Designing with a Fork: lessons from past urban foodscapes for the future

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ABSTRACT: Unlike other basic needs, food has been virtually absent from today's urban design and planning. Historically, however, food matters were key factors underlying the location of pre-industrial cities, the size attained, the organization and land use of their hinterlands. Food production was present around and within the city; distribution routes defined its roads and streets; food activities were remembered in place-names; markets were the beating hearts of urban life. Cities and food were interconnected.

Nowadays, apart from food consumption, food became almost invisible in the city, being relegated to distant places, private spaces and off-hours. This distance conveys severe environmental and cultural consequences, jeopardizing urban sustainable development. Food, however, might contribute to designing more sustainable cities for the future. Architects and urban designers have proposed creative solutions — edible buildings, productive continuous landscapes — which might be crucial in this context. These realities will be explored, for a more balanced future.

1 INTRODUCTION

Cities might be defined as "groups of populations that do not produce their own means of subsistence", implying a technical, social and spatial division of production, and exchanges between those who produce subsistence goods and those who produce manufactured goods, symbolic goods, power and protection (Ascher, 2010: 21). This does not mean, however, that cities have developed *regardless* of their food supplies.

In fact, the very origin of cities is intrinsically linked to a more constant and abundant food supply made possible by *agriculture*. Until then, almost the entire community had to be channelled to ensure food supply through harvesting, hunting, fishing or pastoralism. With agriculture, it became possible to sustain individuals engaged in different professions and crafts. Social classes, monumental architecture, writing and numerical systems, exact sciences, art, state and politics, taxes, commerce, etc. — civilization — have since arisen. Childe (1950) termed it *urban revolution*.

Therefore, cities can be characterized by not producing their own means of subsistence, not because food production is absent from urban space or the daily activities of its inhabitants, but rather because a set of other characteristics and activities overlap them. In the physical design of cities, however, this food dimension was very much present.

2 PRE-INDUSTRIAL URBAN FOODSCAPES

2.1 *The location of cities*

Several factors determined the location of pre-industrial cities: defence, policy, religion and symbolism, climatic and health issues, proximity to water resources, among others. However, throughout history, one factor was key: *transportation*. Since, for centuries, land transportation was difficult, conditioning the movement of products and raw materials, physical proximity to (food) resources was central. Inner cities were, therefore, dependent on the agricultural resources available in their immediate hinterland.

> "As soil can hardly be built, the general principle is to organise the entire community according to the best soils and, within possible, never occupy them with land uses other than food production." (Pereira dos Santos, 2010: 18-19)

For a community to be established in a place, the existence of a set of favourable conditions had to be identified — topography, water, soil fertility, temperature, rain cycles. Conditions, that is, which allowed it to survive and thrive. The location of cities could be the reason of their prosperity or the cause of their collapse, which translated into an aura of symbolism around the foundation of a city. For this very reason, in the Roman Empire, the sites were chosen by *augurs* who made careful observations of

the natural phenomena before defining the location of the *mundus*, the well that marked the city centre and was its symbolic connection to the place and to land gods (Steel, 2013: 15). Vitruvius highlighted this importance in his *Ten Books of Architecture* (2006), describing a dialogue between Alexander the Great and Dinocrates, the architect who proposed him to build a new magnanimous city. Alexander liked the proposal, but inquired the architect about the existence of surrounding fields to supply the city with grain. When Dinocrates answered negatively, Alexander would have replied:

> "Just as a new-born child cannot feed himself or continue to grow into life without the milk of a nurse, so a city without fields and without fruit that comes into its walls cannot grow, since it cannot develop without the abundance of food, nor can it sustain its population if it has no resources." (Alexander the Great quoted by Vitruvius, 2006: 69-70)

Alexander reproved the chosen site, and Alexandria was later founded in a place where it could thrive. This episode reflects a fundamental reality: in the absence of fast connections to distant territories, pre-industrial cities depended predominantly on local *foodsheds* — the area from which a community extracts their food (Hedden, 1929: 17).

