The spatial organization strategies of productive cities

N A Hasan
Architectural Engineering Department, University of Technology/ Baghdad. (Iraq), E-mail: nadaabdulmueen@gmail.com / 90048@uotechnology.edu.iq

Abstract. The cities provide the possibility of achieving gains and production opportunities, and the productive city has been explored as an important advantage of sustainable development, as productivity and sustainability challenges and opportunities are part of an interconnected relationship and dynamically system. Studies have focused on the way in which places are designed at the local level as a major – enabler factor to productivity, and that strategic design interventions can drive evolutions towards a higher level of aspirant. Accordingly, the problem of the research was identified as "the absence of a theoretical framework for the spatial organization strategies and its role in productive cities development."

To address the research problem, a theoretical framework has been built for the spatial organization strategies of productive cities and depend on its derived vocabulary to analyze a number of contemporary urban elected models that have adopted intervention and treatment procedures for the vocabulary and indicators of the subject of the research, which reflects the design strategies embodying what was presented by contemporary urban trends. The research reached a set of theoretical and practical conclusions concerning formulas that achieve the spatial organization strategies of productive cities.

1. Introduction
If we look through history, the relationship between production and city construction has always been essential and constitutes one of the main reasons behind the organization of human settlements. Countries have responded in different ways and in different time interventions. Studies have recently appeared showing the impacts of urbanization on productivity. There is strong proofs that cities provide chances to increase productivity by growing awareness of cities as an economic power. Indeed, the way in which the urban environment is developed provides a chance to enable the entirely built environment to participate in domestic productivity. As the issue of the productive city is recognized in the sustainable development plans, it is also related to work in the field of spatial organization and the relationship between productivity and place. Therefore, this research seeks to "explore the spatial organization strategies that affect the productive cities development". In order to address the research problem and achieve its goal, it will adopt steps that include:
- Defining productive cities, clarifying their importance, factors for their improvement, and a number of international policies for productive cities.
- Clarifying strategies of construction productive cities.
- Detecting and extracting the most important indicators of spatial organization strategies of productive cities, and then building the theoretical framework.
- Applying the extracted framework to urban elected models and extraction the most important results and conclusions.

2. Definition of Productive Cities
2.1. Idiomatic Definition of Productive Cities

Productivity is defined as the ratio of the output value to the inputs consumed and it is determined by how efficiently inputs are used in production. The higher the productivity, the one can provide a good or service for consumers [1].

Organization (ICLEI)\(^1\) believes that productive cities override upgrade the efficiency of existing or future urban systems, comprising new cities or new urban evolutions, with the goal of becoming pure production systems (in environmental, economic and social aspects). Consequently, the productive city reduces its dependence and extractive burden on international resource chains, and also its dependence on semi-urban and regional remote areas [2]. And NSW Intergenerational Report (2016), based on an analysis by the Grattan Institute in New South Wales, notes that urban areas with relatively high levels of economic activity and employment tend to be more productive [3]. Also the SACN\(^2\) program philosophy and goals refer to productive cities as Competitive & Inclusive Cities in their economic growth path. The State of English Cities (2006) report defines competitive cities as the capability of cities to continuous develop their commercial environment, skills and physical, social and cultural infrastructures, in order to attract and maintain the high evolution of innovative and gainful companies, and educated and creative manpower, thus enabling them to realize a high rate of productivity, labor, wages, high per capita GDP, and depressed levels of income variance and social exclusion [4].

Studies refer to the issue of how to plan a productive and inclusive city by exploring the arguments for industrial integration in the urban fabric as well as the benefits of separating land uses and preserving land-use designations, and how urban populations are divided [5]. On the other hand, there seems to be a great opportunity of "City ... as a second nature" to become productive. Each of the interpretations of the second nature as Behavior, the Man-Made and New Wilderness is able to explain and reflect strategies or desires behind practices of urban agriculture and the specific effects on food production and urban space production [6].

The studies defined that the productive city, as space, will turn on the way to a more unique spatial regulation that blends the special circumstance of the population with the working circumstance and any type of productive activities (commercial, handicraft, production, warehouse, … etc) in a flexible, welcoming and open urban space. Productive urban areas are creating new proximity conditions between laborers and inhabitants, between knowing and production, between the public and shared space; it focus on the common production of agents in the city. It allows for the emergence of contemporary architectural types, and has made the functional and social blend as a fundamental stipulation for living with one another [7].

After this general views to the concept of productive cities, it is possible to define three trends of definitions that indicate the theoretical dimension towards urban design. Productive cities focus on:

- Efficiency of urban systems (environmental, economic and social) in the use of urban resources and dependence on peri-urban areas;
- Achieving high levels of economic (commercial, industrial and agricultural) and social activity and growth, continuous development, in addition to integration with the urban fabric;

---

\(^1\) (ICLEI): It is a varied and powerful universal organization with a history and countless achievements. Its main concentration during its history - across the five continents - was the sustainable cities. It addresses additional ideas or approaches, as they relate to the most efficient use of environmental, social and financial resources, such as: productive cities, smart cities, urban risks, etc [2].

\(^2\) (SACN): The program philosophy refers - Can the local economy provide opportunities to earn a reasonable livelihood for the majority of population? The objectives of the program are: Development of the economy by facilitating cooperation and enhancing competitiveness in both formal and less formal parts of the economy [4].
- Spatial organization that mixes the social population conditions and any kind of functional-productive activities through contemporary architectural types within an urban space with characteristics (common hybrid, different, more unique, flexible, welcome, and open).

2.2. The Importance of Productive Cities

Challenges and opportunities of productivity, sustainability and livability are part of an interrelated relationship and dynamic system in cities. Addressing one goal can have a positive or negative impact on the other goals. For example, effective public transport can address congestion and improve access to jobs and opportunities (productivity); it can also reduce greenhouse gas emissions (sustainability); and enable affordable access to education, and health and recreational facilities (livability) [8]. The symbiotic relationship between productivity and the livability in addition to the place is recognized in the plans of smart cities. It understands that cities need to be productive and available (accessible) but they also need to be livable with a clear focus on serving their citizens. The increased recognition of the economic benefits of grouping businesses and workers in cities supports a focus on the livability in the city. Benefits include lower transportation costs, collecting the labor market and increasing opportunities for knowledge exchange between individuals and companies [3].

