RECLAIMED URBAN.
MACAU AND SINGAPORE: TWO CASES OF LAND SUSTAINABILITY

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ABSTRACT: The main subject of this paper is to study land reclamation as a construction of urban space and as a place of development of science and technology. Conditioned by these elements, it is interesting to analyze binomials such as continuity/rupture, water/land, urban sea/water city, specifically led to the metamorphosis and urban tensions created by built space and remaining spaces;
It is a comparative study on urban situations using massive land reclamation not only as a process of gaining more land “for needs” but above all as a way of building and “making” city: samples such as Macau in the Pearl River Delta, China or Singapore which are important references of land reclamation urban structured cities.

KEYWORDS: land reclamation, planning, science and technology, urban space, sustainability

1 INTRODUCTION

The main subject of this paper is to study land reclamation as creation of urban space and as a place of development of science and technology. Conditioned by these elements, it is interesting to analyze binomials such as continuity/rupture, water/land, urban sea/water city, specifically led to the metamorphosis and urban tensions created by built space and remaining spaces;
It is a comparative study on urban situations using massive land reclamation not only as a process of gaining more land “for needs” but above all as a way of building and “making” city: samples such as Macau in the Pearl River Delta, China or Singapore which are important references of land reclamation urban structured cities, other samples could be Monaco, Rotterdam or even Dubai.

In both cases (Macau or Singapore), it is important for us to understand some of the relational aspects of urban planning which are associated to the issues of the practice of science on material production and the generation of space that creates the relations with the pre-existing.

Land reclamation is presented as a comprehensive solution to the planned urban development at present and for the future. Today territorial expansion is driven by acceleration and competitiveness of economies which can be found in the scientific novelty of its designed buildings – infra and supra structures – and on the expression of politic, culture and social aspects that distinguish territories of the urban and particularly those of reclaimed lands.

Land reclamation involves scientific practice with material expression that is translated into the
urban morphology. However, in its technical component, there are more important factors for sustainable development of the city. One example is the protection against the continuous rise of sea levels.

The purpose of this paper is to question whether land reclamation can remain as an option for a territorial expansion or if there is any limit when it concerns also the environmental aspects and sustainability.

In addition to the main propose this research is linked to the study of the urban entities interspersed by water and land reclamations, adding some interesting aspects to the frequently debated and tested subjects of theoretical models such as waterfronts, islands or water cities, serving also as basis for other theoretical fields and issues such as artificial landscape, *tabula rasa*, etc. All these have a direct connection to scientific practices on material production and are a cause for discussion on architecture and urbanism.

The challenge of the theoretical discussion on land reclamation as a built entity and as a morphological entity that provides a way for the (re)configuration of urban and metropolitan areas and as a way of urban expansion and resource, seeks to understand space and time, its implications on the design and project to be undertaken on the contemporary city planning. It is not intended to close the issue since the results of the investigation will contribute to further discussion on the topics that may change the entire urban contemporarity.

Land reclamation comes from the need to create more land, more room for human activity. It is a resource, a new opportunity but raises questions of various kinds such as environmental and ecological impacts that directly or indirectly relate to the way they shape and build the city.

Throughout history the city’s landfill was emerging as a solution to various situations such as the re / construction of the damaged urban fabric by natural disasters (earthquakes, tsunamis, typhoons, cyclones, etc..), avoiding and helping to prevent the proliferation of diseases (yellow fever, plague, etc.) or recovering from destroying actions of man such as wars, etc. . Thus, in the course of history land reclamation appears as a solution for renewal, growth and added value to the city.

Is it then that land reclamation can be seen as the future of cities, solving problems such as increased population densities in the territories of compact vertical city in favor of a wide and sprawling city expanded to other areas such as artificial islands and peninsulas?

What horizontal and vertical limits (sprawling and altimetry) should have cities that are built today at a nivelated platform, just above sea level and using land reclamation as a way to hide, beneath herself, the debris production?

