"La tutela, dunque, conserva il suo vero significato
solo se si inserisce in una politica sociale dell'habitat,
e cioè in un discorso unitario che investe sia i nuovi quartieri,
che dovranno essere a dimensione umana, sia il restauro dei centri antichi,
sia il risanamento e la bonifica dei quartieri senza valore storico o artistico"

(Roberto Di Stefano,
in "Il recupero dei valori")

Housing Policies and Urban Economics – Vol. 3 / 2015

ISSN: 2385-1031 (print)
ISSN: 2385-0671 (online)

Invited paper

Preface

How does the value of landscape change following an intervention? What monetary and non-monetary impacts can we define by examining proposals of regeneration of urban landscapes? How do we learn from past experiences? What evaluation tools and approaches could we use to understand the value of change so to guide the decision-making processes? How can we better integrate the knowledge economy and cultural heritage in the context of sustainable urban development strategies? These issues are explored in the first section "Historic urban landscape" of HoPUE, where the contribution by Luigi Fusco Girard deals with the prospects for change generated by the conservation and enhancement of cultural landscape resources in port cities, in the view of rethinking the functional and spatial connections between port and city. The author F. Girard has long been engaged on the issues of sustainable planning of port areas; in this paper he points out the importance of protecting the original identity of places, considering at the same time the need for change required by the dynamic processes of urban development: this is the assumption of a new urban economic base, to be pursued through innovative *hybrid* processes which may include and integrate heterogeneous values, generating new opportunities. According to a holistic perspective to deal with the complexity of the contemporary city, F. Girard highlights the importance of a strategic role for these processes, identifying in multi criteria and multi-group evaluation of alternative choices, a suitable tool of decision-making support for urban regeneration. In the second paper of the section, Martina Bosone refers to the recent experiences of Icomos and World Bank in the field of cultural heritage conservation and urban development, emphasizing that now the need for new metrics is widely recognized to capture the complexity of the cultural heritage values through the definition of appropriate indicators, in a multidimensional perspective. With reference to the role of the historical and architectural heritage in the port cities, the paper describes the case study on the port area enhancement in Acciaroli (Sa, Italy).

In the second section "Building quality and energy resources", Rossella Franchino and Antonella Violano address the issue of the technological retrofit of school buildings in the Mediterranean area, with an application to a case study in a primary school in Roccadaspide (Sa, Italy). The authors emphasize the importance of the environmental regeneration of training places and the role of *energy-environmental audits* as tool to ensure sustainability in terms of proper use of resources, through an actual knowledge of the energy consumption of existing buildings and the identification of effective and efficient interventions. In the following paper, Evangelia Sklavou and Ioannis Tzouvadakis stress the importance of a multidisciplinary and strategic approach in planning and adaptation of the hospital buildings, considering both economic and financial aspects, energy consumption, environmental quality, use of local resources, aspects related to climate and topography of sites. With particular reference to the hospital building typologies built in Greece, the authors provide empirical data on building elements and information on the nature of sites, as a starting

database and an essential framework for future adaptation processes of existing hospitals to international standards, or for new hospital buildings in the view of an efficient use of resources.

In the third section "Public space, urban and environmental redevelopment", Francesca Muzzillo and Fosca Tortorelli investigate the perspectives of learning and socialization offered by *school gardens* to students and their families, as food and environmental education tool in order to better know the territory, to rethink the concept of urban sustainability and the relationship among man, natural resources and quality of life.

The last section "Housing and social policies" reports findings of a joint research work developed between the University of Chieti-Pescara and the College of Architecture in Miami on the theme of urban sustainability and use of technological systems for the integrated planning. The authors Andrea Mammarella, Gianmichele Panarelli, Thomas Spiegelhalter and Clarissa Di Tonno show that planning of sustainable interventions for urban renewal and building in condition of uncertainty and complexity, is evolving towards innovative systems for electronic processing of many information of a structure in every moment of its life cycle. An example is the *building information model* (BIM) that specifies the functionality and performance of various project elements, considering the architectural, structural, energy and management aspects simultaneously. The issue is also the subject of particular focus in the European context, in view of a gradual introduction of these methods in public procurement.

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Come cambia il valore di un paesaggio a seguito di un intervento? Quali gli impatti monetari e non monetari che derivano da processi di rigenerazione dei paesaggi urbani? Quanto si può imparare dalle passate esperienze di recupero urbano? Quali strumenti valutativi possono aiutarci a comprendere il valore del cambiamento e indirizzare i processi decisionali? Come integrare l'economia della conoscenza e del patrimonio culturale nel quadro di strategie di sviluppo urbano sostenibile? Tali questioni sono indagate nella prima sezione ***"Historic urban landscape"*** *della rivista, introdotta dall'articolo di Luigi Fusco Girard sulle prospettive di cambiamento generate dalla conservazione e valorizzazione delle risorse del paesaggio culturale nelle città portuali, nella prospettiva di ripensare i legami funzionali e spaziali tra porto e città. L'analisi di F. Girard, da tempo impegnato sui temi della pianificazione e progettazione sostenibile delle aree portuali, evidenzia l'importanza di tutelare la originale identità dei luoghi e considerare al contempo le necessità di cambiamento imposte dai processi dinamici di sviluppo urbano: tale approccio rappresenta il presupposto di una nuova base economica urbana, da perseguire attraverso processi ibridi innovativi che possano includere e integrare valori eterogenei, generando nuove opportunità. Secondo una prospettiva olistica volta a trattare la complessità della città contemporanea, F. Girard mette in luce la necessità di conferire un ruolo strategico a tali processi, identificando nella valutazione multi criteri e multigruppo delle alternative di pianificazione, lo strumento*

essenziale di supporto dei processi decisionali di rigenerazione urbana. Nel secondo articolo della sezione, Martina Bosone richiama le recenti indicazioni dell'Icomos e gli studi della Banca Mondiale in tema di conservazione del patrimonio culturale e sviluppo urbano, sottolineando come sia ormai riconosciuta l'esigenza di nuove metriche per catturare la complessità dei valori del patrimonio culturale attraverso la definizione di idonei indicatori, in una prospettiva multidimensionale. Con riferimento al ruolo del patrimonio storico-architettonico nelle città portuali, il lavoro descrive il caso studio sulla valorizzazione dell'area portuale di Acciaroli (Sa).

Nella seconda sezione ***"Building quality and energy resources"****, Rossella Franchino e Antonella Violano affrontano il tema della riqualificazione energetica e funzionale dell'edilizia scolastica in area mediterranea, con un'applicazione ad un caso concreto di studio in una scuola elementare di Roccadaspide (Sa). Gli autori sottolineano l'importanza della riqualificazione dei luoghi della formazione e il ruolo degli audit energetico-ambientali come strumento per garantire la sostenibilità ambientale attraverso la conoscenza effettiva dei consumi energetici degli edifici esistenti, l'individuazione delle tipologie di intervento efficaci ed efficienti, un monitoraggio dell'efficienza e dei risparmi conseguiti dopo gli interventi. Nel successivo articolo della sezione, gli autori Evangelia Sklavou e Ioannis Tzouvadakis sottolineano l'importanza di un approccio multidisciplinare e strategico nella progettazione e nell'adeguamento delle strutture ospedaliere, considerando contemporaneamente aspetti economico-finanziari, consumi energetici, qualità ambientale, impiego di risorse locali, aspetti legati al clima e alla topografia dei siti. Con particolare riferimento alle tipologie edilizie ospedaliere realizzate in Grecia, gli autori forniscono dati empirici di carattere tipologico/costruttivo e informazioni sulla natura dei siti, come database di partenza e cornice di riferimento essenziale per i futuri processi di adeguamento degli ospedali esistenti agli standard internazionali, o per la realizzazione di nuove unità edilizie nella prospettiva di un uso efficiente delle risorse.*

Nella terza sezione ***"Public space, urban and environmental redevelopment"****, gli autori Francesca Muzzillo e Fosca Tortorelli indagano le prospettive di apprendimento e socializzazione offerte dagli orti scolastici agli studenti e alle loro famiglie, come strumento di educazione alimentare e ambientale, per conoscere il territorio, per ripensare il concetto di sostenibilità urbana e il rapporto tra uomo, risorse naturali e qualità della vita.*

L'ultima sezione ***"Housing and social policies"*** *riporta le esperienze di un lavoro di ricerca congiunto, sviluppato tra l'Università di Chieti-Pescara e il College of Architecture di Miami sul tema delle trasformazioni urbane sostenibili e impiego di sistemi tecnologici di progettazione integrata. Gli autori Andrea Mammarella, Gianmichele Panarelli, Thomas Spiegelhalter e Clarissa Di Tonno evidenziano che la pianificazione di interventi sostenibili di trasformazione urbana ed edilizia in contesti territoriali sempre differenti, caratterizzati da elementi di incertezza e complessità, richiede sistemi progettuali innovativi che prevedano l'uso di strumenti elettronici per il trattamento delle informazioni di un edificio o di una infrastruttura in ogni momento del suo ciclo di vita. Un esempio è rappresentato dal building information model (BIM)*

che consente di specificare la funzionalità e le prestazioni dei vari elementi progettuali, considerando contestualmente gli aspetti architettonici, strutturali, impiantistici, energetici e gestionali. Il tema è peraltro oggetto di particolare approfondimento nel contesto europeo, nella prospettiva di una progressiva introduzione dell'obbligo di far ricorso a tali metodi negli appalti pubblici.

Barbara Ferri

Housing Policies and Urban Economics Vol.3 / 2015, pp. 5 - 22

The Regeneration of Historic Cultural Landscape in Port Cities

Luigi Fusco Girard[1]

Abstract

Cultural heritage and cultural landscape are more and more recognized as resources for the economic local/regional development, able to produce new employment, stimulating the localization of creative, green, ICT activities, thus increasing inclusiveness and social cohesion. The paper discusses how to mobilize the "*comprehensive/complex landscape"* as a key local resource for economic, social and environmental regeneration. Practical means/tools to implement sustainable development strategies in port cities, using the *cultural/complex landscape* as an asset for their economic development are proposed.

Keyword: Cultural heritage, cultural landscape, port cities, economic development, regeneration.

1. Introduction

Cultural heritage and cultural landscape are more and more recognized as resources for the economic local/regional development, able to produce new employment, stimulating the localization of creative, green, ICT activities; increasing inclusiveness and social cohesion [1]

The Communication of European Commission [2], considering cultural heritage a catalyst of creativity and growth, underlines the need to go "towards an *integrated approach* to cultural heritage for Europe". In particular this document, for the first time, uses in an institutional statement the notion of "*intrinsic* and social value of heritage". Cultural

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heritage/landscape have also an independent of use value: an *intrinsic* (or in itself or inherent; see 2005 Faro Convention, art 10) [3] value, that is not linked to the existing use/needs/functions but that is of interest for the future generations, because it is related to the incorporated information/knowledge.

The "*intrinsic"* value is the expression of the need of conserving relevant parts of material heritage as it represents a symbol of common and shared characteristics rooted in the history of a community. It has the capacity to contribute to the attractiveness of a site for people, activities, investments, thus enhancing the landscape multidimensional productivity.

In other words, cultural heritage/landscape is today recognized as a key resource in the urban regeneration strategy, both directly (through tourism, building activities, creative industries, commercial services, etc) both indirectly, (the heritage community stimulates new *relationships*, that can become social *bonds* ,that in their turn promote *new value creation chains*).

A particular landscape is the one of port cities.

Port cities are more and more characterized by strong potentials and also contradictions: they are the spaces where national/regional economic wealth is produced, but also where negative environmental impacts and social problems are concentrating. But if well governed, managed and planned (through suitable tools) port cities can offer new opportunities for economic productivity, social cohesion and ecological resilience. The challenge is to change their structural organizational assets.

Which practical means/tools to achieve circular sustainable development in port cities [10], using the *cultural/complex landscape* as an asset in their economic development ? Which are the conditions for *integrating conservation of the cultural landscape into an inclusive economic developmen*t ?

The paper discusses how to mobilize the "*comprehensive/complex landscape"* as a key local resource for economic, social and environmental regeneration.

2. The general model

The role of the "comprehensive/complex urban landscape" for city regeneration is proposed in the figure below (Figure 1), in its relations with circular symbiotic/hybridization processes: they increase the territory productivity, the local attractiveness and development capacity.

A high landscape quality enhances the city attractiveness and thus relations and exchanges, and multiplies the flow of benefits, and thus of the perceived well-being.

Regenerative cities need a new comprehensive organization able to imitate, as much as possible, the processes of natural ecosystems: adopting new circular organization processes for conserving and improving their wealth. In this way, they make city more resilient, prosperous and socially equitable.

The regenerative city not only implements actions to conserves the city wealth, but also to increase it, regenerating and increasing the existing stock of (all) kinds of capital (forests, water, land, man-made infrastructure, cultural heritage, social capital, etc).

The regenerative economic model starts with initiatives for: saving, maintaining, re-using, re-cycling, re-generating materials, and using renewable energies. All these activities, included into circular economic processes and thus synergistic networks, become economically advantageous, able to produce new jobs.

The regenerative city model reproduces positive relationships between the city and the eco-system, and also with the social system. Not only stimulates the reduction of economic circuits at a local and regional level, reinforcing the chain of value creation (in the construction, in the food industry, etc.) but it repairs damages, restoring values, and producing new plus-values. It is characterized by environmental high-technology industries, with networks of small and medium-sized enterprises which produce with low environmental loads new (and traditional) goods, services, by recycling and reusing materials, water, waste (and thus reducing the resource and energy needs).

The implementation of the regenerative-city strategy starts from the introduction of green economic processes/productions: regenerative -

city strategy de-couples economic wealth production from environmental negative impacts.

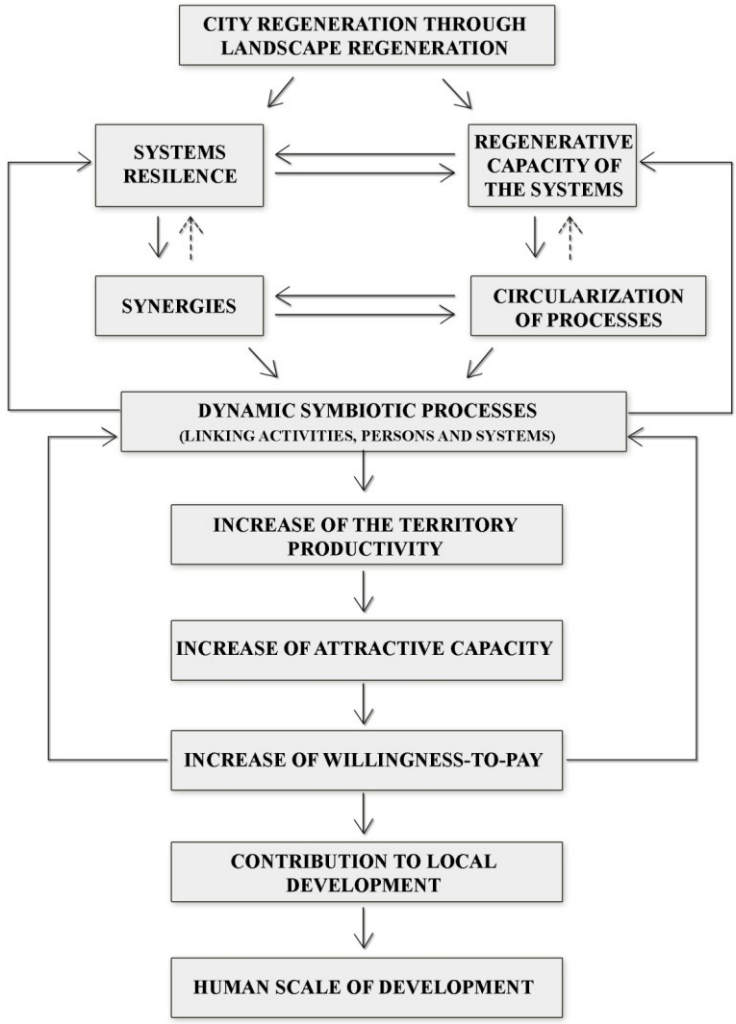

Figure 1. The attractivity of the urban cultural landscape

3. The complex landscape of port cities and the HUL approach

Port cities (and port areas) have a particular development potential. They can assume a key role for launching a smart sustainable development model, starting from local cultural resources to activate creative processes of *circular economy* through a synergistic approach, combining the port economic, logistic, industrial activities with cultural heritage regenerations, with creativity of inhabitants/community/civil society.