The importance of productive cities is represented by their interrelated relationship of a dynamic-reciprocal nature with concepts of place and livability and sustainability, by enabling access to various infrastructures and enabling participation and service of people, within the dimensions of environmental, social and economic sustainability.

2.3. Factors of Enhancing Productivity in Cities

Many factors participate to enhancing productivity, that include workforce skills, technology, investment in infrastructure and openness of the economy, and relationships in the workplace. The efficiency of our cities in connecting people, industries, companies and markets, and the effectiveness of using human and economic capital, has a great influence on the economics of cities and their participation to the growth of national productivity. It must be a lot of work to make the city's economies competitive, productive and inclusive. This means expanding people's capabilities to participate in the economy by improving education and training and access to basic services, as well as improving the environment in which companies operate by increasing investment in the economic infrastructure of the city [9]. Finally, the indicators that measure the main drivers of competitive cities are: innovation and creativity, investment, human capital, economic diversity/allocation (including exports), communication, quality of life, governance and decision-making (through municipal financing) [4].

The relationship between production and territory development throughout history has been described by Geddes and then Mumford's proposal to divide human civilization into three distinct eras: the Eotechnic, the Paleotechnic and the Neotechnic, which are respectively characterized through the dominance of different energy sources (wind, water, coal, and electricity). Each of these technological periods had different effects on productive systems and thus in shaping the spatial organization of human settlements [10]. It was clarified that the spatial form is important for strong and productive city economies, and the spatial transformation enhances economic strength and is necessary for cities to become effective engines of local and national development [9].

Cities provide the possibility of significant productivity gains, especially when specialized or complementary activities come together. Benefits arising from these concentrations of activities,

---

1 Production and manufacturing sites in the Eotechnic era (AD 1000 - 1800), were initially located along rivers or where winds allowed windmills to convert wind energy into mechanical energy. The localization of production was freed from the geographical constraints associated with energy production, during the Paleotechnic era (1700-1900). Construction of industrial concerns began near ports, mines, and infrastructure junctions, which would enable the efficient provision of coal and raw materials. Neotechnic (1900-1930; Mumford's Present) provides an additional degree of freedom in terms of production territorialisation and human settlements thanks to the ability to transfer energy [10].
known as agglomerations, include greater opportunities for innovation, knowledge and services sharing, and the most specialized labor market. [8]. In this future, what is the force that will drive productivity and progress? Again, the answer is: more connected cities. Connected cities provide transportation and communications platforms that facilitate civil and commercial interactions between people. Enabling such interconnections within and between cities, through sustainable, affordable and digitally accessible transport networks, will create payment systems the basis of an effective and inclusive global economy for tomorrow [11].

The factors of enhancing the productivity of cities can be classified into: economic factors represented in economic performance which include both openness of the economy and trade, economic diversification and allocation, participation in the economy, effective use of human and economic capital, innovation and creativity and workforce skills, investment in infrastructure, quality of life and improvement Work environment, technology, and governance and decision making. And spatial factors are represented by spatial form and transformation, sustainable communication and transportation that facilitate civil and commercial interactions. It include both effective communications between individuals, companies, industries and markets; collecting specialized activities; and access to services.

2.4. Productive Cities Policies
This paragraph deals with reviewing a number of different international policies in order to clarify the different urban trends related to indicators of planning, design and development of productive cities in general.

- The productive transformation policies of cities in Africa, Asia, and Latin America: The studies of Cape Town and Nairobi in Africa illustrate the important role of ICTs in their economies and societies. Studies show the transformation of the economic structure of Quito, the capital of Ecuador in Latin America, after a significant growth in the services sector, and the most important changes in the productive sector occurred in manufacturing, and in scientific and technical professional activities. In Asia-Pacific, the Ho Chi Minh city, in accord with the structural transformation of Vietnam's economy, has become a production center and a growing source of manufactured products [12].

- Australian National Urban Policy: The policy goals for improving the productivity of the main urban centers (and their sustainability and livability) have harnessed the productivity of Australia’s people and industry, through the best managing of labor, knowledge and creativity, infrastructure and territory [8].

- Melbourne’s 2050 plan policy directions: A number of outcomes were identified along with policy directions to support the principles of the plan. Outcomes include: “Melbourne is a productive city that attracts investment, supports innovation and creates jobs”, to support the principle of “environmental resilience and sustainability” [13].

It is clear from the review of the international policies above, that studying the political directions of productive cities in terms of amplitude and inclusiveness goes beyond the intention of research, because there are a number of knowledge trends related to: scientific and professional technical activities; economic activities, investment, capital and manufacturing; infrastructure and information and communications technology; and labor and jobs. So the study of productive city policies came to a number of indicators in relation to urban planning and space organization:

- The first indicator: integrating of land use and social and economic infrastructure, providing comprehensive spaces socially and economically and multiple spaces centers, in addition to a greater mix of uses.
- The second indicator: improving access and communication.
- The third indicator: supporting the productive use of land and resources in non-urban areas, establishing a system of ecological reserves and paths, and protect sites.
3. Strategies of Construction Productive Cities
The Fab City\(^1\) international initiative focuses on developing Locally Productive, Globally Connected and Self-Sufficient Cities. The city revolves around building a new economy based on distributed data and manufacturing infrastructure. The basic strategy of Fab City is to develop a global network of cities that are part of a sustainable ecosystem for production and knowledge. The city has become involved in the following specific strategies: advanced manufacturing ecosystem, distributed energy production, food production and urban permaculture, educating for the future, building the spiral economy, collaboration between governments and the civil society [14].

The theme of European Federation of National Organizations (EUROPAN)\(^2\) was: (Europan 14) competition under the title "Productive City", which focused in particular on the issue of ecological transformation into the producing city [15]. The main question was how a multi-faceted city could mix productive elements (cultural, commercial, and knowledge-based activities) beyond housing to include workplaces, industry, and other production places as important elements. Thus studying the relationship between production, housing and urban life. The current competition of (Europan 15) will continue to explore the "productive city" as an important feature of the city's development, and what kinds of synergies can be created, or considered necessary, for a city characterized by natural production modes? In general, what types of infrastructure or interfaces are needed to facilitate and improve the city's productive features? [16].