But it was not only fertility that was important in defining soil quality: in a context of rudimentary agriculture, it was important that the land was easy to work, resistant to erosion and easy to protect (Raison, 1986: 324). Thus, cities would settle as close as possible to the most fertile and workable soils, being often completely surrounded by cultivated soils.

The only exception, in this pre-industrial context, was granted by navigable rivers or seas: privileged communication routes, uniting different and distant peoples. Rivers and seas allowed the fast transportation of food products since Antiquity, at a cost rate up to 42 times cheaper than land transportation (Steel, 2013: 73), giving riverside and seaside cities an unequalled advantage over inner cities.

2.2 *Size and distribution of pre-industrial cities*

Food supply also conditioned the size — in both population and physical terms — that a city could attain, a condition which parallels biology's notion of *carrying capacity*, which defines the relationship between an ecosystem and the number of individuals it can sustain in terms of food, water and habitat (Brun et al., 1986: 24). In a pre-industrial context, the *maximum population* of a city depended directly on the productive capacity of its soils and complementary food resources (Mumford, 1970: 316).

> "[These cities] were still in essence agricultural towns: the main source of their food supply was in the land around them; […] they could not grow beyond the limit of their local water supply and their local food sources." (Mumford, 1956)

During the Medieval Ages, European cities remained within a few thousands of inhabitants (Morris, 1995: 119), and respected a certain proportion of urban to rural populations to insure food supply.

The *physical size* cities could attain was connected to the fact that food products could hardly travel more than one day before spoiling, especially vegetables, meat and milk. This limited the distance of their provenance to about 30 km if travelled on foot, or a bit larger if wagons or animals were used, fixating a practical limit to the city's productive belt. Thus, there was a maximum area an urban settlement could attain before occupying its production lands and reducing them to an insufficient size:

> "A day's journey by cart, a distance of around 20 miles [32 km], was the practical limit for bringing in grain overland, which limited the width of the city's arable belt. The simple laws of geometry meant that the larger the city grew, the smaller the relative size of its rural hinterland became, until the latter could no longer feed the former." (Steel, 2013: 70-71)

For Braudel (1992a: 99), it was advisable for a city to be fed on what it possessed within its reach, and limiting this supply to a circle of 20 to 30 km would avoid expensive transportation and imports. These limitations to growth led to an urban expansion model through new satellite cities, which maintained a certain autonomy.

The distribution of urban settlements in the territory was also relatively homogeneous. According to Élisée Reclus, European cities tended to distribute equally as much as topography allowed, maintaining a distance of a day's travel on foot between them (Mumford, 1970: 59). Thomas More, in his *Utopia* (1973: 63), also advocated a similar model, with cities being about 24 miles apart, and never more than a day on foot. Likewise, each city should have 20 miles (about 32 km) of arable land around, "and sometimes more if, from either side, the distance between one city and another is greater".

2.3 *The hinterland of pre-industrial cities*

Food supply was so crucial that it constrained the hinterland's land use and type of crops. Throughout time, we can witness a particular organisation: the *aureolar models*. Von Thünen, in *The Isolated State* of 1826, conceived a pioneering model, based on an idealised situation for a city located at a fertile plain, with no topographic constraints (relief, watercourses) and a constant climate, where farmers made rational decisions to maximize profits.

> "Imagine a very large town, at the centre of a fertile plain […] the soil is capable of cultivation and of the same fertility. Far from the town, the

> plain turns into an uncultivated wilderness which cuts off all communication between this State and the outside world. […] The central town must therefore supply the rural areas with all manufactured products, and in return it will obtain all its provisions from the surrounding countryside." (Von Thünen, quoted by Björklund, 2010: 49)

The main factor defining land uses would thus be transportation and its costs, directly related to the distance travelled (Steel, 2013: 71). Under these conditions, the tendency would be for food production to be organized in concentric rings around the town. The first ring was devoted to more perishable fruit, vegetables and dairy products, to which closeness was crucial. Being more expensive, they could bear the higher land rents, while benefitting the most from urban wastes, used as manure. The second ring was an area of forest, supplying the city with timber and firewood. Proximity was necessary because wood is heavy and difficult to transport. The third ring consisted of grain fields which, being lighter, had cheaper transportation costs and deteriorated less. The fourth and last ring was devoted to pastures. Although located far from the town, cattle were able to walk and be slaughtered near its place of consumption. Beyond these rings, there was only wilderness, too distant to be useful for the city supply, since transport made these goods too expensive.

