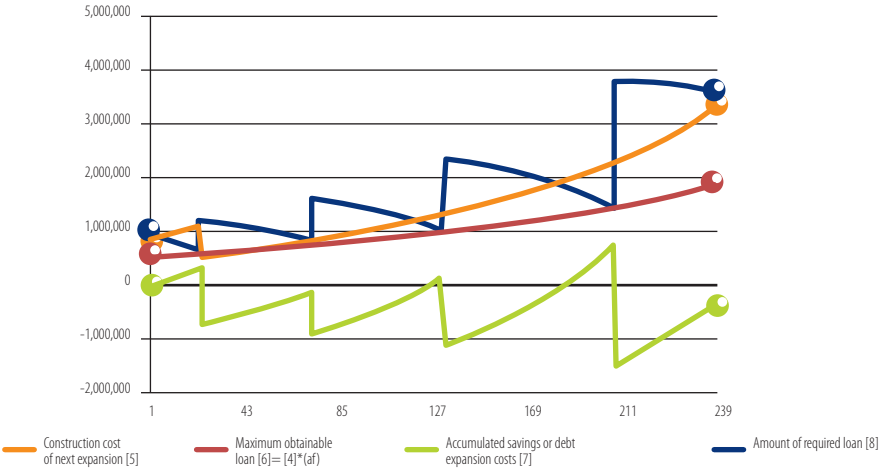
c) Save and borrow (Table 7 Fig. 8)

In this option no subletting income is considered even though extensions are present, presumably for the family only. Loan money is used to spur expansions. Whereas the first expansion is swift, in less than a year, the rest follow regular intervals that keep increasing with time. The maximum expansion is only five units. The scenario is somewhat disadvantageous to the 'save and sublet' scenario before.

Table 8: Expansion with loans and savings.

Expansion	1	2	3	4	5	6	7	8
Period in months	7	44	88	139	202	#N/A	#N/A	#N/A
Period in years	0.6	3.7	7.3	11.6	16.8	#N/A	#N/A	#N/A
	Interval in year	3.1	3.7	4.3	5.3	#N/A	#N/A	#N/A

Figure 8: Expansion with savings and loans



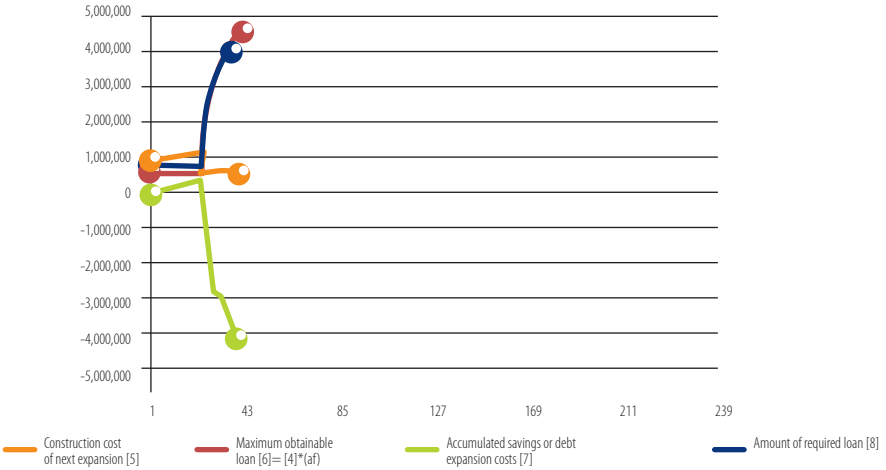
d) Save, borrow and sublet (Table 8 & Fig. 9)

This culminates in the use of the possible scenarios at hand for incremental housing. This fast tracks the process and within two years the maximum possible expansion can realized. This situation is only hypothetical and is rooted only in the economic values used in the exercise.

Table 9: save, sublet and borrow for expansions

Expansion	1	2	3	4	5	6	7	8
Period in months	7	8	9	10	11	12	14	16
Period in years	0.6	0.7	0.8	0.8	0.9	1.0	1.2	1.3
	Interval in year	0.1	0.1	0.1	0.1	0.1	0.2	0.2

Figure 9: save, sublet and borrow for expansions



It may be possible that this will be calibrated with physical environmental considerations including planning controls and structural stability within the limitations of the land parcel. These include:[18] Plot Ratios, Building Set-back Lines and Ground Coverage percentages are used to control the environment and the urban design of the zones, and therefore must considered fully exploit the investment potential of the model. The output however confirms that well-managed income savings, subletting rents can spur expansion of the units and generate desired housing.