Rotterdam presents its participation in the productive city an opportunity to field-test the concept Omgevingvisie meaning (Concept Environmental Strategy Rotterdam), in addition to gaining knowledge about the biggest post-war change in the spatial planning field in the Netherlands. The drafted of the concept Omgevingvisie puts several perspectives of the city on the agenda in mutual cohesion, and takes productivity as a starting point. The evolution of the concept that summarized the above in five perspectives: a compact city that turns into a dense and attractive city; a healthy city that makes healthy urban life possible; an inclusive city that provides a space for meeting and sharing; and a circular city that provides a space for sustainable energy and recycling; a productive city gives way to the new economy [17].

It is clear from the above that the adoption of spatial strategies, in many contemporary urban directions of productive cities, is directly or implicitly within the sustainable global ecosystem networks. And the strategies relate to a number of concepts and vocabulary which take a special direction for development and transition to a production system, and multi-faceted synergy, in addition to place planning and design strategies. Hence the emergence of the need to examine detailed aspects and vocabulary specialized in spatial organization strategies and their secondary indicators, in an attempt to crystallize a theoretical framework derived from the specificity of productive cities. This will be covered in subsequent paragraphs.

4. Spatial Organization Strategies of Productive Cities
The previous literature excreted a group of spatial organization strategies of productive cities, as follows:

---

\(^1\) The project is linked to the global Fab Lab (Fabrication Laboratory) network. It includes an international research institution for civil society leaders, and makers and innovative city planners to work for changing the current industrial economic model, as the city works on a linear model for importing products and producing waste, into a spiral ecosystem in which materials flow into cities, and information is circulated about how things are made globally [14].

\(^2\) It is the European Federation of National Organizations, which runs architectural competitions for building or design projects. It is launched simultaneously by many countries of the European Federation on a specific theme and with common goals. Arbitration rules and methods are identical in all participating countries, and apply to all competitions in EUROPAN sessions. ([http://www.europan-europe.eu/](http://www.europan-europe.eu/))
4.1. Bio Synergies
The issue of the productive city is related to the work in the field of bio-synergies. Synergy points to the effective collaboration between the elements, and the total that is more than the parts [18]. The synergy relationship between the city and the productive spaces can be considered in three different issues represented by [15]:
- Implanting: It is according to two aspects: the first aspect is the productive milieus that relate to planting or revitalizing a natural, cultural, social and economic environment. The second aspect is through adding new productive uses that lead to the start of the dynamics of change and the transformation of the surrounding environment into a reliable program.
- Proximities: It is related to the proximity between living and working and between the residential areas and mono functional production areas. It also relates to rethinking the move between high-speed urban and low-speed transport in neighborhoods. It is through the new third space in-between that is entered between the residential and production area. It can stimulate the conversion of production cycles through creation synergies with urban spaces and daily life.
- Changing Metabolism: It means finding a new balance between relationships, operations and multiple powers of locations that are contain a diversity of factors (human and non-human) with long and short-term cycles, and long-term environmental, economic, and spatial impacts. It is according to two aspects: The first aspect is the shift from linear to circular economy. The site, which is characterized by a linear, old or mono functional economic approach, aspires to integrate other resources and new uses that create new synergies and capabilities for interaction so that they create a circular system, stimulating flows and processes in a more integrated and effective way. The second aspect is represented by multiplying and connecting factors. Identifying and connecting factors in terms of air, soil, floods, programs, activities and users, and new functions may result to equiponderant growth.

Six paths of productive synergies were identified in urban-architectural scales on the subject of productive cities, the overlap of ecosystems, lands, spaces, districts, city and the neighborhood, and are directly related to the issue of architecture, which is [18]:
- Synergies between nature and artifice: It is the acknowledgement of the new circumstances of common development and the common rhythms between human and nature, and all of the living elements (plants and animals) and elemental (water, air, earth and fire). This is done by restoring identity and returning to the roots of city construction, where natural elements become an element of the urban space, architecture intertwines with it, and accommodating environmental risks. In addition to achieving resilience and reactivation by combining agricultural production and industrial treatment. This depends on the obtainable natural resources using. The goal is to direct attention to the spaces by buildings with light-framed that host different functions. A strategy based on natural cycles, improving available resources, and generating biological exchanger with other neighborhoods in the city was also proposed. Such taking advantage of runoff water to irrigate green areas, which helps decrease pollution of environment and create new sources for the region.
- Synergies between local resources and sustainable urbanism: It means using the durability and local resources as a material for regenerating and restoration the contemporary city. Restoration means making the city more livable and less separated with other environments and across local scales. In the end, it is "trans-local delocalization." Industrial areas and shopping centers are the best models of these challenges. Their processes are depended on consumption, production and increase, and on feeding and consumption of huge amounts of energy, especially fossil energy. It is proposed to generate Productive Urbanism by preserving and producing local resources of new architectural and urban forms; improving site's hydrological and geographic systems; and creating a dynamic of redistribution, collection, reuse and recycling. In addition to the proposal to depend on the existing original systems (especially those that combine production and culture) to create the operation of collecting and interchange between production programs around of a public places network that constitute an environmental system from the environment and learning.
- Synergies between mobilities and production: The physics of cities is composed of movement tracks that serve various places and links. In addition to the green or active mobilities associated with other faster modes. Digital mobility is also critical for the contemporary sustainable development. This kind of synergy is achieved by converting the mobility space into a mixed use urban boulevard with new links for pedestrians and public transport directly related to nature. In addition to generating a new green spaces linking cultural, commercial and managerial life for giving identity. It is centralized of a remodeled roads and public spaces network that re-link to transportation systems using multimedia nodes connecting the city to the land on a larger scale. As well as inserting a digital platforms within the space (mobility) while introducing a pedestrian/cycling paths that accommodate a set of programs.

- Synergies between mixity of uses, practices and urban-architecture: The focus is on urban density generation by interlinking practices and uses. Wide-ranging geographical visions integrate with micro-spaces that assist to raise meeting capabilities: (public spaces, cultural facilities, and spaces of production and services) work together, reviving the vernacular traces that reflect the attachment to the place as well as the importance of healthy life and urban quality. This synergy is adopted by linking production spaces and a mixed community that provides a wide mix of uses with different users in a new public space. A new public space is the location of a major semi-public building where accommodates some blended uses such as (workspaces, building skills center, cafes, ... etc). As well as converting enormous factories into public spaces, through retained some production and introduced a new production; and adding urban facilities and residential areas with urban and productivity activities, and flexible accommodation that can be used for both residential and working purposes.