Ribeiro Telles (2016) also referred a similar territorial model, organized into four strips. The first strip (F1) was the urban settlement itself, while the second strip (F2) was for orchards, vegetable gardens and small cattle breeding, being women's role in the high productivity achieved highlighted. The third strip (F3) had extensive agriculture and rainfed areas, intended for cattle breeding in the winter and growing grain in the spring/summer. It would have the greatest extension and the most determinant in the size attained by the community, being the responsibility of men. The fourth strip (F4) was polyvalent, consisting of bushes, eventually vineyards, wild berries and nuts. Its functions transcended food supply and included defence, livestock and manure.

Other concentric-ring models were composed of two or three zones, with different agri-pastoral functions. Ring limits were directly related to labour: intensive cultivation was closer to dwellings because it required greater work by a larger part of the population and allowed transporting manure in a shorter time. A smaller number of producers were mobilized for livestock breeding, so this area could be located further away (Lemonnier, 1986: 82). Examples occurred more significantly in the Middle Ages in the Western and Central Europe (Lemonnier, 1986: 81), and could be found in London, Caen, Paris, Frankfurt-am-Main, Worms, Basel and Munich, among others (Braudel, 1992a: 428; 1992b: 25-161). In London, intensive agricultural areas concentrated within 25-30 km of the city centre, in areas like Uxbridge, Brentford, Kingston, Hampstead, Hertford, Watford, St Albans, Croydon and Dartford (Braudel, 1992b: 26). There was, even, a subdivision of the first ring: closer to London's centre, vegetables but mainly delicate and exotic fruits were cultivated, requiring great care; beyond this area, less perishable vegetables were produced — peas, beans, onions, Brussels sprouts, broccoli and cauliflower — and, farther still, ordinary vegetables in rotation systems. A similar situation occurred for animal products:

> "[…] the whole country round London was easily separable into zones or annular belts […]. Milking, for the supply of the metropolis, was carried on within a circuit of six or eight miles, either by cow-keepers […] or by farmers who sent the milk in large upright tin cans by spring vans, to the retailers in town. Beyond, and surrounding this zone, was the veal and lamb suckling district, extending from ten to thirty miles; while still farther off was the fresh-butter district, whence heavy, broad-wheeled waggons brought the butter to London." (Dodd, 1856: 219-220)

Paris derived most food supply from an area roughly coincident with the Seine's watershed, protected by numerous regulations governing food production and trade (Braudel, 1992b: 24). London and Paris were also examples of an exception included by Von Thünen in his model: the presence of a river that allowed the fast movement of products at a lower cost. This variable changed the whole model configuration, turning the production rings into parallel stripes along the watercourse (Steel, 2013: 71).

Pre-industrial cities maintained a relationship of proximity and interdependence with their food production lands, at a local scale, and strongly rooted in the territory's potentialities and constraints. It was characterized by a *circular metabolism* of energy and matter flows between urban and rural. However, food systems also impacted the organisation and urban form within cities, with food land uses being intrinsically connected to the different elements of urban form: open spaces, streets and buildings.

2.4 *Food production within pre-industrial cities*

Food production has always been part of cities. Even when cities were enclosed by walls, there were cultivated spaces inside —orchards, vegetable gardens, even commons and pastures — shown in engravings and maps (Mumford, 2004: 285). *Urban* and *peri-urban agriculture* were ancient practices — *hortus conclusus* existed in Egypt, Persia, Greece, Rome, Pompeii and in Islamic Spain — and were present both in small and large European cities (Parham, 2015: 47-49; Mumford, 2004: 88-285).