In these cities the historical centre often reaches out to the seaport. Often ancient city boundaries coincide with the port areas, where old warehouses, silos, wharfs, industrial archaeology heritage and lighthouses are situated and contribute to build the particular character, image, landscape. Port areas contribute to the particular beauty of the landscape, which expresses the combination of human and natural creativity and characterizes the true identity of a city: its unique image, but also its lifestyle and culture .

A particular landscape is thus a key characteristic of port cities/areas. Landscape is more and more recognized as an important economic resource in the global competition. Many of the most beautiful urban landscapes all over the world are port cities/areas: Amalfi, Venice, Genoa, Naples, Syracuse, Malta, Liverpool, Bergen, Istanbul, Saint Petersburg, Oporto, etc.

Here the notion of landscape is assumed and interpreted in a complex dynamic adaptive perspective: the complex urban landscape consists of combinations and interactions among six different and interdependent landscapes: natural, man-made, man-made cultural, financial/economic, social and human landscape [11].

The quality of the natural and the cultural man-made landscape is certainly important for the regeneration of local economic dynamics, but it is not enough. It must also be integrated with a human and social landscape of high quality for enabling synergies and processes of virtuous circularization: in order to strengthen bonds and to reconstruct economic wealth, job opportunities, ecological conservation and thus contribute to the *human* dimension of urban development/urbanization.

The *human* dimension of development is the key characteristic of the sustainable development, as recognized in the [5].

Natural landscape is composed of existing natural capital, (biomass, biodiversity, parks and urban corridors, agricultural areas, natural resources, lakes, rivers, energy resources, etc.).

Infrastructure man-made landscape is composed of built infrastructures and equipment system. *Cultural man-made landscape* is produced in the course of history and that is the heritage (cultural memory) of past generations.

Social landscape is represented by social/civil networks, density of associations, third sector.

Human landscape reflects the expertise, local knowledge, local entrepreneurship, creativity of individuals.

Financial landscape is made up of local credit institutions, "community – based" lenders, foundations, co-operative banks, organizations of third sector and/or religious organizations .This interpretation of landscape as a complex system is compatible with the Historic Urban Landscape (HUL) notion proposed [6] and suggested by UNESCO, and can help to identify more creative, resilient and sustainable regeneration solutions.

In the HUL approach the interpretation of conservation is oriented to respect integrity of values, to avoid alterations of values, but assuming a *general changing perspective*. The city is the central subject, and not the single set of monuments: the city as a "social complex" and as a "living heritage", that is the city as a complex system.

Historic Urban Landscape (HUL) approach opens heritage conservation to a new visioning that links tradition and modernization, cultural values and economic values, past and present, present and future in a systemic/circular and synergistic perspective, which promotes resilience, synergies and stimulates creativity and thus sustainability.

The HUL approach reflects a unifying cultural perspective based on *relationality principle.* Relationality principle is the capability to explore/understand complex systems recognizing interdependences, links, connections also when they are implicit; («other»/«hidden» aspects…) assuming a multidimensional perspective; it is a way to

interpret reality in a comprehensive /holistic perspective, that does not exclude (*either/or* – trade off approach) but integrates (*both/and) e*conomic, aesthetic/visual, fairness aspects and values. The HUL approach is here interpreted as a perspective for implementing *circular* processes, synergies, symbioses and hybridations for integrating landscape conservation in economic development.

Historic Urban Landscape (HUL) becomes a useful approach for leveraging city economic development while conserving "places": for managing changes in activating circular processes and synergies (between city actors, points of view, specialized knowledge).

The consequences of the interpretation of cultural heritage/landscape as a sub-system of city complex dynamic adaptive system is that cultural heritage/landscape should evolve with society, reflecting its changes, adapting itself to new needs of inhabitants: through i*nnovative hybrid* processes [12], in a circular dynamic way.

HUL proposes a *creative* integration between conservation and development, according to a dynamic and proactive perspective. It stresses the necessity to conserve the original identity, but considering change as something to be managed in a dynamic perspective, in order to fully satisfy all people needs.

In this perspective, conservation of cultural landscape/heritage becomes a *productive activity*, able to increase values in multiple dimensions (economic, environmental, social...).

Combining adaptations with continuity, this approach moves toward the increase of: use values, market values, independent of use values, social/relational/ communitarian values, cultural values, spiritual values,... stimulating the introduction of *hybrid* processes.

The role of the proposed approach is to avoid that conserved cultural heritage/landscape remains only as vestiges of an ancient past, unable to transmit meanings and sense (that goes beyond aesthetical dimension) into present time. It should open to a systemic /holistic perspective to face city challenges.

4. Toward innovative *hybrid* processes in port cities

The general changing perspective suggested by the HUL approach stimulates hybrid projects in port cities/areas. For example, the logistic industrial port economy should be integrated in the city urban economy, through symbiosis between the port and the city. The industrial system should be integrated with the circularized processes of heritage/culture economy, with the support of social economic system (which is characterized by circular -mutual approaches) .

Many net benefits of circular processes have been achieved in the industrial production: the reduction of materials costs, of labour and energy costs, and also the reduction of carbon emissions, with other positive impacts.

New jobs and businesses are created. They show that cooperation is economically convenient: many co-benefits come from waste and pollution reduction.

Circular processes and synergies in industrial economy are the first step in promoting a new urban productivity and economic base, that should be "integrated" in tourism and heritage economic development, for producing new plus-values.

In the 'circular' heritage economy, *import* capability (attractiveness for tourists, talents, capitals, people...) and *export* capability (handcrafts products, art, local identity products/knowledge products, innovative services) are going to be integrated in wealth creative processes. Reuse, restoration, regeneration of materials have stimulated these circular processes in building rehabilitation and restoration/preservation. High landscape quality has been considered (and used) as the incubator of new creative activities, as it happens within cultural districts.

Some good practices that introduced elements of circularization into heritage economics have been implemented (for example in Dublin, Liverpool, Hamburg). Some others are more directly related to ECoC (European Capitals of Culture) program [13].

The hybridation processes should be sustained by the social economic system.

Social economic system is characterized by value creation processes that are different from conventional economic ones. It is able

to increase cultural resilience because it produces, in its exchanges, virtuous circular processes: reciprocity, social responsibility and public spirit. In a word, social economy replaces/regenerates the social capital that makes the economy and democracy work. It stimulates circularity processes and also employment and care of eco-systems.

Good practices show that social economic system is both auto-poietic (based on circular processes) as well as hetero poietic, able to sustain other systems. It is structurally characterized by circular and synergistic organization.

In fact, it includes civil society associations, voluntary groups, civic societies and community networks, formal and informal organizations; independent of government and self-governing (eg. housing associations, charities, social enterprises, etc.) whose surpluses are principally reinvested in production of goods and services, to better satisfy needs. It sustains from bottom up heritage and industrial circular economy.

Hybridation processes between these different economic organizations should be proposed in port cities/areas to integrate different development strategies and management approaches (by the city and by the port).

Certainly, hybrid processes are becoming a new leitmotiv in complex, dynamic and uncertain contexts.

Hybrid processes evoke the notion of connections between two (or more) contradictory/heterogeneous entities/organizations/elements, toward the building of a new space able to generate new productivity and values, through mutual new interdependences.

Examples of hybrid processes are in the connection of different model of business: for example between the profit and not-profit sector, between industrial and service sectors, which overcome the existing conflicts and stimulate the production of new economic value.

The proposal here is to hybridate the different economic approaches of the port and the city, and to integrate the industrial circularized system in port cities/areas with the circularized processes of heritage /culture economy, with the support of social economic system .

5. Outcomes of the hybrid proposals

The intrinsic value, the social value and the economic value of the urban cultural landscape will become able to *increase the comprehensive local productivity* and thus the city prosperity in an economic and also multidimensional perspective, from the point of view of the different stakeholders involved. They will benefit because the city (tangible and intangible) wealth will be increased, thus enhancing the people well-being.

Transforming conflicts into opportunities, cultural heritage/landscape regeneration can produce economic attractiveness and also strengthen social awareness and cohesion: thus, it enhances the ***city multidimensional productivity***.

How can we assess this multidimensional productivity?

The production of new knowledge that is useful to be used to contribute to the city decision making processes in the regeneration strategies, that are based on cultural heritage/landscape is strongly required.

The challenge of generating synergies between conservation and transformation issues requires adequate evaluation methods and financial tools, engaging civil society and local stakeholders, capturing both tangible and intangible values.

Ex post evaluations produce empirical evidence on the economic, social and environmental benefits of conservation towards a ***productive city regeneration***.

In particular, the research aims to:

- produce empirical knowledge about the role of cooperation in stimulating new economic value creation chains;
- suggest approaches and tools for urban heritage/landscape regeneration and management (adaptive evaluations, financial tools, etc);
- deduce a set of quantitative/qualitative indicators for comparing different programs/plans/projects;
- discuss new tools, methods, approaches for planning and managing cultural heritage/landscape.

6. New tools for implementing circular processes, symbioses and *hybrid* processes

The above mentioned approach requires specific tools for managing change. In particular, it requires new tools for evaluating different alternatives on the base of their multidimensional impacts: new multidimensional indicators should be able to be identified and tested.

There exists a relationship between the quality of the planning choices and the increase of economic/social/environmental productivity, and thus the increase of well-being of inhabitants.

New specific tools are required, able to transfer a percentage of private benefits (coming from change projects) to public institutions in a circular process. Such tools should involve the private sector to achieve the public interest in a contractual perspective, to implement these paths concretely by means of experimental projects, with new rules and financial economic incentives, for capturing new plus values in an indirect way. Innovative tools to finance new public spaces/infrastructures/services through private resources are currently being introduced in urban planning. Transfer Development Rights (combining private and public interests) has been already considered and implemented as tool s to realize urban parks, landscape conservation, useful also in the transition to the post-fossil-fuel city. Compensation Impact fees, Development Agreement, Cost Recovery, Planning Obligations, Planning Gain, Linkage Fees are other tools which help to achieve, through agreements and contracts, a satisfying compromise between public and private interests, to recover resources for maintenance and new investments of public institution. For example, social houses and social infrastructures are increasingly being financed by means of an 'exchange' between public and private values/benefits. They integrate other self -financing procedures (crow funding, participatory financing, people mecenatism, etc.) and also they integrate the new tools for designing land readjustment for land plus value capture (Tax Increment Financing, Community Infrastructure Levy, Betterment Levy, etc.) for capturing increments created by land use planning and thus creating a source of financial resources for cities.

These are some examples of circular process that reinforces local financial base, requiring economic/financial indicators.

The economic approach can be the main leverage in defending landscape, if soft values (as visual landscape, social and cultural landscape, etc) are converted into monetary values.

The economic approach in evaluation through willingness to pay is able to better communicate values, and in particular the values change coming from different actions on cultural landscape.

The economic indicators should be selected considering these different impacts on the:

- tourism and recreation economy
- creative/cultural economy
- industrial economy
- environmental/ecological economy
- social/civil and sharing economy
- real estate economy

But economic approach, if necessary, it is not sufficient to identify limits to change.

Multi-criteria-multi-group evaluation techniques are a key tool in management of positive and negative impacts to compare, to balance, to compensate different impacts for all involved stakeholders (Public, Private, Financial, Social, Civil …). Economic, social, environmental, cultural, symbolic both quantitative and qualitative, short and medium-long term perspective, impacts are to be assessed and compared to deduce priorities for actions.

7. Integrated Spatial Evaluation Tools

Evaluation processes are fundamental tools in integrated planning for checking feasibility of creative and resilient alternatives. Choices regarding each form of capital require specific evaluation approaches. for example, the social impact evaluation, the environmental impact evaluation, when social and natural landscapes are involved.

For example Heritage Impact Assessment, Landscape Impact Assessment, Visual Impact Assessment, Cultural Impacts Assessment should be reunited into a more general "*spatial integrated evaluation strategy*" to identify limits to acceptable change and to manage smart sustainable changes: to assess landscape value change due to new volumes of malls, tall buildings, new roads to be construed and to evaluate, through specific indicators, the “absorption capacity” of a specific urban landscape.

The regeneration of the landscape produces many monetary and not monetary impacts in the surrounding areas that should be assessed through a multidimensional approach. Strategic Environmental Impact Assessment, Economic Impact Assessment, Heritage Impact Assessment, Landscape Impact Assessment, Health Impact Assessment, Social Impact Assessment are examples of evaluation tools.

Innovative urban alternatives are characterized by high uncertainty, costs and risks. Lack of knowledge is the common element in all creative choices/actions that have impacts in the future. Therefore, they require experimental, testing approaches and simulations, in order to learn from their successes or failures and about the specific characteristics of the dynamic urban system in supporting uncertain and/or irreversible effects. Evaluations may suggest how to improve experiences: whether to transfer them into ordinary practices or totally change them.

Evaluation processes help to make decisions on ‘what’, ‘where’, and ‘with whom’ in order to implement creative synergic initiatives in the eco-industrial system, between it and the city, between them and the territory, between physical assets and people, between heritage, talents, creative entrepreneurs, and to convince different actors about their mutual/respective convenience. Evaluation is a fundamental tool for selecting and prioritizing alternative/choices in urban planning and design, verifying the comprehensive feasibility of the economic, environmental, social convenience of synergies and circular processes for all stakeholders, agents and inhabitants. Specific impacts link public investments and land values. They are to be evaluated in their quantitative, qualitative, direct, indirect and induced impacts, in the short, medium and long term, beyond any bureaucratic or strictly

economic approach. They have to be integrated into the assessment process, that does not only help to compare 'given' and defined alternatives but it also stimulates the identification and exploration of new alternative solutions. So, the evaluation process can become the engine of city planning and design, toward a new green, knowledge and social -led economic base. At the same time, evaluations by all actors should be stimulated on the urban scene to understand the ex-ante and ex-post comprehensive impacts of actions, projects or plans. Evaluation is not only the expression of expert knowledge but also of interpretation by the all people (as tested in Participatory Development Assessment). Integrated planning requires critical evaluations in order to participate in public Forums, Laboratories, or other public Arenas.