2 THE TERRITORIES OF LAND RECLAMATION

The sandy beaches are places of exchange, public spaces par excellence of the sixteenth century Portuguese expansion, from then onwards. In there small sea-shelters, the first harbours, are consolidated and shaped structuring administrative agglomerates from official buildings (mayor houses, senates, etc.) installed on the flat and down parts of the city fixing transverse transcontinental identity matrixes.

Simultaneously, but not separated from the harbour, or from the original or motivated agglomerates, the city is developed on the hills and is defined by a urban set associated to as military or as religious constructions that althogheter or separately outline spatiality and urban design actions such as churchyard/pillory/church, or sea yards associated to markets, that is tranverse to a universal Lusophone urban culture. (Fig.1).
Many sands end up consolidating more permanent territorial bodies, sedimented by time and space and moulded by men. This new territorial body unfolded over the waters, sediments and consolidates under the shape of land reclamation, new territories of the city.

Sailors, living on boats or authorized by contract to more or less permanent settlements, merchants and religious build places that were consolidated both in water, on their boats, creating floating urban sets in hierarchy and law, authentic floating cities. Much of those spaces are now withdrawn from the sea and turned into suitable areas of land in the form of land reclamation. One same place, a new space, where before was a place of water is now a place of land.

The need for transportation to land of those sea places is a constant throughout the Lusophone space where architectural and urban culture exists. From the Atlantic Coast to the Indic, land reclamation now plays the role of what once was consolidated in the sea shore, structured and hierarchicalized by ships and support vessels of different sizes, intensely inhabited and experienced by different cultures.

Almost three hundred years after the foundation of Macau, the small fishing village of Singapore acquired on behalf of the East India Company by Sir Thomas Raffles, start tenuously doing their first land reclamation, at this time concentrated on flooded areas, draining swamps. Earlier as 1822, the new plans for Singapore New Town, the Jackson Plan, were drawn, previewing the implementation of a urban grid scheme based on the new territories conquered to water.

Land reclamation binds the city’s territories reclaimed from the sea, under various conformations using its own urban tools (roads, buildings, open or released spaces), to which are assigned different roles and forms, originating different urban morphologies.

The setting on land of maritime population, mainly formed by fisherman, or agricultural needs inducing people to look for soil, reclaiming it from the waters, appear in a first moment as a resource of growing human agglomerates sustainability.

Due to the scarcity of arable soil, and to the difficulties of farming in mountains, less suitable for most crops, horizontal and naturally flooded land reclamation appears to be an effective solution for cultivation. Those are lands that meet the rural needs, providing food and the livelihood of the city before integrating it as urban soil.

The city that slowly grows here is subject to rural subdivision from which depends the future urban form often generated from private but also state properties, separately sold or expropriated in a discontinous time, and gradually building them in accordance to urban plots.

2.2 City, Port and Industry

Land reclamation in the harbor consolidates margins, ie, lines up and regulates bays, beaches, etc. (at
Macau: The Inner Harbor and Outer Harbor) transforming the physical coastal limits and facilitating the docking of vessels and thereby improving the operability of ports while allowing protection of the water coast from the fury of natural elements such as typhoons, floods and tides, etc.

On one hand the port strengthens the connection between land and water towards the operability (commercial, recreational and others); on the other hand ends up “to immure” the city with large vessels, containers, etc. which prevent natural contact (both visual and physical) between the city and the water. This situation is worsened by the ongoing building of continuous roads, such as railways, marginals, etc. which are connected to different industries (metallurgy, ceramics, glass and sawmills) and a range of warehouses related to the development of shipyards and shipbuilding industry. The city and the port are two independent entities.

The quay, the piers, etc., are samples of physical marks left on the standing city, the city on land, and are the result of the use of water as road lanes, as a convenient and effective circulating way. The evolution and the gigantism of the vessels were creating new needs and warehouses increasing the number of ports and harbors.

Throughout the nineteenth century the connection between ports and inland is gradually changed by the implementation of railways (which Macao still does not have) or by the opening of roads where circulates the newly created automobile, however shipping is assumed of vital importance as local, regional and transcontinental means of transportation.

