Habitat International 48 (2015) 20–29

Contents lists available at ScienceDirect

Habitat International

journal homepage: www.elsevier.com/locate/habitatint

Age of land as parameter for sustainable transformation of Singapore's building stock

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ARTICLE INFO

Article history:
Received 31 July 2014
Received in revised form
20 February 2015
Accepted 22 February 2015
Available online 23 March 2015

Keywords:
Urban dynamics
Topographic change
Long-term-management of cultural resources and cultural capital
Long-term management of building stocks
Multi-scale planning
Steady-state economics

ABSTRACT

This paper investigates alternative scenarios to a doctrine of economic growth requiring the cyclical replacement of large parts of the building stock. For the case of Singapore, methods for long-term management of building stocks are discussed. These methods enable continuity of cultural resources and cultural capital that is linked to the built environment, and are pegged to the age of the land's surface. In a two-step approach that spans the district scale and the scale of the entire city-state the relationship between the age of land surface and the character of its built environment is explored. Indicators for development speeds are derived in three areas: the Central Area, Tanglin/Commonwealth and South Bedok, and expounded on in their relation to the entire city-state. Land age based conservation is proposed as a novel tool. At the level of the Concept Plan, land age based conservation can enhance the conventional building based approach and through quotas impact the speed of the replacement of buildings. It is thus a top down strategy for retaining cultural and economic capital embedded in buildings.

1. Introduction

With the urbanisation of the Earth, cities have expanded and existing built-up urban areas are being reconfigured and rebuilt in response to economic pressures (Hufbauer & Severn, 1973; Muth, 1971). Singapore stands out for her high speed of urbanisation and her staggering economic growth. The extensive expansion of her built environment involved and continues to involve the partial demolition of existing built-up areas on old land, and their rapid replacement (Wong & Yap, 2004; Yuen, 1998). Land reclamation has been practised since the 1820s to gain construction land in central locations (Dobbs, 2003; Ord, 1872). In the 1960s improvements in technology accelerated the process and increased output of new land (Pui, 1986) in tandem with urban expansion and redevelopment (Cheng, 1990). By 2012, reclaimed land accounted for one fifth of Singapore's area (Wang, Belle, & Hassler, 2015). The process of land reclamation created new surface for construction beyond and within the natural coastline. Cutting hills for fill material left plains that were then ideal for new settlements and rugged terrain was levelled by cutting knolls and filling in depressions. As a result, 54 percent of Singapore's surface have undergone significant changes between 1924 and 2012 (Wang et al., 2015) and 71 percent are covered by buildings and infrastructure (The Nature Society Singapore Conservation Committee, 2013).

For Singapore, rejuvenating her building stock at a constant pace means living up to her image as an ultra-modern city-state where stable growth and high efficiency are of paramount importance. The national development agenda pushes for continual growth, and is dependent on an economy that functions on compound interest. Its constant demand for new tangible objects that can be mortgaged, sold, or leased, calls for a rapid replacement that ends the lifespans of many buildings prematurely. Existing conservation schemes have not been designed to counter this trend on the level of Singapore's overall building stock.

2. Theoretical framework

2.1. The age of the land's surface

Singapore has so far not made use of the age variations of her land surface that result from extensive land reclamation and grading for planning purposes. Sites where evidences of human

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http://dx.doi.org/10.1016/j.habitatint.2015.02.002
0197-3975/

activities have been excavated over the past three decades have been mapped (Miksic, 2000; Miksic & Low, 2005 (Reprint edition)), and the question of the legal status of subsoil antiquities has been raised (Lee, 2013). This paper presents an approach to use the age of land as an indicator to improve the conservation of Singapore's building stock and slow down the rate of cyclical replacement with the aim of promoting the resilience of urban systems (Hassler & Kohler, 2014). This is different from the archaeological management plans of other countries, that devise regulations for areas with high concentrations of potential archaeological remains in order to protect these remains (Iacono, Lavelle, Stankowski, & New South Wales Heritage Branch Heritage Council of New South Wales, 2009) and are mostly concerned with preserving material remnants of the past. Instead, the relationship between the age of the land and the age of the building stock is investigated. The objective is to explore if relationship patterns are strong and could thus serve as an indicator for the maturity of contiguous parts of the built environment.