> "[…] the town of the Middle Ages was not merely *in* the country but *of* the country; food was grown within the walls, as well as on the terraces,

or in the orchards and fields, outside." (Mumford, 1970: 24)

The existence of agricultural and livestock areas within the walls ensured the city's *resilience* and even *survival*, in the event of war or prolonged siege (Björklund, 2010: 21; Mumford, 2004: 88; Braudel; 1992a: 435). The walls of Florence covered meadows and vegetable gardens, as in Paris, Toulouse, Poitiers, Prague, Barcelona and Milan (Morris, 1995: 106-218; Braudel, 1992a: 435). In the 17th and 18th centuries, nearby vegetable gardens played an important role in food security and innovation: vegetables, fruit and herbs represented a reservoir of food resources, but it was also here that one learned to cultivate delicate, little-known plants. In France, these were the first sites to welcome novelties: cabbages, cauliflowers, radishes, carrots, peas and, later, the potato (Roche, 1998: 252). The need for close food production even led to innovative solutions as the *hortillonnages* in Amiens: floating vegetable gardens covering around 300 hectares, which played an important role in the city's food supply.

Animals — such as pigs, chickens, rabbits, pigeons, etc. — were also raised in the city for meat, but mainly for milk. In New York, in 1840, milk supply came from 18 000 cows living in about 500 farms in the city and in Brooklyn, fed on grain waste of distilleries and breweries (Santlofer, 2017: 239). Atkins estimates urban milk production of 52% for Edinburgh (1921), 30% for Liverpool (1927) and 20% for Belfast (1929), while London will have declined from 80% in 1850 to 28% in 1880, and only 3% in 1910 (Atkins, 2003: 137). Often, raising animals was a practice complementary to agriculture, getting manure and because animals could be fed on waste or raised in plots unsuitable for crops, due to slopes or soil characteristics.

Working on agricultural land (owned or rented) and raising livestock were part of the daily lives of city dwellers, who possessed rear vegetables gardens and practiced these occupations within the city. Many bourgeois also possessed orchards, vineyards and olive groves in the outskirts (Mumford, 2004: 146-314). Cows and sheep grazed on commons and city dwellers still benefitted from municipal forest and fishing resources (Mumford, 2004: 314-315). The size of these lands could be significant: in Poland it reached an average of 8-10 ha/person; while some small towns in France controlled extensions up to 5 km away from the city (Björklund, 2010: 21). In Sweden, the area of orchards, arable land, meadows, grasslands and forests belonging to a city averaged 970 ha and could reach 2500 ha, in some cases (Björklund, 2010: 89-91).

> "Living in such a city, there could be no doubt as to where your food came from: it was all around you, snorting and steaming and getting in the way." (Steel, 2013: 6)

2.5 *Urban form: squares, streets and buildings in pre-industrial cities*

Food systems covered virtually all dimensions of urban development, organising land and building uses, street layouts, squares, and other public spaces, allowing flows of people and products and the interaction of different professions and social classes. Food was a strong link between communities, cities and territories.

Food production spaces, livestock breeding and food processing coexisted with housing, services and other urban activities. Roads of food distribution later materialised into roads and streets. They were designed to accommodate these flows and, although their names have changed over time, their layout has left indelible marks on the urban fabric (Martin-McAuliffe, 2015: 249). Fluvial ports also impacted the city and place-names. Squares received weekly, monthly and festive fairs. Specific buildings were designed to house food activities: barns, warehouses, markets, shops and restaurants. Attending food trade spaces was part of the daily routine and identity of these communities. City dwellers knew where and by whom food sold was produced, how and through where it was brought into the city. Food, in all its dimensions and activities, was part of the city.