Whereas the simulated output confirms the supposition that well-managed investments in incremental housing yields optimal outcomes, this has to operate within practical considerations like construction time, structural stability needed before additional vertical space can be added, and sourcing a tenant to occupy the unit. Further, the building remains occupied as these extensions proceed and this must be compromised by the transformations only sparingly. There is therefore need to incorporate these practical realities as confirmed by empirical findings, in order to operationalise the proposal.

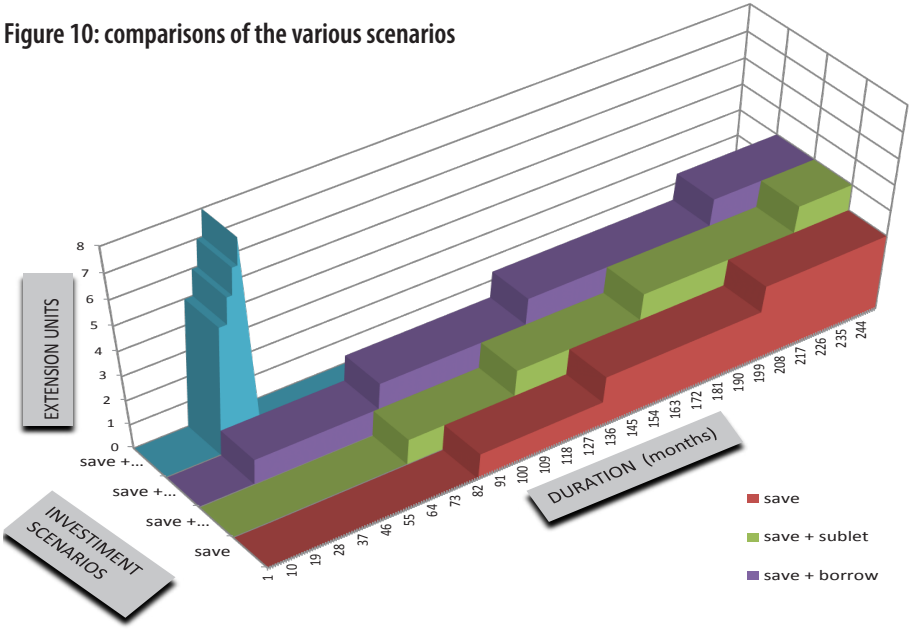
e) Conclusions

Figure 10 graphically compares the output scenarios presented.

This confirms the hypothetical position that well-

18 Tools used in Physical Planning enforcement that are aimed to control the form and population densities in given zones.

Figure 10: comparisons of the various scenarios



managed savings from the dweller's income, coupled with sub-letting rents and loans can spur faster expansion of extensions. For a green economy, incremental housing operates within a negotiated framework of the environment, the people and the natural resources. The thesis of the discussion centred on letting dwellers make decisions on housing expansions, assuming they are best suited in harnessing the virtues of the environment sustainably and within the set economic scenario. This remains the position and the models illustrate the prudent use of capital resources can also be useful in reassuring financial institutions that 'green' architecture can be done without risking economic returns.

The other lesson confirmed is that smaller phased loans that tally the incremental phases may achieve a better outcome than the larger loans conventionally preferred in housing. This way the investors would thus qualify for these smaller loans based on the stages of the simulation outcomes. For instance, in the comparative graph, the 'save + borrow' option seems to yield faster units than the 'save + sublet' one. This may be a pointer the weaker rental returns and softer loan conditions. This may be reversed with changed economic conditions on inflation, interest rates of savings and bank loans. The possibilities are many and

can be optimized to realize most objectives and aims by banking and financial institutions.

The example also demonstrates that the model has the potential of guiding decisions for the households and the micro-funding agencies in the innovative financing alternative. Incremental housing should therefore, be supported financially to housing development for the low-and middle income dwellers in towns. Financing agencies and banks can factor the potential of incremental developments in housing in enhancing the values of the houses and hence their eligibility as secure collateral for borrowing.

General discussion

The paper prefers incremental housing initiated and managed by individual dwellers that is guided by a rational design and economic principles. It does not support wanton extensions that serve purely ill-understood economic objectives at the expense of convivial urban and neighbourhood space, which has proved unsustainable with evidence of environmental dereliction in existing housing estates.

The value to self-guided, 'sweat equity', housing is more than economic as it leads to development of domestic space better appreciated by the inhabitants that forms the basis for sustainable city development. The opportunity of banking institutions to play a role is a chance to serve as an oversight body whose mandate, though remains economic, and ought to evolve to encompass conducive physical environments. This may be the major guarantor of minimized risks of credit to urban housing. Somewhat inadvertently, the financial sector will assume a greater regulatory role in the physical environment in housing for sustainable economic development, if support for the incremental housing is recognized.