Implementation of the railway occurs on flat terrains, slightly inclined. With the construction of railways and the need for flat land, land reclamation is created to underpin the new lines. The use of land reclamation (in detriment of beaches) is encouraged as a pragmatic solution, with advantage, as it facilitates access to the coast and the transhipment of goods, ensuring the delivery of products to cities.

Thus, the railway, on one hand facilitates movement and shortens distances, on the other it creates a deep division that runs through the territories. Cities that have adopted railways, many of them portuary cities, look at it as a physical barrier impassible or difficult in its relation with water and the harbor, protagonizing the appearance, at high costs, of solutions as the construction of roads and road crossings and pedestrian undergrounds or flyovers that determine the shape of many of these cities.

On the other hand, proximity of the railway to the coast, leaves a narrow strip of land between that and the former which strongly determines the ability of building or urbanizing this fragment, remains to the city to expand towards the road routes and railways. At its limit the city refers to land reclamation to expand towards the sea and the river and eventually incorporate, convert or reject, not only the railways, the road rings (peripherals) as well as other built (urban plots, industry structures, etc.) and functional structures that serve them.

Waterfronts are the backdrop of achieving this ideal of urban transformation that successively and historically uses land reclamation as a way to retrain and revalidate the city itself. Land reclamation is not merely the unfolding of the existing city, is the new facies marked by time, architecture and urban space, registered in the memories and stories of the place that are planned, rejected or ignored in the future.

We found that the port needs are now relocated from large cities where they have traditionally existed. The waterfronts as played today by Real Estate speculation or for the setting of urban parks, among others, are the residual component of the marks left by the port activities, to which later would be connected the Industry that led the accelerated process of constructing land reclamation. The latter arises primarily by the need to create new waterfronts, longer and regular, and the need to do deeper dredges, with the purpose of berthing greater vessels, which not only justifies the growth of onshore facilities, but also increases the development of inner cities.

A city that developed along its harbor rarely integrates it. It is easy to understand why, considering the fact that up until recently the port was where all sorts of rubbish were dumped, and where the density of vessels and the residing community lacked the most basic rules of hygiene, since many lived in swamps, infect of mosquitoes, etc., and even experienced some social and ethnic segregation that forbid them to inhabit dry land (as happened, by Chinese imposition, in Macau).

Some cities are formed by the relationship they establish with others where the need to appeal to the
port either disapeared or was exponentially enhanced. This functional separation integrates or separates these regions into networks of local, regional or global scale and with them the cities that they bind.

In this context, land reclamation sustains the needs of functional expansion areas, either for city construction in the strictest sense of the term, or in a broader sense such as building of ports, as we have previously noted, airports, land for agriculture, etc.

3 CITY and LAND RECLAMATION TERRITORIES

With the increasing and accelerating increase of population living in cities and congestion that this generates, cities experiencing a lack of response and balance to such pressure, namely in providing basic services, such as housing and various facilities: schools, health care, etc., or natural resources like potable water, soil available, air quality, etc..

With the accelerated migration of population to big cities we are witnessing rapid densification and simultaneously an increasing demand of soil and space resources. Due to scarcity prices of land increase and have, among others, environmental impacts.

Among the varied and inventive options, searching for valid answers to solve issues of the fast increasing of needs for more soil, creation of space, parks and public sidewalks all directly connected to the need of creating city, there is land reclamation as a solution.

Land reclamation introduces marks in the city and promotes the creation of it. Fragmented or not, land reclamation is in this context a new territory, flat, and the attitude of the planner (urbanist, architect, etc.) is of vital importance as responsible for the interdisciplinarity of different scientific and technical areas involved. (Fig.2).