- Synergies between production, public and private: This trend is concerned with the common depend on the new shares: reviving rural traditions of share pastures, and inspiring territorialist trends to search for modes to revitalize a circular economy, through temporary means or third shared durable (social) spaces. This practice is adopted and revived the idea of the collective right to the use of shared lands. The goal of family gardens is to make the land available for production of all kinds. It also suggests generating a big intermediate public space as a gathering place that works as a transition between production and the day-to-day activities of the city, society, and nature surrounding them. But the surroundings can accommodate several public and private uses that can develop over time, and boost several services which consist of urban blocks including a blend of housing and productive spaces.

- Synergies between scales and spatial and temporal rules: The synergies that bind part to the whole trigger the matter of the need for synergy between scales and between rules in their production of space. Features such as modularity, diversity and adaptability need to be prioritized. Diverse systems with many links and scales are more strength against external impacts than simply built for efficiency. Diversity is adopted to enhance resilience, and to insert a different scale into the existing site. As well as proposing modules as elements of human interaction with a human scale. Several programs (housing with commercial and productive spaces) must be combined to create an active. Between these regional and local scales, the circumstances for development are created over time of a part of city that will integrate the wishes and cooperation of its inhabitants.

4.2. cological - Productive Transition
A special focus was placed on the issue of ecological transition to the vision of a productive city for the future. The various applications of urban project references in transitional contexts are categorized into [19]:

- From monofunctional residential area to productive district: it is through multiple programs and scales. The concept of rapprochement - small merchants, craftsmen and service suppliers, and habitats work can lead to productive uses.
- From business area to living neighborhood: this is done through the restructuring of housing and facilities around public or shared areas.
Productive street: it is by maintaining production spaces around the structure of streets through a variety of uses. It also includes rethinking these streets in an urban way manner and allowing for compatibility between various uses and transfers.

Multifunctional building: It is a multi-mix buildings design, capable to accommodate various functions, and also has an integrated transformation of uses through over time. This adaptation of building involves in relationship to the urban environment through the integration of common spaces.

Urban agriculture: It means the possibility of rural areas to become productive spaces within the urban fabric and the possibility of local bio agriculture within a small scale.

4.3. Previous Studies

The research presents in this paragraph a number of studies, in order to promote and complete the theoretical framework. It relate (with some) indicators of spatial organization strategies for productive cities, which allow them to be placed side by side so that we have a broader theoretical basis.

4.3.1. (WSP, 2018): “Productive Places: Boosting Productivity Through Planning and Design”

The study focused on the manner of places designing at the local scale as an enabler of productivity. It takes into consideration, through (SHARE), how places designed and presented with space, health, accessibility and resilience can be more productive, as shown below [20]:

- Spaces: create aesthetically attractive spaces that encourage social interaction, and have good and comfortable connectivity. The city spaces need to absorb changing technologies and be designed in Durable urban structures and public spaces. Space efficiency is a significant component of productivity, and it revolves around generating economic value from spaces - vacant plots and empty space on the roofs of buildings.

- Health: There is a strong concentrate on high-quality internal spaces. Comfortable temperature, good air quality and adequate lighting are main agents that make buildings healthier for people.

- Accessibility: Enabling mass movement through reallocating space for cars, cycling and walking, and using spare space for more productive activities.

- Resilience: Risks can be transformed into opportunities through future-proofing city systems and their integration in design that decreases the confusion and cost of external shocks, and preparation for climate, technology and demography changes.

4.3.2. (Bodart & Borret, 2018): “And Productive Again”.

The study pointed to thinking on the process of transformation industrial lands as a renovation and continuity: and how at the same time it is possible to renewal and maintain the productive dynamics of these areas? On the other hand, how to inherit bygone forms the productivity in the urban surrounding? The legacy concept should not be understand here as a simple transition, but as a special method of transformation. The study presented three strategies for dealing with inheritance that vary in their pursuit of new frameworks of flexibility; obtaining new forms of connection; and specific mode of intensification, including:

- Leave room for uncertainty: It is through the idea of inserting an orthogonal grid as a model of social and spatial flexibility that provides a reduction density with an appropriate distribution of programs, and releasing new forms of participation between various stakeholders in order to make the transformation processes more flexible. As well as the introduction of a modular structure able for structuring a wide range of programs in time and space (public amenities, mixed residential, and productive activities).

- Connecting the scales of time and space: It is about new spatial and temporal modes and forms of connection. As defining a multimedia link between different surrounding neighborhoods and redefining them as axes and places for social and economic interaction; as well as restructuring interchanges between the city center and its suburbs through the generation of productive, walking and cycling paths that are managed by the huge topological variety of the built environment,
where the new micro-amenities combine with the development areas designated for temporary production activities.

- Intensifying the potentialities of the existing fabric: The call for an urban and architectural reconfirmation of productive qualities and their activation in sites which already has a productive background, is through restructuring the productive fabric by centering on the sites of activities in charge of its original fragmentation, and intensifying the current function by binding it to a whole program of multifunctional spaces and benefiting from the productive legacy of the location transforming its built structure through four architectural processes (dividing, adding, connecting and revitalizing) to reshape the built heritage [21].

4.3.3. (Europan 15 Rotterdam, 2019): “Transforming the Productive City: From Monofunctional Business Area to Innovative Urban District”

The study presents a summary of the (Brainpark I) site development in Rotterdam and introduces spatial strategy within the concept of the Environmental Strategy Rotterdam, which takes productivity as a starting point. Where a two-aspects spatial strategy was adopted. The first aspect is the densification the area through innovative workhome housing patterns, using the capabilities of the public transportation center and dealing with difficult environmental matters on the location (as highway emissions and vehicle noise). The other aspect is strengthen the interactive milieus by providing high-quality public space and places for working and living, and creating the correct mix of functions. The embedding economic engine, such as Erasmus University, which is considered a strong asset, in the interactive milieus on location adds big and unique ingredients to the blend.