8. Participative Evaluation Tools

Urban planning is becoming the entry point to stimulate urban evaluation processes, characterized by participation of people/inhabitants.

Evaluations should be open to dialogue, discussion, debate between many different stakeholders. An iterative decision-making process is activated through continuous feedback and improvements in the level of the achievement of objectives, clarifying with inhabitants and actors undesired impacts, unintended consequences, learning constantly from experiences and reshaping the proposals.

Integrated assessment of all plan impacts, through specific indicators, should be strongly strengthened for identifying the ranking of various alternatives with different levels of change on city landscape, that determine different level of attractiveness.

Many *Living Lab* processes are enriching urban planning. Living Lab is a tool for promoting innovations. Through reciprocal learning, different actors are put in a new condition for identifying better solutions to react to socio-economic needs. New produced knowledge is used to create new activities.

Living Labs offer a real prospect for combining technical evaluations, proposed by expert knowledge, with participant

evaluations, drawn from common knowledge, in order to carry out a community co-design of transformation of landscape.

Living Labs try to identify explicit and implicit needs of different social groups, and then to focus use-values, independent of the use values, symbolic values, which are interpreted by the stakeholders through interactive and iterative processes.

With Living Labs, the construction/reconstruction/management of landscape and different "landscapes" is traced to reference community, with its own specific values, needs and interests, through a progressive exercise of critical insight.

In these workshops, we move from data collection to production of information, from this to production of knowledge and in particular to critical knowledge. It also seeks to broaden the horizon, moving from a short-term perspective to pay attention also to long term perspective, which is essential requirement for the development of original proposals. They can become laboratories for deducing the intrinsic and social value of the cultural landscape: that is its complex social value [7]. And also laboratories of self-government and self-management, in which each participant should be transformed into an "artist of citizenship" [9], able to evaluate and combine/integrate creatively particular interests and general interests: utility, fairness and beauty. Living Lab should be able to transform natural/ecological values or artistic/cultural values in social/civil values: of mutual trust, co-existence, legality. These are essential resources for economic development.

But above all, Living Labs are an effective way to develop not only creative and strong ideas and actions about desirable urban future, but also to deduce the real needs and objectives of each actors (and social groups). This knowledge about needs and objectives is critical for deducing the variation of well-being for different actor, consequent to each transformation project of the urban landscape.

Clearly, it is here assumed that an economic approach is absolutely necessary, but it is not sufficient to identify the limits to manage change. It needs, therefore, *"hybrid evaluation methods"* in which the quantitative **economic matrix** is enriched with qualitative indicators, expressed by social components **(social matrix)**, and environmental

components **(bio-ecological matrix)**, to which the need for development of operational tools at local level is linked. Multi-criteria and multi-group evaluations are key hybrid tools [8] for the management and the comparison of the positive and negative effects to balance and compensate for the different impacts for all stakeholders (public, private, financial, social and civil).

Thus, the cultural heritage/landscape approach necessarily requires an *adaptation of evaluation tools* to improve decision-making processes related to planning/managing changes.

9. Some Concluding considerations

In the UNESCO *Recommendation on the Historic Urban Landscape* [4] (and in the more recent EC Document, "Getting Cultural Heritage to work for Europe" [14]) it is clear the need to implement the proposed approaches and to find proper tools to make them really operational.

Through tools, it is possible to pass from general principles to operational practices.

The objective here is to operationalize the HUL approach to port cities, first of all through evaluation tools.

Without tools the risks in implementing the hybrid processes stimulated by HUL are very high.

Regenerative city model certainly refers to economic, environmental and social dimension.

A new matrix as the one proposed in the Community Impact Statement proposed by Nathaniel Lichfield [15] can be identified as a new tool for comparing in a multidimensional space different alternatives of urban landscape regeneration, considering both the quantitative economic net benefits and both the changes in the well-being of people.

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Housing Policies and Urban Economics Vol.3 / 2015, pp. 23 - 44

Il Patrimonio Culturale come Motore per lo Sviluppo Economico

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Sunto: Il presente articolo prende spunto dall'oggetto della 17ª Assemblea Generale dell'ICOMOS, il "Patrimonio come Motore di Sviluppo", con l'obiettivo di valutare in quale misura il patrimonio culturale, da componente passivo ed estetico, possa cominciare ad agire come un più attivo e determinante fattore di sviluppo culturale, sociale ed economico. Lo studio di best practices, condotte dalla Banca Mondiale, ha fornito evidenza empirica all'ipotesi su esposta e ha permesso di proporre una strategia di sviluppo per il Comune di Pollica, nel Cilento.

Parole Chiave: patrimonio culturale, sviluppo economico, rigenerazione urbana, identità marittima, città portuali.

Abstract: The present article is based on the argument of 17th General Meeting of the ICOMOS, the "Patrimony as Motor of Development", with the objective to appraise in which way the cultural patrimony, from passive and aesthetical component, can start to act as a more and determinant factor of cultural, social and economic development. The study of best practices, conducted by the World Bank, has furnished empirical evidence to this principle and it has allowed to propose a strategy of development for the Municipality of Pollica, in Cilento.

Keywords: cultural heritage, economic development, urban regeneration, maritime identity, port city.

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1. Introduzione

I Paesi che si stanno maggiormente distinguendo a livello mondiale sono il Canada, l'Australia, la Nuova Zelanda e il Regno Unito. Nelle loro ricerche emerge sempre più la necessità di individuare "nuove metriche", cioè il bisogno di individuare un metro di misura che riesca a valutare il patrimonio racchiudendo in maniera quanto più esaustiva la complessità dei suoi valori. Il problema che emerge nella valutazione è quello di definire degli indicatori e stabilire in che termini e fino a che punto essi esprimono aspetti tangibili e intangibili, se riguardano cioè la sfera economica, quella sociale, o quella ambientale (che si traduce in benessere e qualità della vita).

La valorizzazione del patrimonio culturale è una questione economica, sociale, culturale e ambientale e livello di benessere è un fattore determinante per una maggiore o minore predisposizione delle persone a recepire l'importanza del patrimonio culturale e, conseguentemente, l'urgenza della sua conservazione e valorizzazione. Dunque il patrimonio va considerato come insieme di valori [4].

L'idea del valore sociale complesso, come combinazione del valore economico del territorio (VET) in termini "monetari" e del suo "valore intrinseco" (I) in termini non monetari (ordinali e/o cardinali), è di comprendere la connessione e l'interdipendenza tra impatti economici, sociali, culturali e ambientali. La comunicazione della Commissione Europea del 22 Luglio, ripropone il patrimonio come valore "intrinseco". Nel trasformare l'aggettivo "inerente", finora in uso, in "intrinseco", essa riflette lo sforzo, che si è registrato recentemente in economia, di trasformare tale valore (la bellezza di un monumento, di un parco, di un paesaggio naturale, di un ecosistema, ecc.) in un valore d'uso, "misurato"/espresso dal numero dei fruitori, dal tasso di intensità di fruizione e dalla spesa sostenuta nella fruizione. L'intenzione di voler dare anche un valore economico ad una risorsa che di per sé non lo ha, ha lo scopo di rafforzare il valore originario della risorsa stessa, ottenendo il doppio vantaggio di renderlo comunicabile a tutti e "operativo", cioè incorporato nelle decisioni [7]. Dunque, per raggiungere l'obiettivo della conservazione, il valore economico, viene

associato a quello ambientale/culturale/artistico, in quanto il suo linguaggio è comunicabile molto più di quello morale dell'obbligazione.

Nell'ambito di un approccio valutativo "integrato" [5], il valore è necessariamente multidimensionale perché connesso ad un concetto di utilità che risulta anch'esso ampliato, in quanto non riguarda più solo i fruitori diretti ma anche il soddisfacimento contemporaneo di altri bisogni dell'uomo attraverso l'erogazione di flussi di servizi [1]. In questa prospettiva di valutazione così ricca, che include aspetti quantitativi e qualitativi, è necessario che le informazioni che si ottengono come risultato finale siano esprimibili attraverso una scala univoca, che abbia il più alto contenuto informativo. I dati di tipo economico sono i soli a rendere operativo l'approccio valutativo in quanto gli indicatori che misurano i benefici culturali e quelli non commerciabili non possono costituire da soli una base solida per giustificare e valutare positivamente un intervento sul patrimonio. Il problema valutativo, allora, diventa quello di riuscire ad unificare col linguaggio dei numeri tutti i risultati delle analisi. Le analisi multicriterio, riconoscendo l'esistenza anche di dimensioni extraeconomiche, diventano lo strumento con cui si riescono a tenere insieme questi due aspetti offrendo confronti multidimensionali tra diverse alternative in presenza di criteri molteplici ed eterogenei.

2. Cornice metodologica: i casi studio

Lo studio è stato condotto analizzando interventi di valorizzazione del patrimonio culturale in sette città (Skopje, Tbilisi, Copàn, Quartiere Hafsia di Tunisi [8], Armenia [14], Medina di Fès, Zanzibar [15]). Da ciascun caso studio sono stati estrapolati indicatori esplicativi degli impatti positivi di tali interventi in termini economici ed extraeconomici.

Le valutazioni svolte nelle città di Skopje e Tbilisi [9] sono le uniche in cui valutazioni di tipo economico sono state affiancate da valutazioni di tipo sociale, basate sul livello di gradimento degli utenti.

Di seguito, a titolo dimostrativo dello studio svolto per ogni caso studio, si riportano a confronto i costi dell'investimento nella città di

Tbilisi, in Georgia, (Tabella 1) e i benefici (Tabella 2), espressi sia in termini monetari che in termini extraeconomici.

COSTI Costs
US$ 4,49 milioni: credito approvato il 29 Gennaio 1998, dalla Banca Mondiale per il Progetto per il Patrimonio Culturale del Governo della Georgia col nome di Learning and Innovation Loan (LIL). **US$ 1,9 milioni**: l'investimento della Banca Mondiale per quattro siti pilota, uno dei quali è stato la vecchia città di Tbilisi, approvato nel Marzo del 2002. • **Componenti dell' Investimento** - **US$ 1,3 milioni**: Programma Nazionale di Riabilitazione che ha fornito US$ 75,000 nel finanziamento di sottoprogetti attraverso un meccanismo competitivo. - **Neighborhood Fund**: sono stati forniti **US$ 1,500** per miglioramenti esterni per abitazioni unifamiliari e **US$ 4,500** per abitazioni multifamiliari. • **Componente di Assistenza Tecnica** - **US$10 milioni**: fondi idretti dal gabinetto del Presidente degli Stati Uniti dedicati alla riabilitazione dell'infrastruttura della vecchia città di Tbilisi. - **US$ 898,948**: l'importo dell'investimento della Banca Mondiale a Zemo Kala. - **US$ 86,223**: l'importo per il piccolo programma di riparazione.

Tabella 1. Costi del caso studio di Tbilisi

Economici	**1998 - 2002**	**2010**
Incremento del numero medio di visitatori giornalieri per i negozi (n°)	60	83.4
Incremento della spesa media giornaliera dei visitatori nei negozi di Zemo Kala (GEL)	95	132
Numero medio di visitatori al giorno nei ristoranti (n°)	75.6	
Spesa media giornaliera di visitatori ai ristoranti a Zemo Kala (GEL)	96	
Numero medio di occupazione nelle attività economiche: - Hotel - Ristoranti - Negozi	11.0 11.1 4.8	
Salario mensile per i ristoranti (GEL): - Amministratori/manager - Personale di servizio	460 300	
Salario mensile per i negozi (GEL): - Amministratori/manager - Personale di servizio	300 250	
Incremento dei prezzi immobiliari (€/mq)	700	1100
Piani di Espansione Economica (incremento nel numero del personale di servizio, acquisto o fitto di spazi aggiuntivi, o apertura di nuove attività)	Il 44% dei ristoranti a Zemo Kala ha indicato di volersi espandere, principalmente incrementando il personale; il 17% dei negozi prevede un'espansione.	

Incremento nelle tendenze nei valori di mercato a Zemo Kala (valore medio per metro quadro (USD)):	**1998-2000**	**2003-2005**	**2008 - 2010**
	604	1024	1624
Incremento del numero di visitatori	**2007**	**2008**	**2009**

adulti nei musei di Kala	36.851	38.420	34.557
Durata media di permanenza (minuti)	90 (min.: 10 – max.: 150)		
Spesa media giornaliera (GEL)	80 (50 dei quali per il cibo)		
Concordare con l'affermazione "investire nel miglioramento di Kala è un dispendio di denaro"	0		
Culturali	**Percezione dei Benefici Culturali dai Visitatori a Zemo Kala (%)**		
Atteggiamento positivo verso le caratteristiche del patrimonio del Vecchio Bazar:			
- Kala è una parte importante della cultura della Georgia	77.8		
- Valore identitario/simbolico ("Kala mi dà un senso dell'identità culturale della Georgia")	88.5		
- Valore educativo ("Essendo qui ho imparato qualcosa sul mio patrimonio culturale")	55.6		
- Kala dovrebbe essere demolito e sostituito con edifici moderni	8.3		
Sociali			
- Valore sociale ("Kala è un posto che aiuta le persone ad incontrarsi")	97.2		
- Restaurare Kala migliora Tbilisi come posto da visitare o in cui vivere	91.7		
Percezioni dei residenti del cambiamento nelle loro condizioni abitative nel 2010 confrontate con il 1998			

- Migliorate - Uguali - Peggiorate	42 16
Visivi/Estetici	
Valore visivo/estetico ("Gli edifici restaurati di Kala sono belli")	86.1
Benefici non monetizzabili	
Disponibilità a contribuire ad ulteriori lavori di restauro nell'area (%)	92

Tabella 2. Benefici del caso studio di Tbilisi

Dall'analisi degli altri casi studio è emersa una forte attenzione dei progetti di intervento sul patrimonio ad aspetti legati al turismo e allo sviluppo urbano, che si è concretizzata nella creazione di nuove infrastrutture e di nuovi servizi, in aggiunta al miglioramento di quelli esistenti. In questi casi gli indicatori sono specificamente economici (VAN e TIR) e conferiscono allo studio solidità nei contenuti e nella forma, che per gli stakeholder e per gli utenti si traduce in uno strumento di controllo sufficientemente attendibile. Nel report relativo al progetto di valorizzazione del patrimonio culturale della Valle di Copàn, in Honduras [6], sono stati proposti diversi scenari di sviluppo in base al variare dei fattori economici presi in considerazione in precedenza, rafforzando lo studio valutativo nella sua dimostrabilità e rendendolo più trasparente e accettabile per gli interessati.

E' importante sottolineare che l'intervento nella Medina di Fès [12] è stato l'unico a presentare particolare attenzione all'aspetto ambientale: il progetto si è orientato su quattro "componenti" di cui la terza componente si è occupata del miglioramento dell'ambiente (raccolta, trasferimento e smaltimento finale dei rifiuti domestici; creazione di due impianti per raggruppare attività artigianali mediamente inquinanti all'interno della Medina).

La logica che ha accomunato tutti i casi studio è stata quella di favorire la valorizzazione del patrimonio culturale, in modo che la sua rivalutazione partisse dai cittadini stessi, rendendoli promotori attivi delle loro risorse, per poi estendersi all'utenza turistica [11].