![Figure 2 Macau Land Reclamation Evolution Map. 1912-2008.](image)
Source: Author’s Map

3.1 Morphologies

On one hand we can understand land reclamation as a specific place, empty of references – the tabula rasa, available to the most inventive proposals, some even utopic; as well relational trying to integrate this place in pre-existing contexts, by continuity; but also rethink them as spaces of opportunity to create city, introducing qualities and concerns of contemporanity as a balance of systems (ecological and environmental), of integration and of sustainability.

Planning and projecting urban and urban architecture, by way of engineering and its technical constraints on the effectiveness of responses to the problems of science in the city, with its social,
anthropological implications, among others, demand appropriate responses of these territories where the city space is planned.

Land reclamation in its current condition give power to types of intervention and projects built that serve on one hand very specific population groups, extreme situations (on very poor like the Brazilian favelas, or very reach, luxury entreprises) or, on the other hand, enhances cleavage and breaks with its resident population, to give place to large companies and multinationals, who acquire property rights in exchange to substantial sums of capital.

The construction of urban space, planned, wanted, built and owned by its populations becomes of vital importance in these new territories reclaimed from water, where the criteria and rigor meet the demands and society and community needs, diverting the attention from some latent vocation of Real Estate specultative nature, which prevent sense and purposes with unpredictable and harmful urban consequences. (Fig.3)

![Figure 3](image.png)

**Figure 3** Singapore’s Land Reclamation Evolution Map. 1957-2004.
Source: De Koninck et al. (2008:15).

### 3.2 Constraints. Technique and Science.

Land reclamation can be artificially created by debris (rubbish from works, factories, ships, etc.), or resulting from marine sediments collected from dredging and from drying of muddy land covered or filled with earth, stone or cement blocks. Implementation and consolidation of these areas is slow and implies some technical constraints with high cost solutions.

Some of these constraints are construction of crossings either in depth or horizontal (road tunnels, subways…), construction of garages and foundations (buildings, bridges), but also the immurement and containment walls, necessarily robust and resistant to sumit and to constrain land reclamation in itself.

The demand for more land to build on one hand, the need of reciling garbage and rubbish on the other, find in reclamation an apparently quick and effective solution. Bieing land reclamation a flat soil, where it is, technically speaking, easy to build, recticular models (grid or tree schemes) provide speed and easy passage of pipes and necessary infrastructural conduits to any modern city, and in addition to that reduces the costs of its maintenance.

The gradual improvement of science response capabilities leads to the deepening and the improvement of techniques used where new materials are artificially created or the previous ones substantially improved, aimed not only to reduce the thickness but to decrease the use of scarce natural resources or of strong impacy, as are the dismanteling of mountains and hills for extraction of filling materials, or even treatment and recycling, sewers, etc., avoiding the launching harmful substances to the ocean, to environmental and ecological cicles.

The underground city generated by multiple cables, ducts, pipes of all kind horizontal crossings, and the vertical crossings as pilings, buildings foundations, etc. appears to find on land reclamation more demanding and acurated technical solutions by its intrinsic perishable conditions, especially when located in a intensive seismic zone, or when subjected to rising water levels with flood risks or other
4 LOCAL and REGIONAL

Land reclamation is presented as a global solution to the planned urban development – the one that move us - , current and future. Land increase is today – more than ever -, driven by economic acceleration and competition that finds in the scientific novelty of its buildings designed – infra and supra structural -, the expression of politic, culture and social that mark urban territories, especially those of land reclaimed to water. Land reclamation has served political and hedonistic purposes with relevant results, some problematizing questions within the new urban utopias – the ones that least concerns us.

Land reclamation involves scientific practice with material expression that is translated into the urban morphology, but has, in its technical component, not less important factors for sustainable development of the city, examples of that are the protection against the continuous rise of sea levels of which some cities are protected creating new peripheric reclaims transforming urban waterfronts and landfronts.

Land reclamation, by its contribution to the expansion of the territories, also favors construction of large dimension equipments such as airports, and deepwater ports, so important to conurbations such as the one currently developped in the Pearl River Delta that includes Guangzhou, Hong Kong and Macau, the world’s place where rapid urbanization provokes the fastest rythm of construction and where population densities beat records.