The strengths of the river bank, including high-quality green areas in public spaces, institutions and facilities have been strengthened and used with a strategic locations of mobility centers. Functions mixing and intensifying, especially around high-quality public transport centers outside the city center, are promising options to address the urban challenges. The connections of high-quality public transport centers are used more intensively than in monofunctional areas. In the future, Rotterdam may obtain an additional (multimodal) crossing for public transport, automobiles, and cyclists, which will connect a series of urban centers on the eastern side of Rotterdam. A new urban axis will be established, linking several cities (in the continuity of the axis). Erasmus University Rotterdam Campus, next to the site, along with the Central District of Rotterdam and other areas, will qualify as one of the economic engines that represents a significant contribution to the larger whole [17].

It is clear from the above, the studies that dealt with the spatial strategies of productive cities, have clarified new aspects related to: the transformation of industrial lands in relation to the resilience, connection and intensification, Transforming monofunctional business areas into innovative urban areas in relation to the intensification and strengthening of the interactive milieus. It highlighted important aspects represented of how to design places as an enabler of productivity through sharing between space, health, accessibility and resilience.

5. Theoretical framework

Based on what has been presented from the contemporary literature and studies specialized in defining and developing productive cities as well as the strategies used to develop them, it provided a theoretical basis and a knowledge field that can be adopted in defining productive cities as "spatial organization that mixes the social conditions of the population and any kind of functional-productive activities through Contemporary architectural types within urban space; the efficiency of urban systems (environmental, economic and social) in the use of urban resources; and by adopting spatial strategies related to the bio synergy between the city and productive spaces and between urban-architectural scales, and strategies related to ecological-productive transition, in addition to strategies of designing places for productive cities; in order to achieve high levels of activity, economic and social growth, and continuous development, as well as integration with the urban fabric".
Accordingly, the main vocabulary and its secondary indicators that focus on spatial organization strategies for productive cities have been defined, and extracted from the organization of previous knowledge, represented as a follow:

- **Bio synergy strategies**: determined by synergy between the city and productive spaces, and between urban and architectural scales.
- **Ecological - productive transition strategies**: represented by transitional contextual references.
- **Strategies (enabler) for designing places - Share strategy**: that is between space efficiency, space quality, and accessibility.

Table (1) clarifies the vocabulary of theoretical framework for spatial organization strategies of productive cities after symbolization them.

**Table 1. The theoretical framework vocabulary for spatial organization strategies of productive cities.**

(Source: The researcher)

| Spatial strategies related to the bio synergy\( (X_1) \) | Synergy between city and productive spaces \( (X_1-1) \) | Synergy between urban and architectural scales \( (X_1-2) \) |
|-----------------|---------------------|--------------------------|
| Implanting/ \( (X_1-1)1 \) | Revitalizing a natural, cultural, social and economic environment \( (X_1-1)1 \)-1 |  |
| Proximity/ \( (X_1-1)2 \) | Adding new productive uses \( (X_1-1)1 \)-2 |  |
| Changing metabolism \( (X_1-1)3 \) | Shifting from a linear (monofunctional) economy to circular economy (integration of new resources and uses) \( (X_1-1)1 \)-3 |  |
|  | Identifying and connecting natural and non-natural factors (air, water, soil, floods, programs, activities and users) \( (X_1-1)1 \)-3 |  |
| Synergy between nature and artefact/ \( (X_1-2)1 \) | Inserting a new (third) space between the housing and production area \( (X_1-1)2 \)-1 |  |
|  | Combining agricultural production and industrial treatment \( (X_1-2)1 \)-2 |  |
|  | Taking advantage of natural cycles and improving available resources, while reducing environmental problems \( (X_1-2)1 \)-3 |  |
| Synergy between local resources and sustainable urbanism/ \( (X_1-2)2 \) | Preserving and producing local resources, and creating a dynamic for redistribution, collection, reuse and recycling \( (X_1-2)2 \)-1 |  |
|  | Dependence on existing systems (that combine production and culture) around a network of public places \( (X_1-2)2 \)-2 |  |
| Synergy between mobilities and production/ \( (X_1-2)3 \) | Multiple uses - productivity of (mobility) space with new pedestrians and public transport links directly related to nature \( (X_1-2)3 \)-1 |  |
|  | Creating multimedia green central nodes connected to transport systems \( (X_1-2)3 \)-2 |  |
|  | Inserting a digital platforms within the (mobility) space \( (X_1-2)3 \)-3 |  |
| Synergy between mixity of uses, practices and urban-architecture/ \( (X_1-2)4 \) | Transforming semi-public buildings into a new multi-use and user public space \( (X_1-2)4 \)-1 |  |
|  | Transforming factories into public spaces while preserving the continuity of the historical spirit, and adding urban and productive activities, and residential areas \( (X_1-2)4 \)-2 |  |
| Synergy between production, public and private/ \( (X_1-2)5 \) | Using family gardens for temporary - shared use and available for production \( (X_1-2)5 \)-1 |  |
|  | Creating an intermediate public space as a meeting place and providing services, linked to natural landscape \( (X_1-2)5 \)-2 |  |
| Synergy between scales and spatial and temporal rules/ \( (X_1-2)6 \) | Inserting a different scale of buildings into the existing fabric \( (X_1-2)6 \)-1 |  |
|  | Inserting modules with a human scale \( (X_1-2)6 \)-2 |  |
|  | Inserting orthogonal grid \( (X_1-2)6 \)-3 |  |

| Spatial strategies related to the ecological - productive transition/ \( (X_2) \) | Transformation monofunctional residential area into productive district/ \( (X_2-1) \) | Transformation monofunctional business area into living neighborhood and Innovative Urban District/ \( (X_2-2) \) | Productive street/ \( (X_2-3) \) |
|-----------------|---------------------|--------------------------|-----------------|
|  | Adding multiple programs on different scales, facilities and productive places compatible with the residential character \( (X_2-1)1 \) | Restructuring of housing and facilities around public areas, the intensification of the area, and the strengthening of interactive milieus \( (X_2-2)1 \) | Maintaining production spaces around the street structure through a \( (X_2-3)1 \) |
variety of uses, and compatibility between different uses and mobilities

| Multifunctional building/ (X2-4) | Designing multi-functional buildings, integrating the transformation of uses over the time, and the relationship with the urban environment by integrating of shared spaces (X2-4)1 |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Urban agriculture/ (X2-5)       | Possibility of "bio" agriculture within the urban fabric as productive spaces (X2-5)1                                                                                                               |
| Transformation of industrial lands/ (X2-6) | Restructuring the productive fabric, by intensifying the multifunctional spaces (dividing, adding, connecting and revitalizing) (X2-6)1                                                                 |