> "Look at the plan of any city built before the railways, and there you will be able to trace the influence of food. It is etched into the anatomy of every pre-industrial urban plan: all have markets at their heart, with roads leading to them like so many arteries carrying in the city's lifeblood." (Steel, 2013: 118)

Once established, food spatial uses — production, distribution, trade — tend to persist and, even if they fade, their memory still persists in place-names. For example, Oxford derives from the contraction of *oxen* with *ford*, emphasizing the importance of these animals in the area (Morris, 1995: 123). Other food-related place names can be found in several cities, as the case of *Olivais* ('olive groves') and *Laranjeiras* ('orange trees') in Lisbon, and streets referring to specific crops or vegetable gardens.

> "There are a great many streets, neighbourhoods and even […] towns that have their origin in the culture of food." (Martin-McAuliffe, 2015: 20)

According to Dodd — who devoted a full chapter of his *Food of London* to place names — the streets connecting Newgate and Aldgate ('gate' defining a 'unloading area by the Thames') all derived their names from food. *Cheapside* derives from the term *ceap*, 'to barter'. The bread market was located at Bread Street; corn was sold at *Cornhill* (Dodd, 1856: 31-75). The meat trade site, for over nine centuries, was Smithfield, literally a 'smooth' field. Turkeys and geese were traded at *Poultry*. Fish trade occurred on streets like Old Fish Street or Old Fish Street Hill, and Friday Street derives its name from

a Friday fish market (Steel, 2013: 119-120; Dodd, 1856: 29). In Amsterdam, there are also Groenstraat and a Warmoesstraat, literally 'vegetable' streets.

Dublin's place names offer several examples of food activities, such as Fishamble Street, Winetavern Street or Cook Street (Mac Con Iomaire, 2016: 73). Other examples included Blackberry Lane, Bull Alley Street, Bull Wall, Castle Market, Cornmarket, Cherryfield Road, Distillery Road, Goatstown, Haymarket, Milltown, Orchard Road, Pig Lane, Red Cow Lane, Watermill Road or Wheatfield, and others related to pork, due to its importance in the Irish diet (Mac Con Iomaire, 2016, 2014).

Markets were also one of the most basic functions the city performed for its surroundings, being unbeatable for freshness, low prices — due to the absence of intermediaries — and supervised exchanges. Held once or twice a week, markets were the focus of social life: here people met and talked, novelties and political affairs circulated. Incidents, agreements and business took place here. Despite the annual or festive fairs, regular markets had the biggest impact on local life (Roche, 1998: 59).

Markets could take on different urban forms, in an open square or covered bazaar — a *plaza*, *campo*, *piazza*, *grand-place* — in the centre of the city (often by the temple or church); in a ground on the outskirts, progressively absorbed into the urban fabric; in a wider part of the main street, or occupying streets with stalls or shops (Mumford, 2004: 85-234; Morris, 1995: 108-109). Markets were later formalized into market-halls, which often occupied the former sites of open-air markets. One key characteristic was, in fact, their longevity in the urban fabric. Once a site was taken, it tended to persist, despite urban transformations, and food trade occurred at the same place, or nearby. For instance, in Marseille, the Greek *agora* was occupied by the Roman *forum* and by the medieval market, while in Lucca the *forum* gave way to a medieval market that persisted until today (Parham, 2015: 74-75).

The medieval marketplaces had triangular, oval, or polygonal plans, but there were also cases of regular squares. A certain proportion between building dimensions and market area seems to have been relevant, contributing to its social use and ambience, according to a study by Camillo Sitte on *positive* and *negative space* (Parham, 2015: 73). When a certain ratio was exceeded, the space was perceived as too broad or too claustrophobic, a principle also applicable to the spatial structure of the market itself, in the layout and density of the stalls.