La valutazione del valore culturale attraverso la sua disaggregazione in altri tipi di valore più specifici, ha permesso di stabilire una graduatoria di valori, traducibile in una graduatoria di bisogni, e quindi in una priorità dell'urgenza con cui sono state intraprese certe azioni piuttosto che altre. Essi hanno dimostrato che quanto più le valutazioni riescono a perseguire contemporaneamente le diverse componenti che rendono la realtà così eterogenea, tanto più ci può essere un aumento di benessere condiviso socialmente e quindi anche culturalmente.

3. Le città portuali

Le città portuali ed in particolare l'interfaccia porto-città mostrano molte delle sfide che oggi il sistema urbano deve affrontare sotto la spinta dei rapidi cambiamenti globali. Se da una parte le attività commerciali marittime e logistiche sono spesso alla base di problemi di carattere sociale, economico e ambientale, dall'altra le potenzialità offerte dal porto in termini di innovazione sostenibile, se opportunamente sfruttate, possono diventare volano di sviluppo per l'intero sistema urbano.

3.1 Introduzione

Nella storia, le città portuali hanno sempre svolto un ruolo centrale sia come poli di ricchezza economica, sia come luoghi di cultura e benessere, grazie anche alla loro particolare capacità attrattiva nei confronti di merci e persone.

Le potenzialità sotto il profilo culturale, economico, paesaggistico delle città portuali ne fanno un campo privilegiato di ricerca per riflettere sul futuro della società e per individuare soluzioni creative di rigenerazione urbana [2]. Le aree portuali, come dimostrato da molti casi di successo, svolgono un ruolo trainante per lo sviluppo economico. Inoltre, l'adozione da parte di molte città portuali di strategie innovative basate sull'economia ecologica ha consentito di minimizzare gli impatti ambientali delle trasformazioni, riducendo la vulnerabilità derivante dalle calamità naturali (inondazioni, erosione costiera, ecc.) e dalla

crescente sovrapposizione di attività che si svolgono lungo i litorali. L'obiettivo dell'efficienza ecologica è però condizione necessaria ma non sufficiente per uno sviluppo urbano sostenibile che necessita di una strategia integrata basata anche sull'economica civile e sull'economia della conoscenza e del patrimonio culturale. Le sfide del cambiamento che i sistemi urbani devono affrontare pongono problemi complessi e interconnessi i quali, per essere risolti, richiedono un approccio sinergico fondato sui concetti di relazionalità e di comportamento emergente [13].

3.2 La struttura metodologica della proposta: una prospettiva multidimensionale

Questo articolo focalizza l'attenzione sull'intervento nell'area portuale di Acciaroli, frazione del Comune di Pollica, per analizzare come esso possa avere un ruolo nel processo di rigenerazione del contesto urbano. L'obiettivo generale della proposta è quello di definire metodologie e strategie innovative per valorizzare l'identità marittima nel rispetto del principio della sostenibilità. Esso si attua attraverso l'elaborazione di una strategia di sviluppo integrata e multidimensionale, basata sullo sfruttamento delle potenzialità attualmente presenti nel territorio e sulla formulazione di una previsione plausibile dei conseguenti benefici economici (confermati dall'evidenza empirica di dati numerici) ma anche culturali, sociali e ambientali.

Il processo valutativo, finalizzato all'identificazione delle strategie di valorizzazione più efficaci per il caso specifico del porto di Acciaroli, può essere suddiviso in tre fasi fondamentali:

1. individuazione delle criticità,
2. identificazione degli spazi che, attraverso il cambiamento della loro destinazione d'uso o con il potenziamento di quella esistente, diventano attrattori urbani,
3. proposta di sviluppo, la cui validità è supportata da uno studio di fattibilità economica.

Le linee guida del progetto possono essere così sintetizzate:

- realizzazione di spazi multifunzionali;
- importanza della funzione ricreativa e turistica;
- ricerca di un'integrazione tra la valorizzazione turistica e il miglioramento della vita urbana;
- attenzione alla dimensione ambientale e potenziamento della rete ecologica;
- eliminazione della separazione porto/città e ricerca di integrazione funzionale;
- recupero dell'identità marittima.

In quest'ottica il porto diventa il nodo "cerniera" in cui si incontrano le linee di forza del territorio (l'una diretta dall'entroterra alla costa e l'altra nel senso opposto) (Fig.1), e assume il ruolo di motore dello sviluppo di un territorio che si estende anche oltre il solo ambito comunale.

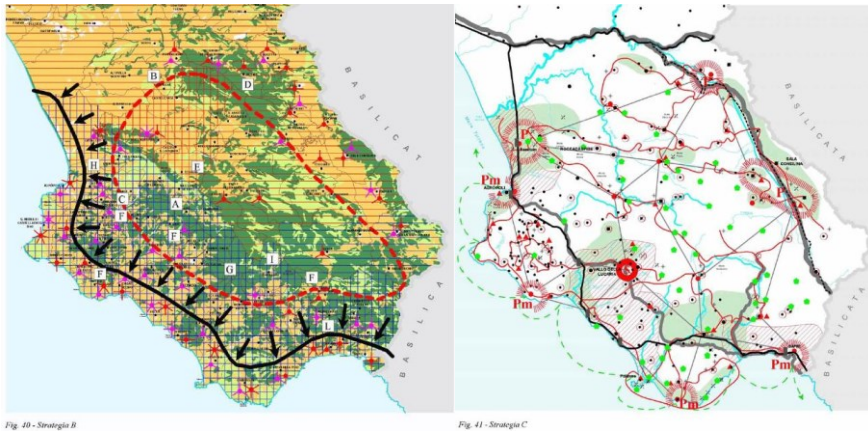


Fig. 1. Stralcio del Piano del Parco Nazionale del Cilento e Vallo di Diano

Il progetto si è basato su due assi indicati nel Piano del Parco Nazionale del Cilento e Vallo di Diano. Il primo asse si concentra sullo sviluppo endogeno e la riduzione degli squilibri interni delle attività produttive, economiche e sociali atte a favorirlo, con incentivi alla qualificazione ed all'innovazione delle pratiche e delle tecniche colturali, sulla riconversione delle attività insostenibili, sul ri-orientamento dell'industria edilizia e delle attività artigianali verso il recupero del

patrimonio esistente, sul rafforzamento delle capacità auto-organizzative dei sistemi locali, integrati in modo da resistere alla crescita della forbice tra sviluppo della costa e del fondovalle da una parte e abbandono dell'entroterra interno dall'altro.

Il secondo asse si basa sullo sviluppo del turismo sostenibile e di forme appropriate di fruizione sociale (ricreativa, culturale, didattica ed educativa) del Parco e delle sue risorse, con politiche ed interventi volti ad incentivare una equilibrata diffusione dei flussi di visitatori, a migliorare i rapporti tra turismo costiero-nautico e turismo interno, ad incrementare e qualificare l'ospitalità e la ricettività diffusa, a stimolare una miglior conoscenza ed una più adeguata utilizzazione delle risorse naturali e culturali, anche mediante lo sviluppo delle attività "interpretative", formative e di comunicazione sociale a livello internazionale.

3.3 Premessa

Sulla base delle linee guida presenti nel Piano del Parco Nazionale del Cilento e Vallo di Diano, il Comune di Pollica ha approvato lo Studio di Fattibilità dei lavori di completamento e ammodernamento del Porto di Acciaroli, per il complessivo importo di €.6.995.000,00. Nell'ambito del POR CAMPANIA, la Giunta Regionale ha approvato l'intervento "Riqualificazione e potenziamento del Porto di Acciaroli per un costo totale di € 4.625.000,00.

In attuazione del progetto denominato "Riqualificazione e Potenziamento del Porto di Acciaroli" il Comune di Pollica ha realizzato 15 locali commerciali localizzati nel molo di sopraflutto del porto di Acciaroli. Tale iniziativa si innesta in un più ampio progetto di riqualificazione dell'area portuale e dell'intero borgo marinaro, in avanzata fase di completamento, volto a raggiungere più elevati livelli di competitività in termini di attrattività turistica, qualità ambientale e valorizzazione delle risorse naturali e antropiche. Il nuovo nodo portuale sarebbe, dunque, non solo motore di sviluppo economico, ma un vero e proprio brand in cui il patrimonio culturale e naturale acquisiscono nuova luce, ravvivandosi a vicenda.

3.3.1 Individuazione delle criticità

La creazione dei locali nel molo di sopraflutto ha rispecchiato la volontà dell'amministrazione di favorire la qualificazione dell'offerta turistica per il diporto e la promozione e la valorizzazione delle tipicità agricole e artigianali del territorio dell'area del Parco Nazionale del Cilento e Vallo di Diano.

Dei 36 locali presenti nel molo, l'amministrazione comunale ne è concessionaria di 15 per uso commerciale. Purtroppo ad oggi la destinazione d'uso commerciale non sembra la più consona, in quanto, sul totale, solo 8 locali sono stati fittati. Oggi questa infrastruttura si presenta senza anima, con un potenziale altissimo ma completamente inutilizzato (Fig.2).

Fig. 2. Locali nel molo di sopraflutto

Altra criticità è l'uso dell'isolotto presente nella darsena interna come spazio "appendice" della passeggiata. La sua collocazione rende questo spazio potenzialmente adatto a diventare un attrattore che caratterizzi il porto in maniera univoca (Fig.3).

Fig. 3. Isolotto nella darsena interna

Nell'area di intervento ci sono quattro parcheggi di modeste dimensioni (Fig.4). Questa frammentazione fa sì che ci sia un'infiltrazione del traffico veicolare anche laddove sarebbe opportuno creare un'area pedonale. Inoltre, non essendo collegati tra loro da un servizio di trasporti comunale, non risultano immediatamente raggiungibili dai diportisti.

Fig. 4. Parcheggi esistenti

Dei quattro parcheggi presenti si conserverebbe solo quello più interno, ampliandolo con la trasformazione dell'area verde adiacente. In questo modo, da 21 stalli esistenti, se ne otterrebbero altri 52 con l'ulteriore vantaggio di averli tutti localizzati in un unico parcheggio. Questa scelta è strettamente collegata e funzionale ad un altro tipo di riflessione che riguarda l'accessibilità a quest'area. Infatti, attualmente, l'area manca di un servizio di mobilità comunale che sia utile soprattutto per i diportisti. La localizzazione di questo parcheggio unico si inserisce, dunque, in una proposta che coinvolge complessivamente tutta l'area in esame e che prevede la creazione di un'unica area pedonale a cui si accede tramite un servizio di navette ecologiche. In questo modo si può pensare anche di riammagliare nell'area la spiaggia del molo sottoflutto, che ad oggi risulta estromessa dalle dinamiche dell'area portuale e di creare, nel piazzale che fa da cerniera tra la passeggiata verde e il molo sottoflutto, anche un bike sharing.

	N° Stalli	Totale Giornaliero	Totale Mensile	Annuo (10 Mesi)	Valore Abbattuto
5 €	73	365 €	10950	109500	65700

3.3.2 Identificazione degli spazi/attrattori urbani

La proposta formulata, che prevede la collocazione di un polo agroalimentare di eccellenza, parte dalla considerazione che l'attrattività di questo porto ha bisogno di essere estesa ad un arco temporale più ampio rispetto a quello attuale, limitato ai mesi estivi e rivolto ad un turismo prevalentemente balneare. La ricchezza del territorio in termini di capitale naturale e capitale culturale è un aspetto da prendere fortemente in considerazione per assicurare un'attrattività a lungo termine. Il sintomo che questa strategia di sviluppo sia vincente è confermato dal fatto che l'entroterra cilentano riesce a mantenere una vitalità continua, seppur debole, durante l'anno, proprio grazie a questo fattore. Il turismo culturale che popola l'entroterra rispecchia un tipo di utenza che riconosce il valore del territorio in sé, anche se questo non è veicolato da nessun altro tipo di attrattore.

Ciò che manca, dunque, non è tanto l'offerta del territorio, ma piuttosto una sua canalizzazione e circolarizzazione in un quadro più ampio in cui le differenze morfologiche (entroterra montuoso e fascia costiera) non implicano la separazione tra le due forme di turismo. La creazione del polo agroalimentare di eccellenza mira a risolvere questo problema ponendosi come nodo cerniera in cui si congiungono questi due aspetti e si concretizzano in un'offerta più completa che, oltre a soddisfare un'utenza più vasta, promuova le risorse del territorio in un ottica di sviluppo sostenibile. L'offerta che si viene a creare in questo modo riuscirebbe a produrre un'attrattività più durevole nel tempo e quindi un maggiore indotto economico.
Investire nel settore del turismo e dell'artigianato, tradizionale e tipico, mediante la riscoperta e la valorizzazione delle botteghe storiche, degli antichi mestieri, delle produzioni artistiche, nonché delle produzioni tipiche legate alle conoscenze e ai saperi del territorio, ha l'obiettivo di:
- incrementare l'attività economica e i tassi di occupazione;
- consolidare ed ampliare il tessuto imprenditoriale locale;
- creare un supporto allo sviluppo del territorio mediante l'incentivazione a microimprese operanti nel campo dei servizi al turismo e nello specifico nel campo dei servizi al diporto.
I valori di fitto (Tabella 3) sono stati calcolati sulla base della tabella presente nel bando attuale, confrontandoli anche con i valori indicati dall'OMI (Osservatorio del Mercato Immobiliare), ipotizzando una durata di locazione di sei anni.

N°	Immobile	Superficie m2	Fitto mensile
1	Servizi igienici	11	€ 180
2	Locale commerciale per la vendita del presìdio Slow Food "Fico Bianco del Cilento"	31,5	€ 500
3	Locale commerciale per la vendita del presìdio Slow Food "Formaggio Caprino"	20,63	€ 335
4	Percorso degustazione	61	€ 990
5	Bar/Ristorante	76,73	€ 1240
6	Locale commerciale per la vendita del presìdio Slow Food "Miele"	31,5	€ 500

7	Locale commerciale per la vendita del presìdio Slow Food "Olio"	20,63	€ 335
8	Locale commerciale per la vendita del presìdio Slow Food "Alici di Menaica"	31,5	€ 500
9	Locale commerciale per la vendita del presìdio Slow Food "Ceci di Cicerale" e "Fagioli di Controne"	31,5	€ 500
10	Servizi igienici	11	€ 180
11	Percorso degustazione	61	€ 990
12	Bar/Ristorante	76,73	€ 1240
13	Lavorazione e vendita del pescato giornaliero	15,75	€ 245
14	Lavorazione e vendita del pescato giornaliero	15,75	€ 245
15	Lavorazione e vendita del pescato giornaliero	15,75	€ 245
16	Lavorazione e vendita del pescato giornaliero	15,75	€ 245
17	Lavorazione e vendita del pescato giornaliero	15,75	€ 245

Tabella 3. Valori di fitto previsti per i locali nel molo di sopraflutto

Per quanto riguarda la riconversione funzionale e visiva dell'isolotto, la proposta prevede l'installazione di tre alberi a vento (Fig.5). Questa soluzione rappresenterebbe un'espressione creativa che contempera l'aspetto estetico con quello energetico, nonché un forte segnale di promozione di uno sviluppo sostenibile grazie alla rigenerazione energetica. Dai tre alberi si otterrebbe una produzione di energia da riutilizzare per alimentare il fabbisogno in luce di tutta l'area o da rivendere ai natanti. In questo modo gli alberi diventerebbero fonti di produzione di ricchezza capaci di contribuire al raggiungimento dell'autosufficienza energetica.