| Strategies (enabler) for designing places - Share strategy/ (X3) |
|---------------------------------------------------------------|
| Space efficiency/ (X3-1) | Creating aesthetically attractive spaces that encourage social interaction (X3-1)1 Generating the economic value from (vacant plots and roofs of buildings) (X3-1)2 |
| Space quality/ (X3-2) | Providing high quality public space and places for working and living (X3-2)1 Providing high-quality interior (for buildings) spaces (good ventilation, comfortable temperature and sufficient lighting) (X3-2)2 |
| Accessibility/ (X3-3) | Enabling mass movement by reallocating multimedia space (X3-3)1 Creating new axes and places for social and economic interaction between different neighborhoods, and productive, walking and cycling paths with topological diversity (X3-3)2 |

6. Applied procedures
The research is adopted the Descriptive Analytical Study Method and Qualitative Measure in achieving the aim of the research and the desired results.

- Research community and sample: The research was based on the Internet community for urban design and development projects: designing an urban-spatial system of relationships. An intentional sample was selected including (3) urban models which were taken into consideration: variation in spatial organization and functional pattern, availability of adequate information on (design strategies and elements, plans and illustrations) that reflect different levels of design, in addition to its clarity in adopting intervention and treatment procedures for the vocabulary and indicators of the research subject, the time dimension reflecting design principles that embody the contemporary urban trends and spatial variation in the election of the urban sample.

- Analytical unit: Various two-dimensional and three-dimensional plans and illustrations were selected, in addition to detailed explanatory texts in the approved sources providing information in a manner that achieves the aims of the research. It has been preferred to select those analytical units from the relevant research community due to the difficulty in providing and identifying an actual urban sample.

- Measurement tool: The research has adopted the Descriptive Analytical Method By the forms specially prepared for it. As the forms include: the description form, which has analyzing each project according to the spatial strategies indicators of the productive cities after providing the general description of the project. And the Checklist form, which is specified to testing the verification of indicators based on the description form for each project.

The research will provide a general description for all the models of the elected sample and the analysis of the first model only as an example of the analysis of the rest of the models due to the limited research area.

- Case study (1): Guebwiller Development Project, France, 2017.
The project aims to make Guebwiller productive again and strengthen the urban fabric by redefining the axis, crossings and nodes; and treatment the context with the project site aims to revitalize the city center and transform old industrial areas into a new urban form, in addition to intensifying dynamic networks. The idea is to save the cultural identity, legacy of the place and give a new image by presenting the innovative program with the appropriate additions and transfers.

The green axis connecting two parks on both ends of the site is confirmed by pedestrian-priority street as the backbone of the city. The spatial, social and economic potentials are being reassessed.
by adding urban spaces, activities and connections on a small scale to restore lost urbanity. Where the capabilities of the industrial spirit and the generous space of the site stimulate contemporary and sustainable ideas such as recycling and co-working to exchange ideas and share resources [22]. See figure (1).

Table (2) shows the project description form (model 1) according to the vocabulary and variables of the spatial strategies of productive cities.

- Case study (2): Karlskrona Development Project, Sweden, 2017.

The project aims to produce a smart productive city that gathers sustainability and design according to the current image of the city. The city (Karlskrona) is established on the relation between the islands and each one has its own character and urban form. The project attempts to link all parts of the city and strengthen the urban structure at the point of access to the city. The relationship with the sea and between regions is developed through the topic of productive cities. The idea of the project is founded on a small unit, with a typical inclined roof, built in different manner to create various types of production related to commerce, energy, marine activities and agriculture. All of these units will create a share ground for the Urban Frame development: new houses and public spaces are built on the beachfront.

The project develops blocks with two types of residential buildings, namely: town houses and condominiums, where the ground levels are using for commercial uses, and the upper levels are green houses for using of residents. The flats have different sizes. Sustainable energy supplies will be provided through photovoltaic plants, turbines of wind with storage system, geothermal energy for the cooling and heating system, and rainwater collection system to reuse it for irrigation [23]. See figure (2).

- Case study (3): Brno centre Development Project, Czech Republic, 2016.

The project aims to produce a smart productive city that gathers sustainability and design according to the current image of the city. The city (Karlskrona) is established on the relation between the islands and each one has its own character and urban form. The project attempts to link all parts of the city and strengthen the urban structure at the point of access to the city. The relationship with the sea and between regions is developed through the topic of productive cities. The idea of the project is founded on a small unit, with a typical inclined roof, built in different manner to create various types of production related to commerce, energy, marine activities and agriculture. All of these units will create a share ground for the Urban Frame development: new houses and public spaces are built on the beachfront.

The project develops blocks with two types of residential buildings, namely: town houses and condominiums, where the ground levels are using for commercial uses, and the upper levels are green houses for using of residents. The flats have different sizes. Sustainable energy supplies will be provided through photovoltaic plants, turbines of wind with storage system, geothermal energy for the cooling and heating system, and rainwater collection system to reuse it for irrigation [24]. See Figure (3).
Figure 1. Guebwiller development project, Franc [22].

Figure 2. Karlskrona development project, Sweden [23].

Figure 3. Brno centre development project, Czech Republic [24].