Pre-industrial markets were often located near the culmination of food land routes, unloading docks, etc. The case of London is illustrative: while a single bridge crossed the Thames, markets clustered naturally in the City. In Lisbon, Figueira Market was located at the junction of two major food routes, while Ribeira Market stayed by the river docks. The same principle applied to cattle and meat markets. Animals arrived through specific roads, converging to designated markets. In 19th-century London, weekly, thousands of animals got to Smithfield, on Thursdays and Sundays, for the Friday and Monday markets respectively. Cattle converged from all the surrounding streets, mainly through the Great North Road, which terminated at St. John's Street:

> "The great stream that passed through St. Johan's street during the night was amazing, comprising thousands, or it might be tens of thousands, of fine well-fattened animals. […] Nine, ten, eleven, midnight, the 'sma' hours' of the morning, all witnessed successive arrivals; and the area of four or five acres, by the time the salesmen and butchers arrived, presented an extraordinary scene." (Dodd, 1856: 234-238)

The increase of trade, coupled with growing urban hygiene concerns during the 19th and 20th centuries, led to the construction of *halles* in Europe: covered, permanent and specialized markets, often still surrounded by the previously existent outdoor markets (Braudel, 1992b: 19), a typology that has in fact become iconic of European cities. Diverse types of buildings were developed, using iron and glass structures, to accommodate different types of goods with specific requirements, having numerous galleries and spacious complementary cellars. These became some of the most important built structures of urban foodscapes, complementing the existing network of food shops, in place since Antiquity.

Open spaces, streets and buildings were, thus, influenced by food activities, being shaped to accommodate and integrate them into the city's fabric.

3 CONTEMPORARY URBAN FOODSCAPES

3.1 *From local foodsheds to global foodsheds*

From mid- to late-19th century, covered market-halls, slaughterhouses, cooling systems and innovative food preservation methods, such as canning and freezing, changed the logics underlying food systems. Moreover, food systems were profoundly transformed by railways, which also disrupted the former rules governing the shape, size, location and organization of cities.

> "Up until the nineteenth century, food, and the natural geography that provided it, had determined where cities were built, and how large they could grow. But railways made it possible to build cities just about anywhere, and just about any size." (Steel, 2013: 90-91)

Railways allowed the transport of large amounts of cargo quickly *by land*, for the first time, resembling 'man-made rivers'. Trains efficiently brought products to and from ports, from distant areas to city centres. This new reality profoundly changed urban diets: it was now possible to consume food from an-

ywhere in the world. Food supply routes became longer; food systems became global.

However, if the distance food can travel increases linearly, its impact on the *foodshed* is not proportional. That is, if these production circles were determined by their radius (r), then the area covered (πr^2) increases in proportion to its square. Thus, an improvement in transport that allows reaching twice the distance in the same time translates into a supply area increase to its quadruple, or to nine-fold, when the distance is tripled, and so on. The introduction of railways — and later trucking systems, cars and airplanes — thus represented a very significant increase in the *foodshed* accessible by urban markets, extending them to the whole planet.

> "Most cities today do precisely that, having long outgrown their local farm belts. London […] is fed by a global hinterland […] more than a hundred times larger than itself — roughly equivalent in size to all the productive farmland in the UK." (Steel, 2013: 7)

For cities, this change carried an obvious consequence: if distribution issues come to prevail over the ancestral issues of proximity, then their relation towards their surrounding hinterlands changes. Agricultural soil loses importance and value, given the need of space for housing, industry, public buildings, infrastructures, etc. (Pereira dos Santos, 2010: 19). Built-up fabric spreads "like oil over a glass surface" over the surroundings (Telles, 2016: 82).

> "This means that one of the chief determinants of large-scale urbanization has been nearness to fertile agricultural land; yet, paradoxically, the growth of most cities has been achieved by covering over and removing from cultivation the very land (often, indeed, the richest alluvial soils) whose existence at the beginning made their growth possible." (Mumford, 1956)

If pre-industrial cities could be measured in tens or hundreds of hectares, the new conurbations take thousands of square kilometres. Western economy has shifted from rural, with some large cities and thousands of villages, to metropolitan (Mumford, 1956). The shape of concentric expansions is replaced by a tentacle-like form (Raison, 1986: 336). Urban areas are expanding faster than their populations. This threat becomes more significant when considered that most cities are located in close proximity of soils on average 1.77 times more fertile than the rest (Bren d'Amour et al., 2017: 8939).