2.2. Cyclical development of the building stock versus steady state economy

The downside of urban renewal is the irreversible loss of historic building fabric and the difficulty in predicting its effects. Results largely depend on the quality of buildings, which both before and after renewal is determined by the cost of maintenance and by the degree of appreciation by citizens (Lichfield, 1989). Buildings are man-made structures of generally high durability that are able to last several human generations if properly maintained and regularly repaired. They have prominent presence in a city due to their volume and materiality, and can be signposts of cultural and intergenerational continuity. Human interactions that take place in and between buildings foster social bonds (Jacobs, 1961; Marcuse, 1986) and create place-specific identities and a culture of remembrance (Licciardi, Amirtahmasebi, & World Bank, 2012; Lowenthal, 1985). The value of the built heritage in nation-building for Singapore has been recognised (Ooi, 1994), but manifests itself in "*selective retention of the old and a constant re-making of the urban to suit the needs of capital*" (Ibrahim, 2007). The continuity of the building stock supports knowledge and economic networks of repair and maintenance that were inherited from previous generations. Such networks furnish societies with the skills to overcome catastrophes and, through repair and upgrade, establish new vital links to other infrastructure sub-systems (Graham & Thrift, 2007).

Growth doctrines ignore such cultural capitals that need to be supported by the continuity of building traditions. A drastic reduction of original building stock of one period to only a small number, threatens to render cultural systems of repair inefficient; crafts and vocations necessary for maintenance become obsolete. Just as demolished buildings cannot be reproduced again, cultural know-how of maintenance, repair and upgrade for new buildings take more than a human generation to re-emerge.

The built infrastructure is also a physical resource and the speed of 'throughput' of material in the building stock is of ecological concern. This is true for either end of the material flow, when it comes to sourcing raw materials for replacements as well as depositing demolition debris (Hassler & Kohler, 2014; Müller, 2006; Thomsen & van der Flier, 2009; Witmer & Lichtensteiger, 2007).

Some economists have, in the general discussion about development goals, pointed out the dilemma of cyclical development for the sake of optimisation of the existing systems. Each time the cycle is repeated, it appears to create less utility for citizens at an increasing cost (Daly, 1977, 2005; Meadows, Meadows, Randers, & Behrens, 1972). As a solution, Daly has proposed the steady state economy which he defined as

> "*… an economy with constant stocks of people and artefacts, maintained at some desired, sufficient levels by low rates of maintenance "throughput", that is, by the lowest feasible flows of matter and energy from the first stage of production … to the last stage of consumption …*" (Daly, 1977).

Hence, a steady state economy aims for stable or mildly-fluctuating levels of consumption concerning stocks as well as material flows. We ask under what circumstances Singapore could, in the future, maintain her existing building stock and add new buildings in such a way; high levels of utility and service efficiency would have to be maintained, while fully taking into account the irreproducible cultural capital constituted in the material and immaterial qualities of existing buildings that are vital for societies to organise their survival. With the above considerations, the dogma of eternal growth through rapid mass consumption and the principle of use and drop seem unsuitable for developed cities and conservation schemes based on protecting individual buildings of special merits alone can impossibly ensure resource conservation of the building stock on a significant scale.

2.3. Planning and administration of development across spatial scales in Singapore

The administration of urban redevelopment in Singapore shows a multi-level planning structure. At the national level is the Concept Plan, a strategic development vision drawn up every ten years with a projection of forty to fifty years (Dale, 1993; Urban Redevelopment Authority (Singapore), 1991). The Concept Plan informs amendments to the Master Plan. Reviewed every five years the Master Plan divides Singapore into zones according to functions and density. Special plans delineate historic conservation zones, nature conservation zones and special activity zones (Yuen, 1998). The development of individual zones is implemented through the Government Land Sales Programme, that matches economic and demographic projections to actual development by controlling the location, function and number of land lots sold to developers (Urban Redevelopment Authority (Singapore), 1995). The development of the individual lot is then regulated by the Urban Redevelopment Authority's Development Control Groups, who check the proposed concept for (re)development against existing planning guidelines. Guidelines for conservation of the built fabric are devised and enforced by the Urban Redevelopment Authority's Conservation and Development Group (Urban Redevelopment Authority (Singapore), 2015b). Together with the National Heritage Board's Preservation of National Monuments and Sites Bureau they are also administering and expanding the list of buildings gazetted for conservation and of protected national monuments (Henson, 2012).

The planning system does not only reflect a clear hierarchical structure in terms of spatial dimensions, it also shows that government steering is able to override market forces when it comes to the supply of construction land, two factors that create a good prospect for implementing a comprehensive building conservation strategy. Such a strategy must go beyond an optimization of heritage through inventories that list particularly valuable buildings and instead aim at promoting the resilience of the entire system.

2.4. Beyond object based conservation

Strategic building conservation is so far located at the same level as its implementation: at the lower tiers of the planning hierarchy. Considerable effort is spent on deciding which buildings to include in the inventory of conservation buildings. Significance of a building or ensemble for the nation and thus for conservation is