Land reclamation today defies new limits, the city’s material limits, carrying the acceleration of urban growth to wich is linked strong real estate and economic interests awakening by one hand the utopias of the ideal and competitive city that consolidates new extremated imagery: from the city’s recovering their ancestral connection to the water looking for interlacinging with it and, on the other hand, the city that looks to find in those spaces of reclamation the architectural and formal expressions of a delirious city immured and dense, facing the individualism of the iconic architectures that as a whole close and eliminate the connections with the water and cannibalize the formal city’s public spaces and do not generate new ones.

On the other hand, land reclamation emerges as a formal purpose in contexts taken up, until now, as imaginary. Some of the samples are the creation of artificial cities, peninsulas (a well-known territorial morphology of the Portuguese), inasmuch as linked by land corridors (isthmus, bridges, viaducts or tunnels) to the borders of a formal or informal existing city.

Some other samples appear in the discourse of the architecture-show and generic-urbanism (AV, 2005:3), as cases of land reclaimsations in the Persian Gulf or in the United States of America or also in China.

Figure 4 Dubai. Thematized Land Reclamation (Moon, Palm, Mundi Map)
Source: Arquitectura Viva, n. 111
In China there is place to formal duplication of entire European and North American (Western, hence) “pastechized” cities and more recently of Dubai’s itself, what we call “‘thematic cities”.

The changes in Macau are an evidence and the seventeenth century city, although its core is classified by Unesco (in 2005) as a world heritage, has been the target of this architectural and urban metamorphosis that before it was self-compared with Monaco or Venice, after that with Singapore and is now the latest Las Vegas of the East.

It is a limit (political, economic and speculative) of city’s construction that responds in the proportion to the asymmetries of the populational structures (social, cultural and anthropological), environmental, of in/sustainability, where the planner’s discourse, as representing the populations needs, must intervene, propose and mobilize without hesitation.

5 FINAL REMARKS

Demobilization of port activities, such as shipyards, docks, dikes, driven by rapid improvement in the economic condition and fostered by global scale policies refers to the discontinuity and the obsolescence of major industries traditionally assigned to a land reclamation site which have supported (roads, railways, etc.) creating an important spacial and imagent void territory in these cities that contemporary rushes to solve.

On those landfills, now empty of industry, new programs and plans are done, converting, rehabilitating and transforming fields generally in continuity with the cities to which they belong to. These cities have become accustomed to the occupation of large-scale alitmetry starring the deep draft ships, or the pipe-oil towers, cement industries and a whole range of industrial buildings such as warehouses, cranes, containers, etc. but also the wide and linear boulevards, to marginals and to continuity of urban flows.

The twentieth century was particularly inventive in the form of occupation of these territories _ converted by hygienists mesures on the previous century and the elimination of the “urban miasmas”, etc. – introducing on them regularization and linearization that opened the city and gave a new scale, both on the horizontal plan, or on the verticalization of the built on these reclaimed land | waterfronts.

These territories for its exceptional location in the relationship they have with the old town, in addition to generating new central places such as large shopping centers, leisure facilities, theme parks, fairs, and International Exhibitions, are the latest stage of technological applications to the construction and building in the city.

The use of land reclamation as a new territory for urban use and building, appears discontinued from the understanding and implementation of previous centuries. Reclamation for agricultural or industrial implementation in the continuity of the city, appears now functionally planned in accordance to the premises of the tabula rasa from ground zero, the point of no reference, trying instead to generate them on a global scale.

Land reclamation contributed for the rapid territorial development and urbanization, both in Singapore (particularly since its independence in the 1960’s) and in Macau during all the 20th century, particularly visible from the 1990’s and after the handover to China in 1999, when territory was dramatically verticalized.

The turn of the twentieth century to the twentieth-first century, provided by technical and economic capabilities and politics will assumed by many states and cities, will be a decisive support for the “thematic city” (China), to create new city (Dubai), among many others, in short for the full condition of diffused city with its own limits in utopia.
REFERENCES