Fig. 5. Render di progetto: installazione di tre alberi a vento sull'isolotto nella darsena interna

In linea con l'obiettivo di sviluppo sostenibile si prevede anche una sostituzione dell'illuminazione pubblica nel lungomare e nella passeggiata verde con illuminazione a led ad efficientamento energetico (Fig.6).

Fig. 6. Illuminazione attuale

Fig. 7. Illuminazione di progetto (fotoinserimento)

3.3.3 Studio di fattibilità economica: Piano di Copertura Finanziario

1. Infrastruttura

IMPIEGHI		FONTI	
Totale Investimento	€ 25.000.000,00	Mutuo	€ 20.000.000,00
		Equity	€ 5.000.000,00

2. Mutuo

Importo	€20.000.000,00
Interesse	0,07
Anni	15
Mensilità	180
Interesse mensile	0,005833333
Denominatore	0,648993086
Rata mensile	€ 179.765,65
Rimborso totale	€ 32.357.817,75
Totale interessi	€ 12.357.817,75

3. Parcheggi

PARCHEGGI ESISTENTI	PARCHEGGIO DI PROGETTO
Area 334.3511: mq	Area 1313.0570: mq
Posti auto: 21	Posti auto: 52
Tariffa applicata: 4.00 € intera giornata	Tariffa applicata: 5.00 € intera giornata

4. Centro di Economia Solidale e Sociale

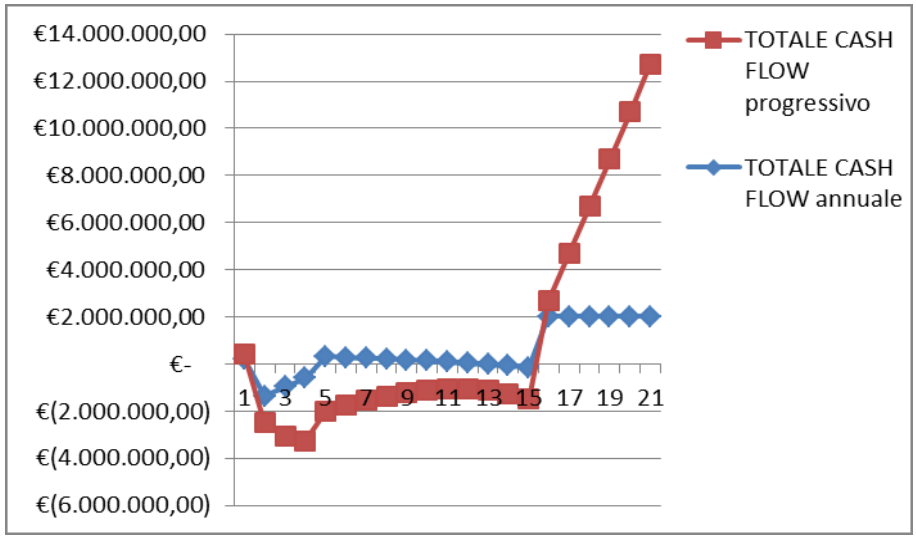
CENTRO DI ECONOMIA SOLIDALE E SOCIALE	
Area lorda	328,44 mq
Area netta	230 mq
n° piani	2
n° di locali per piano	6
Fitto mensile a locale	300 €
Fitto mensile totale	3600 €
N° locali piano terra	2
Fitto locali piano terra coffe break	800
Fitto locali piano terra punto ristoro	800
Fitto totale mensile	5200
Fitto annuo	62400 €

5. Ormeggi porto

	N° ormeggi	Tariffa giornaliera media	Tariffa complessiva
Ormeggi su sede fissa	350	€50,00	€ 6.387.500,00
Ormeggi su sede mobile	100	€40,00	€ 730.000,00

3.3.4 3.2.4.2 Conto economico di previsione

1. Cash flow



2. Energia: Bilancio Economico

ENERGIA – BILANCIO ECONOMICO	
COSTO TOTALE	€ 360.000
Alberi a vento	€ 150.000
Pensiline	€ 100.000
Illuminazione a led	€ 110.000
COSTI DI GESTIONE CALCOLATA A BASE ANNUA	
Operai	-€ 25.000
Materiali	-€ 15.000
Costo totale di gestione	-€40.000
Costo attuale di energia a carico del Comune € 90.000	
Il costo previsto di energia a carico del concessionario è pari a 0	
RICAVO PREVISTO DAL GESTORE	€ 50.000

4. Conclusioni

Le città portuali non sono solo motori di sviluppo economico, ma rappresentano luoghi dove il patrimonio culturale e naturale acquisisce particolare importanza [3]. Le aree portuali spesso costituiscono per le città gli ambiti dove si concentrano le maggiori opportunità per uno sviluppo sostenibile dell'intero sistema urbano, offrendo un ricco patrimonio architettonico, artistico, sociale, economico, ecc., con una grande potenziale per "costruire futuro". Al fine di valorizzare tale potenziale, risulta fondamentale la predisposizione di sistemi di intervento capaci di interpretare le relazioni che si istaurano tra conservazione e sviluppo, collegando le opportunità fornite dalle aree portuali tradizionali con la riqualificazione urbana creativa e sostenibile. Da questa prospettiva nasce la duplice esigenza da una parte di conservare un capitale manufatto/culturale/naturale al quale si riconosce un valore sociale complesso, dall'altra l'esigenza di integrare tale patrimonio in una "moderna creatività", garantendo in tal modo la continuità culturale tra memoria e futuro.

Le risorse culturali e naturali possono contribuire allo sviluppo economico della città svolgendo una importante funzione in relazione all'attrattività e al miglioramento della qualità di un contesto [10]; investire su di esse è l'unico modo per poter fare in modo che, in un bilancio costi-benefici, questi ultimi siano superiori delle spese sostenute. Al contempo, il patrimonio culturale/naturale ha bisogno, per la sua conservazione, che i valori intangibili siano rafforzati da una produttività economica. Perché l'economia diventi strumento di conservazione, è necessario che siano attuati processi di valutazione integrata.

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Housing Policies and Urban Economics Vol.3 / 2015, pp. 45 - 61

ENERGY, ENVIRONMENT AND SAFETY: technological retrofit of training buildings

Rossella Franchino [1] Antonella Violano [2]

Sunto. La rigenerazione sociale e culturale di una città prende il via dai suoi luoghi per la formazione. Il contributo affronta il tema della riqualificazione tecnologica del patrimonio edilizio scolastico, condotto con approccio progettuale integrato, condotto nell'ambito del progetto di ricerca: "Linee guida per la riqualificazione energetica e funzionale dell'edilizia scolastica in area mediterranea", finanziato dalla Regione Campania in attuazione del programma di interventi in materia di ricerca scientifica ai sensi della L.R. n.5/02. La sperimentazione progettuale è applicata al caso studio della scuola elementare "G. Marconi" di Roccadaspide (SA).

Parole Chiave: rigenerazione ambientale, audit energetico-ambientale, prestazioni energetiche, retrofit

Abstract. Social and cultural regeneration of a city begins in its training facility. The contribution addresses the issue of technological retrofit of the school buildings, conducted with integrated design approach, as part of the research project: "Guidelines for energy and functional rehabilitation of school buildings in the Mediterranean area", financed by the Region of Campania in order to implement the program of action in the field of scientific research pursuant to R. L. n. 5/02. The experimental design is applied to the case study of primary school "G. Marconi" in Roccadaspide (SA).

Keyword: Environmental regeneration, energy-environmental audit, energy performance, retrofit

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1. Introduction (by A Violano)

"*Europe needs cities where life is good*" (Leipzig Charter, 2007) and this is possible only if the action project works contemporary on the construction/rehabilitation of the physical spaces (material action) and the qualification of behaviours and sensitivities (immaterial action). True sustainable development is where is possible to have the combination and integration of these two different but complementary types of actions. Directive 2012/27 / EC decrees that the public administrations should be an example for the entire community just like model of efficiency and saving, demonstrating a virtuous energy and environmental management, according to the best practices of the emerging urban challenges, which require competitiveness, efficiency and qualified services for cities.

The training places are a significant example in which the action of physical renewal is always associated with an educational action enlarged not only to the direct users (students and teachers) but also to indirect (families). In fact, the school buildings are in public ownership and have a use "extended" to a large number of subjects, which are, among other things, the future generations of citizens, in whose hands will entrusted the built and natural heritage.

Furthermore, in terms of energy and environment, school buildings consume energy mainly for heating and lighting. Often the service systems (heating, ventilating & Air conditioning, lighting ...) are not adequate to the needs (low yields). Furthermore, envelope's performances are far from cogent energy standards, required by the EPBD Recast (nearly zero energy).

Therefore, in the overall panorama of the challenge in order to reduce energy consumption and global CO2 emissions, this sector constitutes a priority axis of action in which the European research area is very fertile for the character "demonstration" that such buildings can play .

The paper illustrates the case study of energy-environmental and structural retrofit of the primary school "G. Marconi" in Roccadaspide (SA), developed as part of research project: "Guidelines for energy and functional rehabilitation of school buildings in the Mediterranean area"

(Coordinator: prof. Arch. Sergio Rinaldi), funded by the Campania Region, implementing the program of action in the field of scientific research in accordance with R.L. 5/02.

2. Sustainability of energy use: energy – environmental audit (by R. Franchino)

In order to appropriately structure the technological redevelopment interventions of the training facilities according to the guidelines mentioned above, the role played by the preliminary analysis and identification of the problems which define the guidelines of the transformation interventions is particularly important. For the development of this phase, an information and knowledge detection methodology is proposed, with it being described as an energy – environmental audit that, if properly conducted, can allow to achieve the goal of increasing the carrying capacity of the building intended as the ability to absorb and control the phenomena associated with the use of energy with a sustainable impact on the ecosystem.

This methodology differs from the already established and exclusive energy audit, since it is configured as a tool that aims to make energy flows compatible with the sustainable transformations of the environment in which they are located. Currently, environmental issues, closely related to the energy ones, significantly affect much marked the study, implementation and management of new innovative and simply evolutionary technologies.

2.1 Objectives

The energy-environment audit is configured as a survey that detects the present state of an energy system in order to identify measures which modify it, so that, starting from a performance point of view, there is a better consumption, or less use of energy, or even a better performance. It even allows to detect the implications that the energy uses may result in terms of emissions and consumption of resources of water, air and soil sectors in which it is customary to divide the environment.

The above method allows defining the energy and environmental issues characterizing the building systems, the building envelope as well as the performance of the components, in order to propose solutions or reductions in these problems. In general, these solutions achieve and maintain a performance that results in saving not only in energy, but also in the environment, with the latter referring to the costs of prevention and environmental protection. In particular, in finding solutions to be adopted interventions that aim to improve and make more efficient energy uses are preferable, resulting in significant economies of exercise, while at the same time also allowing for the use of renewable energy sources.

Solutions that use natural elements to control the climate and natural lighting of the building as well as encourage interaction with the surrounding environment-climate are also preferable.

In addition, the name energy-environmental audit is particularly appropriate, confirming in the carrying out of the audit, the close link between environmental conservation and energy use.

2.2 Application in a school structure

The audit is based on an investigation carried out by a researcher, who by visiting the buildings collected all the relevant data for the aforementioned purposes. The data are collected into the following categories: type of equipment available, their mode of operation and any emissions, data supply by the electricity and gas companies, other information that may be relevant for energy-environmental purposes. The method allows defining the energy and environmental issues in order to propose efficient solutions.

A learning facility is an interesting case of energy-environmental system in which problems can be adequately addressed by the audit.

The initial analysis considered the function of the system, i.e. learning. This function is characterized by specific conditions of use that include the time, almost exclusively diurnal, as well as the presence of skilled and specialised personnel.

The actions to be implemented are as follows:

- collection of analytical (data) and descriptive information;
- measurement of lengths, areas and volumes, energy interest;

- measurements of significant aspects including the thermal properties, mass transport, thermo-diffusion and thermal radiation properties;
- determination of the configuration of the systems;
- quantification of performance and energy consumption;
- monitoring of emissions from any pollution sources in relation to the water, air and soil sub-systems.

The survey is characterized in relation to the activities carried out and the spatial distribution, the type of construction, the characteristics of the external environment (climate, levels of pollution ...) and the indoor environment.

In the case of the school, the energy-environmental performance of the building-systems, should not be limited to performance sufficiency, but should be targeted to the high-end, since in school, where the phenomena even if at the elementary level are also learnt, the demonstrative aims, which raises awareness of the issues of energy use and environmental compatibility, should be presented.

The information was collected using interview techniques and questionnaires. In the present case, the collection of geometric data and user presence (crowding index) and the direct measurement of the thermos-physical properties was also possible and required. The questionnaires and interviews had to ensure the nominal and actual performance, with the consequent consumption of fuel or electricity. In order to determine consumption, it was also necessary to add that of constitutive energy, namely used to manufacture, transport, install the components or material that constitute parts of the building and the systems, using Life Cycle Analysis (LCA) techniques.

Being a school structure [4], it was also necessary take into account the functional, distributive, typological and climate (micro and macro environment) factors. Regarding the functional ones, three main activities are carried out in a primary school: teaching, collective, complementary, as specified:

1. for educational activities: classrooms, computer rooms, laboratories, library;
2. for collective activities: gyms (in some cases adapted for indoor sports, such as volleyball or basketball), meeting places (assembly hall,

rooms for teachers, meetings or receiving parents), canteen in some cases;

3. for complementary activities: offices and administration.

The services and connections, consisting of corridors and lobbies, account for about 40% of the three listed areas. Consequently, for each space, the audit takes into account the different characteristics.

In the light of the specifications listed above, the audit can be a very valuable tool in guiding appropriate choices of energy-environment redevelopment.

3. The structural and energy rehabilitation design of "G. Marconi" primary school of Roccadaspide (by A Violano)

The school buildings of our country, in many cases represented by the architectural complex that has got also a historical value, is often characterized by evident phenomena of both degradation and poor energy and environmental efficiency. For some buildings interventions of adaptation and/or safety measures are sometimes necessary, which are often implemented in the viewpoint of emergency, but they are not included in a more complete and comprehensive rehabilitation program of the building.

The common interest in these topics and the issue of the Cabinet Decree on 8th July 2014 gave the chance to lead a study about the possibility of combining interventions of both energy rehabilitation and structural and anti-seismic adaptation at the Second University of Naples[1]. The interest was shown particularly in the buildings of the post-war reconstruction (1920-1970), characterized by construction techniques and materials not suitable to resist horizontal earthquakes and very dispersive envelopes, having thermal bridges and moisture from condensation. School buildings are, therefore, a category of public buildings of a special interest for an integrated (both structural and energy) design experimentation.