Table 2. The description form for Indicators of spatial organization strategies of productive cities.
(Source: The researcher)

| Vocabulary / symbol | Describing the active variables |
|---------------------|--------------------------------|
| (X1-1)1-1           | The project adopts revitalization of a natural, cultural, social and economic environment by redefining the various spaces, such as axes and nodes; and re-evaluating the social and economic potentials by including urban spaces, activities and links that create a visual and physical connection. |
| (X1-1)1-2           | The project proposes to add new productive uses in a manner that convert the surrounding environment into a reliable program such as (local markets, workshops, productive gardens ... etc). |
| (X1-1)2-1           | A number of spaces are designed with new functions, and they are between productive spaces and daily life, that encourage communication between different people and start businesses such as a courtyard garden and spaces that can be divided into independent rooms for work, research and sharing ideas for the young start-up work business. |
| (X1-1)3-1           | The project is based on the circular economy through the various uses of the site, preserving local materials and new re-used in buildings and spaces, in addition to preserving many residential and industrial buildings as local resources, so modern working and living situations generate a mix of functions and space resilience. |
| (X1-1)3-2           | A group of natural and non-natural factors are connected, such as green spaces, innovative programs, and various activities and functions in the use of space as (cultural, social, commercial ... etc). |
| (X1-2)1-1           | The synergy between nature and artifice shall be by confirming the green axis that connects the two parks on both ends of the site and many nodes represented by common public spaces (as parks); suggesting the pedestrian and bike paths along the La lauch river; and interesting in views and paths to the domains, farms and forests; in addition to using natural materials and plants in the facades of buildings. |
| (X1-2)2-1           | Local resources are preserved and produced from new architectural and urban forms, such as the reuse of industrial buildings, recycling of materials and ideas in Book Sharing Kiosk, and recycling and reuse of materials as timber in the redesign for skateboards and bike frames. |
| (X1-2)2-2           | The design relies on the spaces and structures on the site to create a network of public places that constitute a system of environment and learning, such as creating an atelier for testing start-up business manually working with recycled materials, and creating common spaces between different users (product designers, fashion designers, and information technologist) for work, research and share ideas. |
| (X1-2)3-1           | The variety of uses of the main mobility space - the green axis that connects to the railway network, and pedestrian and bike paths along the river, has visual and physical axes towards fields and forests. Service facilities and spaces having various activities are provided (as accommodating the expanded pavement with... |
| Spatial strategies related to the ecological productive transition | Various activities and facilities: exhibitions, book kiosk, … ) |
|---|---|
| (X1-2):3-2 | The plazas and spaces along the green axis are redefined as green nodes connecting the city (and between commercial, social and cultural life …), which are a pedestrians- priority and connected to public transportation systems. |
| (X1-2):4-1 | The existing structure at the site is transformed into a common public space - an open multi-functional hall for different activities and uses such as (festivals, local markets, exhibitions …) and for different users. |
| (X1-2):4-2 | The project proposes to renovate the old factory buildings to introduce a second life, as in transformation one of the factories into a multi-functional indoor spaces with a kinder garden on the ground floor and housing on the top floor, and transformation the warehouse into seasonal renting apartments with a restaurant on the ground floor. |
| (X1-2):5-1 | The courtyard gardens (flowers and vegetables) are used as a common space between residents. |
| (X1-2):5-2 | Redefining the plaza as a nodes and public-green spaces for meeting and social interaction through the various uses and services, such as parks, playgrounds, relax areas, skate board, kiosks, cafes, restaurants … (the square in front of the train station), and proposing the library, galleries, and cafeterias to generate the cultural hub with the museum, church, and clubhouse … (the square in front of the city hall). |
| (X2-1):1 | Various types of housing that are suit the needs of the modern city are proposed in a new way of co-living to generate the new dialogue between people, such as (cooperative housing, social/ private housing, and rental apartments) with the provision of facilities and places compatible with the residential character as (co-working, offices, restaurants, the open hall, train station , …). |
| (X2-3):1 | Uses vary around street structures, whether for the main green pedestrian axis, or that are connected to the railway network, pedestrian and bike paths along the river, consistent with / or through production, commercial, social and cultural centers. |
| (X2-4):1 | A number of multifunctional building have been proposed that create living neighborhood and connect with the surrounding environment through shared public spaces. |
| (X2-5):1 | The productive spaces are suggested by adopting bio-agriculture within the urban fabric, as in the vegetable and herbal garden on both ends of the green axis, and plantation on the road, in addition to the courtyard and vegetables garden within the cooperative housing complexes. |
| (X2-6):1 | Former industrial sheds are transformed into creative clusters, and revitalizing the existing building through various activities and the possibility of dividing and linking them with the multifunctional space system. |
| (X3-1):1 | Different Perspective are created when wandering the site: (view and paths to yards and forests), where the introduced paths and redefined spaces create a physical and visual connection that mixes urban spaces. |
| (X3-1):2 | The efficiency of space is economically represented in the former open plan structures for textile-industry machines that generate a place of ideas for the young start-up work business. |
| (X3-2):1 | Public spaces and workplaces are provided that depend on the quality of natural lighting and ventilation, as in (the multi-functional open hall and atelier). |
| (X3-3):1 | Pedestrian paths and bike route are created along the river with the railway network, where mixed movement areas are considered to avoid separation of people and encourage social and economic interaction, in addition to providing multiple access to neighborhoods as a result of opening closed sites. |
7. Results and conclusions

7.1. Results
- The results showed the effectiveness of the bio synergy strategies related to the synergy between city and productive spaces: as the importance of implanting, proximity and changing metabolism strategies arise with a ratio of (18%); but regarding for the strategies related to the synergy between urban and architectural scales, the results indicated the importance of the synergy between mobilities and production, and the synergy between production, public and private strategies with a ratio of (22%); followed in importance is synergy between nature and the artifice strategy with a ratio of (11%).
- The results showed the effectiveness of ecological – productive transition strategies: as the importance of transformation monofunctional residential area into productive district, productive streets, multifunctional building, and urban agriculture strategies with a ratio of (50%); the importance of the transformation of industrial lands strategy with a ratio of (33%); and the rest of strategies appeared with a few ratio (100%).
- The results showed the effectiveness of (enabler) strategies for designing places: the importance of space efficiency and accessibility strategies has emerged with a ratio of (100%); while the space quality strategy emerged with a ratio of (17%). Note the table (3).