Cities pose yet other challenges to the sustainability of food systems, being a factor of diet transformation (*nutritional transition*), which changes food production and puts added pressure over natural resources (Smit, Nasr e Ratta, 2001: 18). There's an increasing physical and mental distance between city dwellers and food systems. Far from production areas, urban consumers tend to ignore how, where or by whom food is produced or processed, seeming to pop up on supermarkets as if by magic. This ignorance fuels indifference regarding the conditions under which food items are produced, promoting socially and environmentally damaging decisions and behaviours (Paxton, 2005: 41), while exacerbating fears about the products consumed. At the same time, food — apart from consumption — has progressively become invisible in the city and public spaces, with food being produced and processed on distant lands, being handled and delivered at off-hours to numerous supermarkets scattered in the city, by *private* companies. Contemporary cities are, in fact, increasingly characterized by processes of *food privatopia* (Parham, 2015: 219).

3.2 *Sustainable cities for a sustainable future*

Cities face, today, pressing challenges regarding sustainable development, which will be exacerbated by climate change. Urban sprawl alters habitats, biochemistry, hydrology and energy flows (Bren d'Amour et al., 2017: 8939). It can affect drainage systems, water supply, increase temperature and environmental pollution, and food insecurity. Currently, around 60 to 80% of total energy consumption takes place in cities, as well as 40 to 70% of the anthropogenic emissions of GHG (UN-HABITAT, 2011: 33-52). Cities are responsible for about 60% of drinking water consumption (Drescher and Iaquinta, 2002: 34) and receive about three-quarters of everything that is collected and extracted from the soil (Smit, Nasr and Ratta, 2001: 9). Each urban inhabitant generates 0.6 kg of solid waste per day (Zeeuw and Dubbeling, 2009: 9). Cities *ecological footprints* are several times larger than themselves. Food is a major component of this reality, being pointed by the Global Footprint Network as the single biggest component of urban ecological footprints. Ensuring the food security of a growing urban world population, while preserving the environment for future generations, is considered as one of the greatest challenges mankind will face in the coming years. In this context, the importance of pursuing a *circular metabolism* — where the outputs of a process act as inputs for another — has been highlighted (Smit, Nasr e Ratta, 2001: 10-17). This cannot be attained without taking food systems into account, considering the amount of flows of matter and energy involved, towards and outwards the city, and the environmental impact (on land, water, biodiversity, climate change) food systems represent.

In fact, in most international declarations — such as *The Future We Want*, *Our Common Future* or the *Sustainable Development Goals* — there are references to the importance of food issues for reaching a sustainable development, mainly through improved sustainable agriculture and food security. However, it was the *New Urban Agenda* (Habitat III, 2016)

that, for the first time, brought food systems to the scope of urban planning, in its several dimensions and stages, from production to waste, and in its various links to other urban systems and dimensions.

Reconnecting these realities by planning *City Region Food Systems* (CRFS) has been pointed as crucial to balancing urban matter and energy flows, while tackling the social, environmental and economic issues raised by the current models of cities and urban food systems (Dubbeling et al, 2016).

3.3 *How urban design can take lessons from the past for more sustainable cities*

To achieve an urban circular metabolism and an environmentally and socially sustainable future, bringing food back into the cities is crucial. Despite numerous initiatives and projects in cities worldwide, stemming from different motivations and through different strategies, the spatial dimension of food (system) planning has been largely overlooked, being food often taken as an 'add-on' to design:

> "[…] food has too often been relegated to the margins of the design disciplines, as a taken-for-granted aspect of place, narrowly conceived as offering a surface gloss of vitality or applied as a kind of pleasant afterthought in spatial design terms." (Parham, 2015: 268)

For architects, changing this means rethinking the principles that govern urbanism, urban form and buildings themselves, in a permanent dialogue with all the stakeholders. This work should cover the whole food system — from production to waste — considering that all these activities occupy and transform specific spaces, shaping *foodscapes*, and intersect with the various scales present in a city. It will be required to think geographic proximity to nutritious foods, plan land uses, rethink zoning regulations, food infrastructures and the typologies of food establishments (Cabannes and Marocchino, 2018: 9). The location of new cities and the expansion of former ones should consider this balance and dependence of natural resources, and city planning and design should be an extension of these principles. That is, *food should be taken as an urban infrastructure*, with specific requirements and spaces.