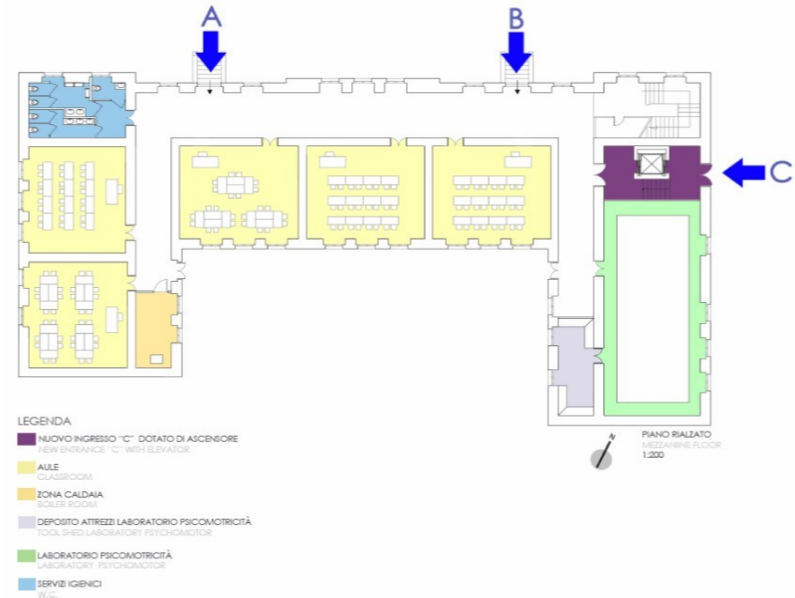

Fig 1 First level plant

Fig 2. Second level plant

Fig 3 Marconi building

3.1 Protasis and methodology: the added value of an integrated approach

In the overall picture of the challenge for the efficiency of existing buildings, where high levels of sustainability and limited extra costs are required, the traditional design approach (linear sequence of the several interventions required) is exceeded by an integrated design approach [2].

After a phase of systematic analysis (which provides indications of historical, architectural and functional, as well as structural and energy type), the proposed methodology includes four phases of action that are propaedeutic to the design:

1. Energy and environmental audit [3];
2. Diagnosis of the points of strength (potentialities) and weakness (critical issues) of the building to be rehabilitated. "*The intervention established by the architect should be always based on a diagnosis, just as the doctor examines the human body before giving a treatment*" [6];
3. Identification of architectural, structural and technological solutions that are necessary in order to improve environmental performances and thermal comfort [5];
4. Evaluation of the positive-cumulative benefit that each intervention is able to produce, after a sensitivity analysis that matches the security needs with the minimum requirements imposed by the Legislative Decree 311/06 and subsequent amendments. mod. and int., mainly related to the Class of Technology Unit Closures and Structures (UNI 8290-1: 1981) and that helps to find out its significance and priority.

At this point, you can make a choice of solutions to be implemented and possibly suggest the experimentation of new innovative technological combined solutions [7].

Therefore, the recommendations are aimed at obtaining, at the same time, an Energy Performance and Seismic Suitability Certificate.

3.2 Apodosis and design: relevant technological parameters

The planning experimentation is focused on the evaluation of the energy and structural performance as well as fruition and functional

potentialities of "G. Marconi" primary school of Roccadaspide (SA), a building constructed in 1935 and closed in 2001 for the earthquake in San Giuliano di Puglia. As a consequence of that catastrophic event, when the school building itself was the most ruined, the use of the building was denied due to problems of structural inadequacy.

The building is developed on three levels. From a bioclimatic point of view, spaces enjoy a good natural ventilation (through cross horizontal) and the exposure of the classrooms is the optimum (in the east, in the south and in the west), while services and connective in the north act as buffer zones. From the construction point of view, "G. Marconi" school has a leading masonry structure in grey limestone and mortar, with continuous foundations in limestone masonry, floors in beams with blocks of hollow bricks and a pitched roof with both a wooden framework and roof tiles of Portuguese type.

The envelope of an overall average thickness equal to 70 cm has got a thermal Transmittance[2] equal to U = 2.2 W/m2K6, far above the law limits that for the climate zone D foresee U ≤ 0:29 W/m2K.

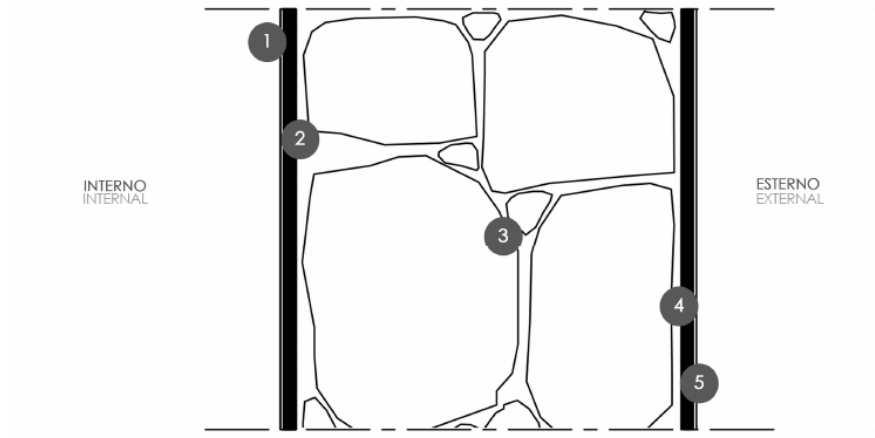

Fig. 4 Stratigraphy of the envelope

Also the transparent envelope has got requirements of thermal Transmittance[3] for fixtures and only glass, exceeding the law limits; the

fixtures, in fact, originally made of wood, today are in pre-painted aluminium with a Float single glass 4 mm tick and a value equal to U = 6.4 W/m2K.

Fig 5 Abac of fixtures

From the plant point of view, the school has got very poor performances, so as to achieve in its whole a class of merit F responding to a global Energy Performance Index equal to 28.3 kWh/m2 per year. In fact, the school, not equipped with systems for summer cooling and DHW production, has got a gas oil heating system (with a power of about 130KW).

4. The proposed recommendations (by A. Violano)

The research has led to the definition of three experimental integrated solutions:

1. the “vaulted diffusing ceiling”,
2. the “collaborating ventilated wall”,
3. the walls reinforced with an integrated coat

in addition to other traditional technological solutions such as fixtures with thermal glazing, insulated and ventilated covering, draining insulation of foundations, as well as the application of products offered on the market such as condensing boilers, the RofixSisma- Lime

system, a concrete structural reinforcement (according to anti-seismic regulations - NTC 2008 "New Technical Standards for Constructions", DM January 14, 2008). It has the added value of being also thermally isolated (meeting the requirements of the Ministerial Decree 59/09) and the Alpha System, continuous supporting partitions in reinforced concrete for constructions in seismic areas, but also light, insulated, transpirable and ventilated coat. The implementation of these recommendations has allowed the building to pass from a class of merit F to a class of merit C, which for an existing building, rehabilitated without changing its construction DNA, is an excellent result.

Below the two solutions of the "vaulted diffusing ceiling" and "collaborating ventilated wall" are analysed in a detailed way.

Fig. 6 Global Energy Performance Index before and after rehabilitation interventions

5. From the energy-environment audit, the proposal of a vaulted ceiling diffuser

The aim of the application was to check the energy consumption for air conditioning and lighting with the audit. Since there are two overlapping layers of classrooms, the transmission of heat can be assumed as represented in the diagram in Figure 1. The classroom should be equipped with a heating system that maintains the temperature at 20 C, ensuring a suitable mechanical change of air. Uniform luminance, with a mix of natural and artificial light over the desks should also be ensured.

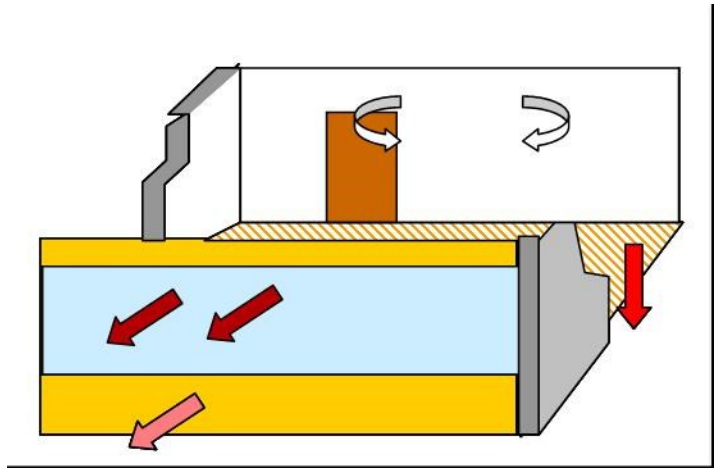

Fig. 7 Lay out of the classroom

If wanting to achieve the objective of including global consumption within sustainable limits of efficiency, it is also necessary to reduce the costs using efficient technologies, calibrated according to the signs of the audit.

The audit, in fact, provides guidance on specific needs, highlighting the weaknesses of the system (e.g. illumination efficiency). It recommends using, in the particular the type under study, a "vaulted diffusing ceiling", which enhances the illumination of the areas that are far from the windows, to uniform the lighting as well as determine the desired mix of artificial and natural light.

The presence of this type of ceiling, whose shape is calculated depending on the reflection properties of the surface, the function performed and other characteristics that are obtained from the audit, makes it possible to be within the predetermined efficiency parameters.

Figure 7 shows the effect of the greater spread of light with a shaped ceiling (on the right) in relation to a flat ceiling (left) on a schematic layout of the classroom.

The results obtained, in addition to reducing energy consumption, also have an environmental value, for the best use of natural daylight, confirming that the energy-environmental audit can be an effective tool for improving performance.

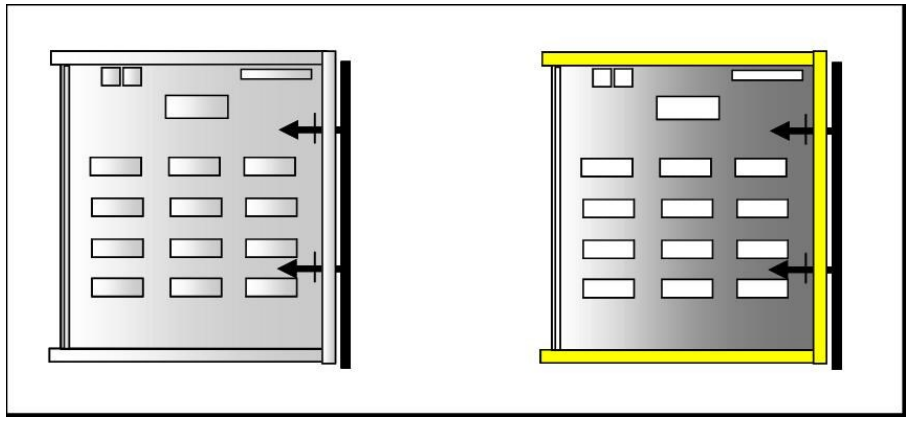

Fig. 8 Light diffusion with shaped ceiling (left) and flat ceiling (right)

6. The collaborating ventilated wall (by A Violano)

The test of masonry piers showed the need for an increase in resistance, implemented thanks to fasten red bricks (12.5 cm x 25 cm x 0.5cm) of about 30% compared with the thickness of the wall (70 cm). Since the wall to be reinforced is exposed in the south-east, they chose to tilt the bricks at 45°, in order to create a series of ventilation chambers, which reduce the risk of condensation in winter and the thermal accumulation on this side in summer.

The direction of the prevailing summer wind (east), in fact, favours channelling the fresh air in the aeration grids and creating a fireplace effect getting an energy benefit, as a passive cooling system, at the same time.

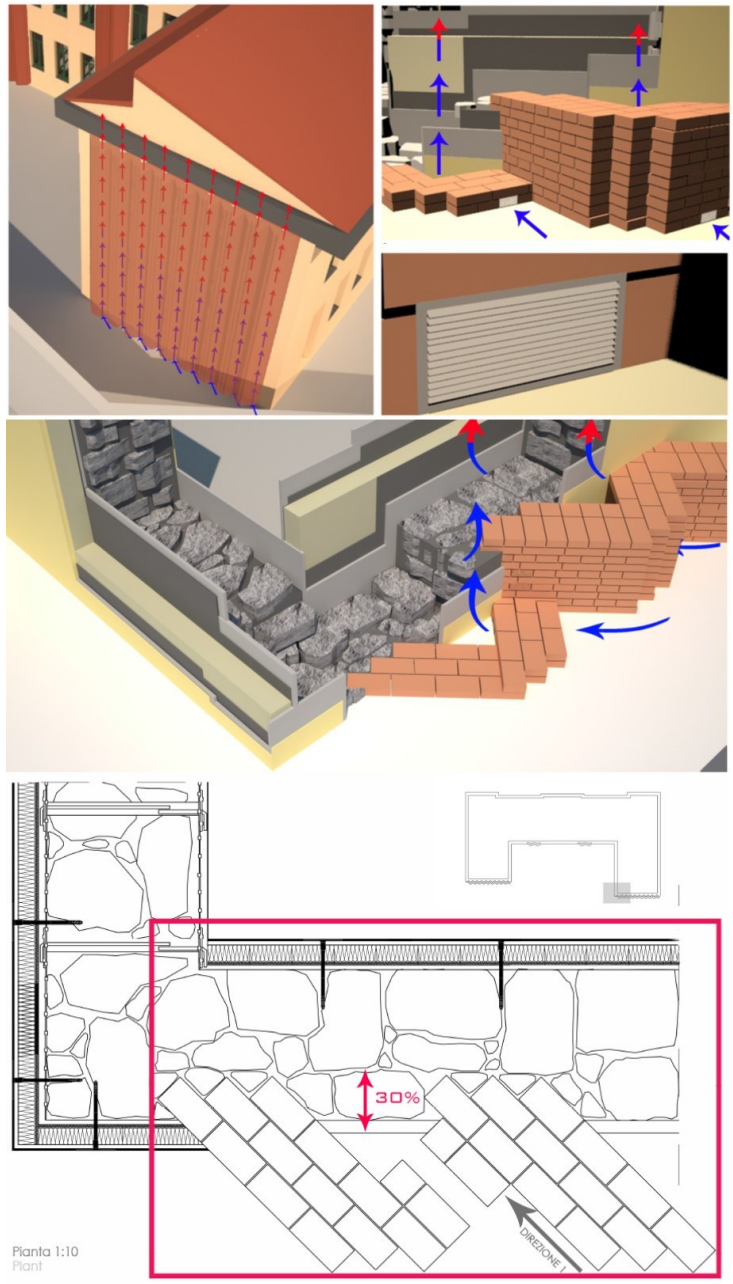

Fig 9 The collaborating ventilated wall

Conclusioni (by A. Violano)

In conclusion, for an effective energy-environmental rehabilitation you must start with an adequate knowledge of the characteristics of the building organism (its technical-construction DNA), so that the interventions, and consequently the materials can be selected according to the specific performance deficiencies of both opaque and transparent components [4].

It is proposed, therefore, on a hand, a tool of analysis of the energy performances of the building to be rehabilitated and on the other hand, a decisional supporting tool for the energy rehabilitation design, that allows to demonstrate the effective validity of the proposed interventions (recommendations) in terms of energy performances reached.

The energy efficiency of the building organism depends on how the designer can "*miser en valeur*" technological and environmental factors, this organism has to deal with the whole day, in all the seasons of the year.

In order to achieve the goals of reducing energy consumptions and emissions, established at a European level, it is a priority to make a concrete professional policy of energy rehabilitation of the existing buildings, which currently represents, both numerically and for typological, construction, technological and maintenance characteristics, the most critical point of the problem.