Table 3. The Checklist form for testing the verification of Indicators/ (Source: The researcher)

| Vocabulary’s Symbols | X1 | X2 | X3 |
|----------------------|----|----|----|
| (X1-1)1 | (X1-1)2 | (X1-1)3 | (X1-1)4 | (X1-1)5 | (X1-1)6 |
| (X1-2)1 | (X1-2)2 | (X1-2)3 | (X1-2)4 | (X1-2)5 | (X1-2)6 |
| (X2-1)1 | (X2-1)2 | (X2-1)3 | (X2-1)4 | (X2-1)5 | (X2-1)6 |
| (X3-1)1 | (X3-1)2 | (X3-1)3 | (X3-1)4 | (X3-1)5 | (X3-1)6 |
| (X3-2)1 | (X3-2)2 | (X3-2)3 | (X3-2)4 | (X3-2)5 | (X3-2)6 |
| (X3-3)1 | (X3-3)2 | (X3-3)3 | (X3-3)4 | (X3-3)5 | (X3-3)6 |
| (X3-4)1 | (X3-4)2 | (X3-4)3 | (X3-4)4 | (X3-4)5 | (X3-4)6 |
| (X3-5)1 | (X3-5)2 | (X3-5)3 | (X3-5)4 | (X3-5)5 | (X3-5)6 |
| (X3-6)1 | (X3-6)2 | (X3-6)3 | (X3-6)4 | (X3-6)5 | (X3-6)6 |

7.2. Conclusions
The research investigates the issue of sustainable urban development in the light of exploring the productive city, through spatial organization strategies and their formulas that deal with the efficiency of urban systems (environmental, economic and social) in their use of urban resources, achieving high levels of activity and economic and social growth, in addition to adapting with the environment and climate. Within networks of a sustainable global ecosystem. The research presents a comprehensive theoretical framework that supports spatial organization strategies as an influencing factor in the development of productive cities.

Case studies of urban development projects, with the aim of revitalizing a city that provides new eco-productive chances and allows a resilient and adaptable process according to its distinct character and cultural identity and the legacy of place, illustrate the ways to develop multifaceted synergistic collaboration between local and global, between nature and culture, and between rural and urban ...etc. It forms part of a future dynamic system that focuses on complementary alternatives and gives the urban dimension and relationship to the surrounding environment. The studies examined the strategies for spatial organization of productive cities through the following perspectives: adopting the strategies of implanting, proximity and changing metabolism related to the bio synergy between the city and productive spaces through synergy between mobilities and production, synergy between production,
public and private, and synergy between nature and artifice. And adopting the transformation monofunctional residential area into productive district, productive streets, multifunctional building, urban agriculture and transformation of industrial lands strategies related to ecological-productive transition. Finally, adopting the share between the space efficiency, accessibility and space quality strategies of (enabler) strategies for designing places.

8. References

[1] Fahmy B & Kamiya M 2019 Productive urban development: linking planning and economy in al-alamiein new city, Egypt New Cities and Community Extensions in Egypt and the Middle East, eds S Attia et al (Cham: Springer) Chapter 2 p 21.

[2] Begin G V and Zimmermann M 2015 ICLEI Seoul Strategic Plan 2015-2021 building a world of local actions for a sustainable urban future: ed M Woodbridge (Germany: ICLEI - Local Governments for Sustainability e.V.) P 4, p 5 & p 27.

[3] Arup 2017 A liveability Framework for Sydney, report was prepared in consultation with The Greater Sydney Commission and Department of Planning & Environment NSW p 11.

[4] Robinson Sh 2009 Productive city indicators, presentation for 3rd annual SACN urban conf. p 2, p 3, p 5 & p 16. http://www.sacities.net/

[5] Ferm J and Jones E 2017 Beyond the 'post-industrial' city: valuing and planning for industry in London Urban Studies 54 pp 3380-3398.

[6] Bohn K and Viljoen A 2015 Second nature and urban agriculture: a cultural framework for emerging food policies Proc. 7th Int. Conf. on Aesop Sustainable Food Planning (Tori) October 2015, ed G Cinà and E Dansero (Torino: Politecnico di Torino) pp 391-398.

[7] Klouche D, 2016 Point of view: building the productive metropolis Productive Cities-Europan14 Theme ed Europen Europe (Paris, France: Europen Europe) p 6.

[8] Department of Infrastructure and Transport 2011 Our Cities, Our Future - a national urban policy for a productive, sustainable and liveable future (Canberra- Australia: Department of Infrastructure and Transport) p 7, p 19 & pp 24-25.

[9] Karuri-Sebina G & Robinson Sh 2016 State of South African Cities Report ed K Davidso (Johannesburg: South African Cities Network) Chapter 3 p 85 & p 122.

[10] Sega R 2018 Productive ecologies: redefining the centrality and marginality of the city-territory, a brief article of PhD thesis expected defence: February 2018, EPFL - Ecole polytechnique fédér de Lausanne, Lab-U - Laboratoire d’Urbanisme, France p 1.

[11] Khanna P. 2017 Connected cities, productive cities, Mastercard International Incorporated p 3.

[12] Un-Habitat 2015 The Role of Cities in Productive Transformation: six city case studies from africa, Asia and Latin America vol 978-92-1-132675-8 ed L Langenkamp first published (Nairobi: UN-HABITAT) pp 40-44 & pp 90-109.

[13] State of Victoria 2017 Melbourne 2017-2050 (The State of Victoria department of environment, land, water and planning (DELWP)) p 10, p 12 & pp24-40.

[14] Diez T 2016 Locally productive, globally connected, self-sufficient cities, Fab city whitepaper. https://fab.city/documents/whitepaper.pdf

[15] Europen Europe 2019 Europan 15: productive cities 2. http://www.europan-europe.eu/

[16] Europen Sweden 2018 Europan 15 - Helsingborg: productive cities - sweden (Sweden: Europen Sweden) p 12.

[17] Europen 15 Rotterdam 2019 Transforming the Productive City, ed M Zoeteman (Netherlands: Stichting Europen NL) pp 8-9 & pp13-16.

[18] Rebois D and Younès Ch 2018 Productive synergies at urban/ architectural scales Productive Cities/ 1 - Europan 14 Results ed Europan Europe (Paris, France: Europen Europe) p 8 & pp 10-17.

[19] Arroyo C, Borret K, Degros A, Stratis S, Younès C and Rebois D 2016 Productive Cities-Europan 14 Theme, ed Europan Europe (Paris, France: Europen Europe) pp 8-9.
[20] WSP firms 2018 Productive Places: boosting productivity through planning and design (London: WSP) p 6 & pp 8-29.
[21] Bodart C and Borret K 2018 And productive again Productive Cities/1 - Europan 14 Results ed Europan Europe (Paris, France: Europan Europe) pp 44-49.
[22] Atelier Gantner 2017 Productive cities, Germany. http://ateliergantner.com/
[23] Cage platform 2018 A small unit city. http://archicage.com/
[24] Dutch urban solutions 2017 Brno centre a model for productive city living, Czech Republic. https://aasarchitecture.com/