One of the main strategies of urban design pointed, in this context, is the implementation of public spaces with a productive food dimension. These production areas can be integrated into (existing) green belts, corridors, and other types of biophysical (infra)structure of cities.

A famous proposal, in this context, is the *Continuous Productive Urban Landscape* (CPUL) developed by André Viljoen and Katrin Bohn, who proposed interconnected productive spaces in existing cities, creating a new urban infrastructure and redefining multi-functional uses of public space (Viljoen, Bohn and Howe, 2005). CPULs would be spatially continuous networks of open spaces, promoting connections between urban and peri-urban. They would include urban agriculture (mainly fruit and vegetables, but also small livestock), outdoor recreational and commercial spaces, natural habitats, ecological corridors and circulation routes, being environmentally, socially and economically productive (Viljoen, Bohn e Howe, 2005: xviii-15).

The final shape and extent of CPULs would vary from city to city, according to the site's characteristics, conditions and competing pressures. They could be materialized into parks (new or pre-existent), urban forests, green lungs, axis and corridors, spaces of reflection, cultural meeting and leisure. CPULs seek to work with pre-existent spaces, complementing and adding to them (Viljoen, Bohn and Howe, 2005: 11-12). Knowing the city's history is, therefore, key for successful CPULs.

The productive landscapes could also extend beyond the ground floor and expand into edible buildings, occupying balconies, terraces, roofs, walls and façades… for a truly three-dimensional and complete productive landscape.

> "Vertical space can be used effectively to grow food. Walls can hold cages for poultry and livestock as well as vines. Recent hydroponic techniques minimize space needs with plastic tubes that can be suspended on brick walls. Some city farmers attach long, narrow planters or boxes to their walls. Others hang plastic pots or halves of plastic soda bottles. Plants such as cucumber and melon can grow up a wall or fence if supported with sticks or twine. Residences have the potential to be three-dimensional places of agricultural production." (Smit, Nasr e Ratta, 2001: 85)

Productive skyscrapers and even floating farms and food forests have been proposed. But other food activities should also be brought back into urban fabric — markets, food-hubs, food stores, cooperatives, and so on — reintegrating food into a variety of architectural programmes, as it did in the past.

Foodscape planning and design are, in this context, crucial, since the incorporation of food in cities and in architecture can help rebuild the lost connection of city dwellers with food systems, but also with nature as a whole — seasonality, climate, weather, topography and vegetation — reversing their alienation and reconnecting them with the natural cycles and with the planet. Towards this goal, some key principles could include: take *food as a design process* (vs a 'green wallpaper'), include *all activities of food systems*, be *site-specific and holistic*, be *multi-scale* and *multifunctional*, be *tridimensional*, keep it *dynamic* and *flexible* (open to urban changes), see the city's food potential through 'the eyes of the urban farmer', aim for a *circular urban metabolism* (matter, energy & water flows) and *learn from the past*.

4 CONCLUSION

Food has been an intrinsic part of cities since the beginning, being a key factor in their location, size attained, land use of their hinterlands and urban form. Food and cities were interdependent and their relationship bound to, and balanced by, natural resources and territorial conditions. In the last 150 years, mankind was able to largely transcend many of the constraints previously imposed, but not without severe environmental and social consequences.

Today, unsustainable urban development is no longer viable, and new solutions are demanded. Surprisingly, the key for a sustainable future may reside in the past, learning from this previous connection between food and city and the environmental and social benefits underlying it. The architect's role and responsibility are to (re)integrate food activities into urban design and architecture, in all of their scales, exploring innovative and historical solutions, in order to promote a more balanced global future for all.

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