Notes

[1] The research project was conducted in collaboration with the arch. Luana Marchese (who also worked on the technical designs), Eng. Renato Carrozza and the group of structural SUN: prof. ing. Giuseppe Faella and prof. arch. Maria Teresa Guadagnuolo.

[2] Thermal Transmittance value is calculated using the software JTempest 2.3.

[3] Thermal Transmittance value is calculated using the software Thermo 2.6 Namirial

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Housing Policies and Urban Economics Vol.3 / 2015, pp. 63 - 78

Towards better planning and design of hospitals: Lessons from the Greek experience

Evangelia Sklavou[1], Ioannis Tzouvadakis[2]

Abstract Hospitals have significant interrelationship with the socioeconomic identity of their surroundings. In these complex buildings, all spatial expressions and interrelations (architectural, healing, financial, etc.) should be equally considered. Rational use of financial and energy resources towards true sustainability call for systematic healthcare architectural design evaluation of new and retrofitting projects. This paper contributes knowledge on the documentation and evaluation of the recent Greek experience.

Keyword: *healthcare architecture, retrofitting, holistic sustainable design, post occupancy evaluation*.

Introduction

Hospitals rank among the most expensive civic buildings. Towards optimizing the overall performance of large scale buildings in the public sector, ever increasing constructional, operational and medical expenses of hospitals demand cost reduction. However, a substantial percentage of those expenses is inelastic and there is a threshold below which financial downsizing would compromise operational safety. Strategic planning and multi-disciplinary approach in decision making, regarding the regional, urban and local interactions of the hospital facilities can significantly contribute in reducing associated costs and safeguarding long term sustainability. Consequently, an integrated approach to the hospital's effectiveness and energy use but also the overall internal

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environmental quality as well as the use of local resources, climate and topography is crucial.

In the future, retrofitting hospitals to meet current international standards will be more probable than constructing new units [1]. Recommendations should therefore be applicable to both new and existing facilities [1]. Simple solutions on existing buildings can mitigate energy use up to 30%, depending, among others, on the country, climate and building age [2].

In Greece, healthcare building fabric comprises legacy hospitals which have surpassed their life-cycle expectancy and contemporary units, embodying international practices. There is an imperative need to collect empirical data and form national architectural databases of hospital construction [3]. This paper is an introduction to such a task and concerns a first critical appraisal of Greek hospital building types.

Background

Although perspective of healthcare has shifted considerably through the years, the efficiency of a hospital has remained highly dependent on the degree to which complex functions and interests are integrated in its facilities [4]. There is also strong evidence of considerable overlap between sustainable and evidence based design [5]. In that sense, balanced spatial expression of human, medical/nursing and infrastructure needs as well as energy and financial demands is a challenging architectural task.

The life span of a hospital building is approximately 65 years. However, the necessary resources for their timely replacement are rarely available, therefore hospitals are used until their usefulness has been exhausted, translating in a hospital life-time of over 100 years [4]. Consequently, construction should be simple, technically and financially feasible and should be evaluated regarding safety, site conditions and specific local requirements [4].

In Greece, management and coordination of the planning and construction of hospitals is performed by DEPANOM [6].The organization's practices and strategic directions include, among others,

the originality of each project, appropriate construction method and material choice, architectural strategies with respective evaluations of application, development and use of overall know-how and functional and operational hospital optimization [6].

In the realm of academia, the need to study hospitals as part of an undergraduate program or as part of an interdisciplinary post-graduate program, had been identified since 1976, but was never achieved, potentially due to the topic's complexity and the necessary prerequisite background knowledge [7].

Today, critical issues concerning the design and retrofitting of Greek hospitals remain unanswered; among others, these include, the flexibility to facilitate future infrastructure needs and downsize patient room number, the expandability potential to adapt according to specific and sometimes unpredicted demands, the extent of urban intervention necessary to secure long-term unimpeded functioning and the urgency to identify realistic and viable strategies towards mitigating operational costs[8]. The inclusion of healthcare design in university training is scarce and involves isolated initiatives [9]. There is a constant lack of specialized architects and engineers that could offer sound, integrated solutions [10]. Hence hospital administrations turn to short-term solutions of problems on the verge of exploding: Towards the 21stcentury, the annual technical expenditure for hospitals was 7,5% of the hospital budget, which for a 400-bed hospital translated annually in today's 3.000.000 euros [10]. Furthermore, a study in 1994 estimated energy use in Greek public hospitals at 650 GWh, which then meant 10 billion drachmas, meaning approximately30 million euros in today's terms [11]. By 2010, energy expenditure per unit was more than twice that of other public buildings [12]. At the same time, the programmatic logic and activity of the Greek healthcare system is static [13].The potential and significant contribution that DEPANOM could have was not materialized. On the contrary, it was merged with other agencies in forming a much bigger and broader construction organization.

There is a significant absence of holistic and systematic approach in transferring international practices to the Greek terrain and culture. This becomes even more conspicuous when the fully developed regional structure of Greek healthcare buildings is factored in. Thus the notion of

retrofitting being more probable in the future and the need to acquire hospital architectural information are put in a critical perspective.

This paper is a first step in establishing important information on Greek healthcare existing architectural practices. Due to the absence of a consistent and comprehensive national database, framing the bigger picture was assessed as more important than extensively evaluating a narrow set of attributes. Findings from this study are therefore expected to have some degree of inferential value. More importantly, knowledge acquired could be used as a concise background for future relevant work to build on.

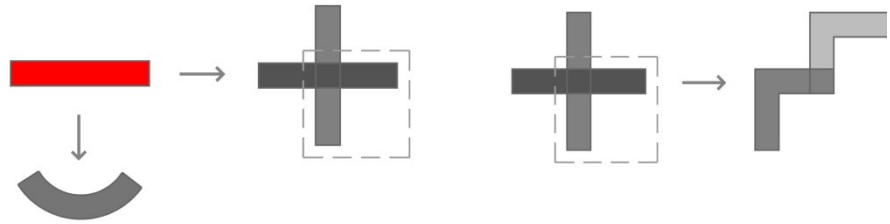


Figure 1*: typologies studied. The linear model, marked with red, is considered the "archetype" form, from which the rest models derived*

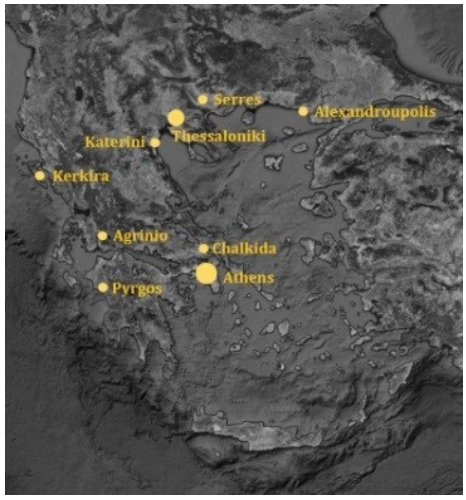


Figure2*: Regional distribution (in Greece) of typologies studied*

Methods

A well-informed appraisal of the current condition of Greek hospitals demands extensive research, ranging from documentation of architectural, morphological and typological aspects to systematic study of applied architectural solutions, with respect to regional, urban and local planning.

To this end, all seven current healthcare districts of Greece were investigated. Typologically, the simple linear model of a nursing ward layout was considered as the archetype and its curved version as derivative (fig. 1). However, the amount of data collected in this early yet important stage is essential towards framing the bigger picture. In this context, certain derivatives, applied and/or repeated throughout the Greek territory were also included, i.e. the cross- and its derivative double-L linear model. Consequently, case studies where these typologies were realized were investigated and respective hospitals are presented accordingly. The spatial distribution of the sampled case studies within the Greek region is shown in figure 2. These case studies were investigated from the architectural point of view with regard to sustainability issues, for example the adjustment (and utilization of) specific urban and local conditions and the healing potential of their environment.

Results - Discussion

1. Simple linear model

The University General Hospital of Alexandroupoli is one of the most contemporary Greek examples and a remarkable expression of holistic planning. Its large size (approximately 90.000 m²), dictated careful consideration regarding operational cost. At the same time, the hospital was planned and designed with environmental awareness and adjusted to the particularities of its surrounding environment. For instance, daylighting and natural ventilation offered by local climate have been utilized to their corresponding extents, positively contributing

to the creation of healing environment as well as the rational use of energy and consequently overall resources.

The hospital is accessed from the National Highway via a provincial street, which was intentionally broadened to facilitate four car lanes (fig. 3a). To better control circulation density, the service entrance was facilitated far from the main entrance, as it is shown in figure 3b.

The hospital complex comprises three linear buildings connected with long traversal corridors in each level. In this way, this massive hospital is broken down into manageable parts. All distances and time needed to walk them become shorter, which in terms of work efficiency means less fatigue and man – hour as well as circulating costs. At the same time, wayfinding becomes easy for its users.

a) ***b)***

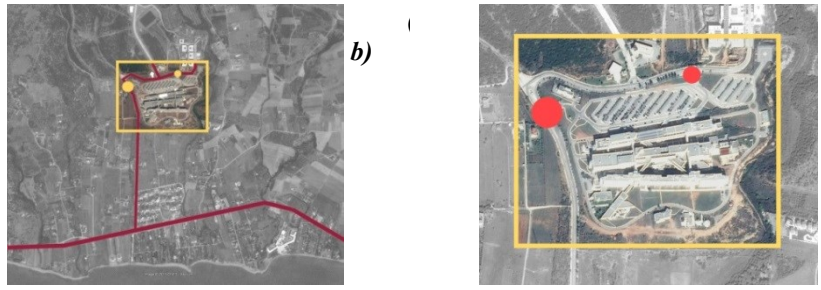


Figure 3: (a) *urban network and* ***(b)*** *site of University Hospital of Alexandroupoli*

a) ***b)***

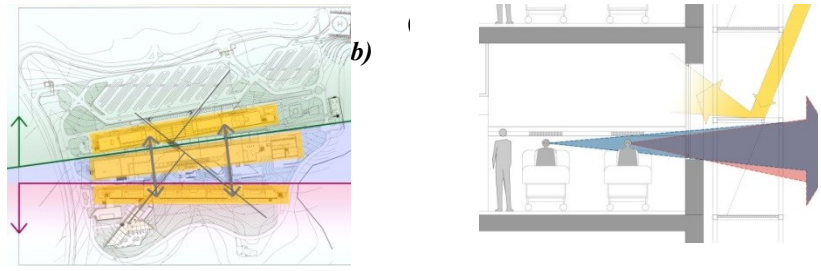


Figure 4: (a) *zoning and* ***(b)*** *patient room section of University Hospital of Alexandroupoli*

The buildings also divide the hospital into respective zones. The nursing unit building is situated at the lower part of the site, in relative

distance from the others. It is oriented vertically on the north axis, realizing the boundaries of the private zone (fig. 4a). This also creates a quiet environment between the nursing unit building and the lower site boundary. Careful consideration was given to utilize and manage the south sunlight in patient room: An independent shading and daylighting system was adjusted externally, comprising a metallic grate and a light shelf(fig 4b). The shading provided by the metallic grate is considered effective, since it features a projection factor (PF) of 0,60, which is a significant advantage, especially during summer. The light shelf is leveraging the window's vertical division, at 2,10m above floor height, into a view and a daylighting part and improves the internal visual quality without compromising view through the window. As Figure 3b illustrates, the light shelf also offers internal shading to the bed beside the window as well as the external lower part of the facade.

A thorough study evaluating the long term fiscal advantage, or disadvantage thereof, factoring in the construction and maintenance costs of this system, as well as its impact on resource use and consequently the hospital's environmental footprint, would contribute valuable information. Such a study falls outside the scope of this study, yet some intuitive and useful preliminary inferences can be drawn already from this stage. This architectural solution seems to enhance and safeguard the merits of the south Mediterranean sunlight while providing protection from the adverse ambient conditions that uncontrollable bright sunlight penetration may promote. This constitutes an integrated sustainable evidence based design practice, which is very likely to be associated with operational and maintenance cost reduction.

2. Curved lineal model

"KAT" is situated in the northern suburbs of Athens(fig. 2 and 5a) and specializes in orthopedics. Its curved nursing unit building is oriented southeast and northwest (fig. 5b). It is an optimal expression of a form following its function for many reasons. The first and possibly the most important is the dynamic between building and sun geometry. The nursing unit building follows the sun path in a way that maximizes the healing sunlight penetration in patient rooms [14], which enhances

Vitamin D production and therefore supports the healing process of orthopedic patients. The second reason is the prevailing wind direction. The northwest introvert façade receives the southeast winds. Horizontal devices between the floor finish and the concrete slab lead the fresh air through the floor towards the vertical shafts, which in turn release it to the patient rooms or transfer it vertically, facilitating optimal natural ventilation (fig. 6).

The hospital also features balconies, a healing architectural feature [15] that no other case study exemplified; these two-meter deep external projections run along the entire patient room façade, in effect acting as horizontal shading devices. They also extend the patient room towards the outside, providing external healing spaces to socialize, connect to the nature and enjoy the view [15].

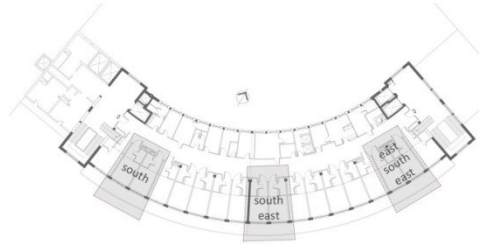
a)  ***b)*** 

Figure 5*: site* ***(a)*** *and floor* ***(b)*** *layout of "KAT" General Hospital*

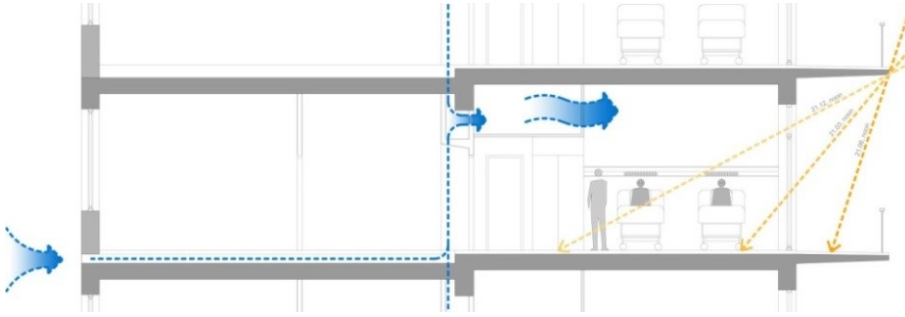


Figure 6*: Passive solar daylight design and natural ventilation design in "KAT" General Hospital*

The hospital was renovated in 2004. With the exception of one floor, all levels were retrofitted to facilitate bathrooms in all patient rooms. Moreover, all wooden-framed, single-paned glazed balcony doors were replaced with aluminum-framed, double-paned ones. A post-occupancy evaluation (POE) of our team concerning the visual environment in patient rooms [14] revealed substantial room for further optimization. Nevertheless, user evaluation was more positive than expected, confirming that perception can significantly deviate from what is anticipated [14].

In general, however, this hospital comprises solutions that aim towards leveraging, enhancing and safeguarding the merits of the local climate and terrain, while protecting from adverse ambience that specific uncontrollable or excessive conditions may facilitate. In that sense, these spatial expressions are in effect sustainable evidence based design features. As elaborated in the "linear model" section, these can positively contribute towards holistic sustainability.