The opportunity cost of self-help building remains a concern to all in incremental housing, especially the middle- and higher-income brackets. The position here is that for micro-development that is incremental housing, various roles will be defined that engage the dweller, and these include: self-building, self-production of basic materials and products and more crucially self-management of the design and construction activities. The divergent roles engage the individual variously may only enhance the quality of the product through this direct or indirect engagement. It is also neither new from an African cultural perspective nor from evidence from other countries like the Scandinavia, Europe, Latin America and Asia where Organized Self-Help Housing (Stein & Castillo, 2003)are broadly accepted as alternatives to centralized housing models that often lead to slums (Hamdi, 1991).

The risk of defaults by dwellers is minimized in incremental housing model advanced here as it is reliant on micro-credits that are known to have a lower default rate as per the work of Nobel Laureate Professor Muhammad Yunus, a Bangladeshi social entrepreneur, banker, economist and civil society

leader and Grameen Bank in Bangladesh (Wikipedia, 2014). This has been demonstrated also by many micro-credit organizations worldwide. This is however reliant on strong logistical infrastructure that most large mainstream banks may shy from (as this roots for development from below), unlikely to get widespread support in free-market oriented societies that most policy-makers prefer 21st Century Kenya. The flexibility of the micro-credit permutations inherent in incremental housing imply that defaults less likely and definitely higher with conventional housing models.

Indeed, in the model, factored in are variables including: cost of finance (borrowing interest rates, repayment periods), cost of construction (materials, labour), cost of saving for construction (savings interest rates), fluctuations in rents from added space, and income fluctuations of the dweller (hence the proportion devoted to housing transformation and its growth rate). This captures the most critical aspects of the economic aspects of housing that will influence defaulting. With effective monitoring of on-going and continuous development, the cost-overruns are less likely. Further, the dangers of sub-prime mortgages experiences in conventional products (mostly in the developed free-market world) are minimized with this model.

The basis of the proposal was a conventional house and assumed it conformed to modern housing approvable in urban settlements in Kenya. This was conformist and aimed at minimizing risks by banking institutions. In low-cost housing found in un-authorised informal settlements this model is even easier to realize as the cost of the dwelling, that utilizes low-cost and even recycled materials, is lower. Further, the chances of self-build are higher with many dweller likely to work as semi-skilled or un-skilled workers on building sites. The avenues of exploiting this potential in approved housing are in zones where Grade II[19] by-laws are still applicable.

Land is a critical contributor to the production of urban housing. The incremental model assumed an existing neighbourhood hence already on available land. This meant the model aimed to optimise the use of the available land in an urban residential neighbourhood. The alternative scenario of a virgin site is considered for employee housing cooperative societies, social security and pensions' schemes, common housing delivery systems in Kenya. Through pooling resources in SACCOs, the above and other myriad schemes, many can access housing land at costs within their reach. The model is thus used to also optimise the use of these lands over time in often rapidly urbanizing city peripheral location. Other costs, not factored in the model, which will be necessary for further operationalisation of the model include the transaction costs that are often needlessly high in Kenya. Policy directions that minimize the cost of land and these related expenses may be additional to the incremental and flexible financial model.

19 These are in the Building Code (Republic of Kenya (RoK), 1997)and are still retained for peri-urban areas formerly agricultural reserves like Dagoretti in Nairobi. The use of non-conventional, like earth, is accepted in the code.

The cost of building is clearly a factor in better urban housing and role of innovative materials and technologies[20] will not be sidelined. Parallel to these directions, and fronted by technical professionals like architects, engineers and quantity surveyors, will be the financial sector though support of innovative financial models that this paper reiterates.

The role of regulatory frameworks in the central and county environments are central to the operationalisation and mainstreaming of incremental housing. These regulatory bodies should envisage this incremental development as opposed to static architectural models. The governments', central and county, role in this model is to offer infrastructure that will tally with growth in building and population emanating from incremental housing within housing estates. The government policy should thus adopt a long-time view in infrastructure development and allow for upgradability to stimulate housing development as propagated in the incremental housing model.

In summary, the paper roots for the use of the dwelling, not as a purely social space, but also as an economic base for income generation. This however is guided by a sound design-led physical regulatory framework. It thus prefers process-based lending for housing credit as opposed to the existing models that are reliant, almost exclusively, on housing products as the collateral and hence credit base. Based on empirical observations, it thus reiterates the need for a stable research base for sustainability in economic development.

20 These include Building Element and Product fabrication systems for walling and other elements, Stabilized soil blocks (SSB) and fibre-cement roofing tiles and sheets (FCR), already in the Kenyan market by institutions like the National Housing Corporation (NHC) and the University of Nairobi. Others include the use of untested alternatives like bamboo. These however, require dissemination frameworks that are supported by the relevant infrastructure, capacity-building of the artisanry and education of individual consumers and dwellers.

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