3. Cross linear model

The cross linear model (fig. 1) has been applied and repeated in many contemporary Greek hospitals (figures2 and7), adjusted in each case to specific needs and particularities.

(a)

(b)

(c)

(d)

(e)

(f)

(g)

***Figure** 7: Cross model hospitals in Greece. **(a)** "Agioi Anargyroi", Athens, **(b)** Agrinio General Hospital, **(c)** Katerini General Hospital, **(d)** Kerkyra General Hospital, **(e)** Pirgos General Hopsital, **(f)** Serres General Hospital and **(g)** Chalkida General Hospital*

The hospital comprises two buildings that connect through a third facilitating the main vertical communication uses. The orientation of this longitudinal complex depends from the site conditions. In the case of the Chalkida Hospital for instance (fig 7g), the site was previously used by the army as a shooting range. The study of the site physiology that preceded the construction phase revealed military residues and the complex needed to be adjusted and re-oriented.

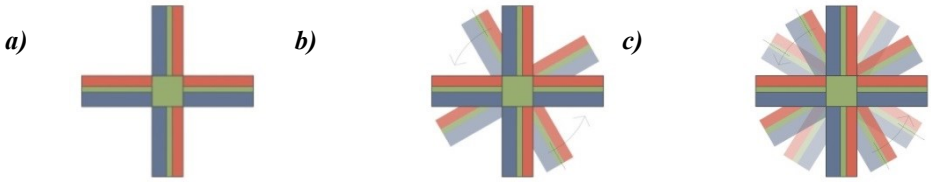


***Figure 8**: orientations of the cross typology. Patient rooms are shown in blue, circulation in green and supportive functions in red.*

The cross shaped nursing ward has a central core and four relatively uneven sections situated in 90°angle to each other. Any orientation configuration will ultimately call for effective shading strategies (fig. 8). Moreover, the specific type selection with regard to Greek solar geometry, will likely result in one volume overshadowing the other or reflect light, contributing to visual discomfort in patient rooms, as a study of our team indicated [16]. Holistic and sustainable design considerations should properly address these issues. However, no case study of this project demonstrated relevant strategies. The generic means of overall shading were internal fabric curtains, whereas external horizontal shades were found above the windows of south and west facing patient rooms. On-site documentation of "Agioi Anargyroi" (fig 7a) verified these findings. Consequently, the heating and cooling demands as well as visual comfort needs are likely to be achieved with higher use of energy and consequently financial resources. Moreover,

the healing potential of the overall design appears to be seriously compromised.

Nevertheless, energy issues and mitigation of environmental impact may not always be among the primary design goals, like in Chalkida General Hospital, as these were included at a later stage [17]. Despite the difficulties like orientation shifting, respective adjustments were made to the extent that they were possible to materialize [17].

Ultimately, the success or failure of any sustainable practice will be determined by the degree of user acceptance. For example, the "Agioi Anargyroi" uses all-air ventilation system [18]. However, the inherent human need to interact with nature and experience natural and fresh air leads the patients to open the windows [18]. Such discrepancies between energy demands and human comfort should be carefully considered, as failing to compromise between them may result in unpredicted and costly system disruption.

4. "Double L" linear model

This typology has the inherent advantage of easy facilitation of patient rooms towards the quiet side of the site. The hospitals that realize this typology are the General Hospital "Papageorgiou" in Thessaloniki [19] and the University General Hospital "Attikon" in Athens[20], which are seemingly identical. However, they have significant differences.

a)  ***b)*** 

Figure 9*: Papageorgiou General Hospital (a) and University Hospital "Attikon" (b)*

The planning and design of the "Papageorgiou" General Hospital (fig. 2 and 9a) had a clear vision to integrate sustainable practices

towards higher energy efficiency [19, 21]. Optimal orientation of the nursing ward was achieved through proper utilization of local climate and topology, ultimately contributing to visual comfort in patient rooms[19,21].The University Hospital "Attikon" (fig. 2 and 9b) had to be facilitated in a much more confined site and the building complex rotated significantly. The change of orientation turned the patient rooms towards the north and east, without any relevant consideration for solar and daylighting issues.

Assumptions - Limitations

The actual range of such a project is impossible to outline in one paper. Therefore, this study concerns only certain aspects of this project. The data derived from on-site and off-site architectural documentation as well as interviews with professionals and online research.

However, the dynamic nature of the hospital and its ever changing needs are likely to dictate spatial alterations that should be identified and included in a next phase and update the evaluation process accordingly. In addition, such projects demand unimpeded interdisciplinary cooperation. Although hospital staff and technical service professionals were more than willing to cooperate with the authors, there were also instances of beaurocratic obstacles.

In the end, the physical environment evaluation of the users is of fundamental importance and any appraisal lacking it would be inherently incomplete. This study included exemplary findings of such an evaluation, but more work has to be carried out in order to gain insight in Greek hospitals.

Conclusions

Our study indicated that architectural design practices of superior quality are demonstrated where hospital morphology follows functional demands and sustainability is considered in its broader sense. These practices can be a significant contributing factor towards mitigating operational and maintenance costs, applicable to new and retrofitting projects. After all, the implementation of low-budget building energy upgrade strategies can mitigate energy use by at least 20%, which translates to overall cost reduction of almost 10 million euros [11].

The broader fiscal advantages of good architectural practices of each model presented are identified and indicated. Nonetheless, actual and current financial data of the construction, operational and maintenance costs could offer a much more comprehensive insight and future studies should include them, as well as fiscal expressions of recommended architectural sustainable strategies and their post occupancy evaluation results. If researched, decoded and adjusted properly with respect to other corresponding cases, construction costs can be further reduced. In the end, an overall optimum level of cost downsize can be achieved.

Such evaluations of healthcare building design are multidimensional and interdisciplinary. This paper partially defines the framework of an architectural approach. It is clearly indicated that systematic post occupancy evaluations should be carried out throughout the Greek healthcare districts and include user appraisal and spatial perception. In this way, assessment of the advantages and disadvantages, opportunities and threats of various practices and strategies will be considerably facilitated. Furthermore, a solution package that would properly translate international practice and experience into Greek reality will be feasible. Last, but not least, the dissemination of Greek knowledge, know-how and findings, in a rational and structured manner, will be also feasible.

It should be noted that an independent multidisciplinary organization exclusively specializing in healthcare infrastructure comprising specialized architects, urban - regional planners and engineers is a critical component of a successful holistic healthcare

system. To that end, the inclusion of hospital as a university training topic is deemed necessary.

Hospitals safeguard public health and welfare. They also have powerful representative cues of contemporary socioeconomic values. Consequently, holistic sustainability is fundamental towards a harmonic symbiotic relationship between the hospital and the city, regionally, urban and locally.

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Housing Policies and Urban Economics Vol.3 / 2015, pp. 79 - 86

Agriculture and Architecture in School Recovery

Francesca Muzzillo[1] Fosca Tortorelli[2]

Progetto. Gli orti scolastici potrebbero essere un'esperienza educativa e una strategia per promuovere la formazione ambientale e sostenibile per coinvolgere gli studenti nelle problematiche di una sana alimentazione e di uno stile di vita sano, creando al contempo benefici sociali e ambientali. Nel nostro lavoro presentiamo alcuni casi di studio elaborati a partire dal Progetto di ricerca ***"Diaeta Mediterranea: Landesign / Ali-Ment-Azione®".***

Parole Chiave: orto scolastico, cultura, spazio sociale, percezione, recupero.

Abstract. Kitchen gardens for schools could be an educational experience and solution to promote environmental and sustainable learning in order to connect students with healthy food and lifestyles, giving back also social and environmental benefits. In our work we present study cases connected with the Research Project ***"Diaeta Mediterranea: Landesign/Ali-Ment-Azione®"***.

Keyword: School kitchen garden, Culture, Social Space, Architectural, Perception, Recovery.

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1. Collective Open Voids inside Architecture

We could wonder whether or not there is a relationship between empty spaces inside community building on one hand and the kind of human relationship in the same community on the other hand. And the answer is obviously: yes, there is a strictly connection. It is sufficient to think of a monastery, its courtyard, usually associated with open air activities, in order to provide space for collective works[1].

But another question arises as regards social vision of open living spaces inside a building[2]. It is possible to investigate if activities are influenced not only by the presence of a void, but also by its shape. Organization of areas very often recalls organization of behaviors and in this sense a research could individuate various correspondences focusing on the features of open spaces and on the way in which they are interconnected with the distribution of interior architecture. They form in fact a cushion among the interior areas, and even if they are small they play as part which is capable of acting in a larger scale compared to its size.

Moving from this point, if the congruence is related to two different planes of organizations, the analogies are of a systematic kind and there is more than a correspondence for each open space. In other words there are always more than one activity that are appropriated for a specifically shaped space, and the systematic approach implies a change of perspective with respect to the univocal functional idea. Each space is apt to more than a function, even to infinitive functions, as only there is a connection on the plane of organization schemes. So the old idea of functionalism at the same time is again recalled and changed. And it is possible to use an open space in different phases of time.

But what are the consequences of these choices on architecture?[3] First of all we need greater flexibility in design in order to optimize the use of a site plan allowing different uses.

The correspondence between spatial voids and social community ideas was already studied by Lewis Mumford: “a conception of the community which isn’t a maze of large collective organizations, but a combination of continuously variable association activities, varying in intensity and duration”. So the reference to Mumford implies that an

open collective area may have different alternatives of usual occupations of space, especially if the times of use are different. And the complexification of spaces implies too that an architect should think on different levels while designing. Moreover varying uses amplifies the space of relationship, reducing consumptions and it has a good consequence in a sustainable design, as for example the increased numbers of hours in which natural light and vegetation benefits are utilizable for a community. An example which is explicative is the case of schools. Open scholastic spaces involving families become more and more collective social places in which learning to work with others. Agricultural practices are the most appropriate for involving a community inside a school court, as they imply change of perspective in the organization of works. In fact behaviors both of students and of families are conditioned by external factors: light in the different hours of the day, seasonal weather, time to be involved in order to let vegetation grow. And sharing a difficult job is the best way for creating a sense of community.

2. Case study: school kitchen garden

Urban agriculture practices are not a novelty of nowadays in town and there is also a wide range of different ways in which they occurs, but it is important to point out how making a vegetable garden may become a main cultural and social aspect of urban life. Particularly the school vegetable garden is an expression not only of a need but also of a creativity desire. In fact these kitchen gardens arise from a collective work and they are "coordinated" inside a community. For this reason they have both inherent a social function, and an environmental one.

Perfectly belonging to this theme is the wide articulated Applied Research Project[4] [Diaeta Mediterranean: Landesign/Ali-Ment-Azione®], which has as scientific director Sabina Martusciello and Maria Dolores Morelli[5]. It is a multidisciplinary scientific platform focused on the theme of food, and the decomposition and recomposition of the three main ingredients which are necessary in view of healthy eating habits:

ALI - intangible component, evocative, made of memories, reminiscence, colors, emotions, woven in

MENTE (mind) that organizes, structures and makes us aware of what we eat with mouth, eyes, ears, nose, body;

AZIONE (action) as necessary approach for pro-moving and making known the results which have been achieved through the synergy of everyone who is involved in this virtuous process.

Among the aims of the Project Landesign / Ali-Ment-Azione it should be noted the recovery of outdoor areas of schools in order to spread care, respect and values, starting from the ground, and let students intend designing as a moment of collective participation.

Starting with the word "diaeta", which means the space of the Roman house intended as hospitality and relationships area, we have made a research to look at the relationship between man and environment, food and health, land and design, content and container, research and scientific innovation for developing products and services in the chain of food production.

This concept aims to the essential goal of "cultivating culture": the school garden becomes a concrete action to obtain possession of own land inside a formative process, in order to educate people to the following values: landscape/environment, economy/society, education/training, perception/senses, ethic/aesthetic.

So taking as a starting point the work of the research team applied to **[LANDesign ali-ment-azione]®,** it has been decided to involve university students of the course of Architecture Construction Laboratory held by Francesca Muzzillo with the collaboration of Fosca Tortorelli for a theoretical-practical work, which is characterized by the following objectives:

• **Recovering** abandoned and neglected outdoor areas in order to convert them into school urban gardens or school agriculture gardens, with the goal of spreading the culture of territory, its regeneration and its traditions.

• **Proposing** a development model which is based on the cultural, social, historical, culinary, food supplier, environmental, landscaping

values, considered as essential for promoting a true food culture through a systemic approach. An approach that is more and more focused on products, people and the relationships which bind them.

This project turned out to be one of the possible concrete solutions to the emerging demand prompted by EXPO 2015 by the three concept: Architecture, Agriculture, Food, which examine various fields and acts through several tangible actions.

Considerable interest was related to recovery actions of the outdoor spaces of the abandoned school buildings and converting back into farming gardens designed and created between the students of the degree courses in Architecture and Industrial Design, school students of all levels, families, businesses and organizations.

Since 2010 to nowadays the Project has achieved results of significant importance, involving more than 350 schools in the Campania region at all levels and leading to the realization of about 250 school gardens.

These results confirm and demonstrate how school gardens, not only represent a concrete resource for individuals and families, but also a new concept for organizing ideas and practices on urban sustainability, on the complex relationship between man, nature and the environment and even more on the general quality of life.

So school gardens are a way of building multiple outcomes and integrated-type as individual, social, environmental and economic impact that are related into the relationship with nature, health, nutrition, environmental education, personal growth, and expresses their own culture and social cohesion.

Below it is interesting to quote some of the works developed and how a simple exercise has generated curiosity and interest with a scientific approach.

The students, in fact, have been able to recover plot, leaved into disrepair, turning them into small gardens. In several cases the focus has been especially important in the learning experience as a social aspect, starting from an initial reconnaissance of the school students selected through simple cognitive tests and involving them in first person (Fig.1-2).

The fact itself of making a small kitchen garden or recover an outdoor space unused (in some cases even with the support of small farms and nurseries) made the experience very concrete and formative.

Fig.1 Soreca R., Mattiello R., Vobbio A., Puca G., Luiso R, Santi,R. “Scuola media statale V. Rocco” di Sant'Arpino (Ce)

Fig.2a Gigantino I., D'Agostino I., Mosca A. "Scuola media statale Renato Fucini" di Gragnano (NA)

Fig.2b Gigantino I., D'Agostino I., Mosca A. "Scuola media statale Renato Fucini" di Gragnano (NA)

This project has also enabled us to offer important group activities, which fostered cooperation, as well as moments of individual growth, cultural and social awareness.

Notes

[1] See http://www.gsd.harvard.edu/#/projects/void-urbanism-a-genealogy.html
[2] See Muzzillo F. Aperture e spazi di luce, Graffiti Napoli 2004
[3] Pianificazione per le diverse fasi della vita, Comunità n. 12, 1951, p. 43
[4] http://www.ali-ment-azione.it
[5] Docenti presso il Dipartimento di Architettura e Disegno Industriale Seconda Università degli Studi di Napoli

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Housing Policies and Urban Economics Vol.3 / 2015, pp. 87 - 111

Climate responsive design. Research, strategies and assessment criteria

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Sunto: Le città, così come i territori costruiti, hanno recentemente subito alcune importanti modifiche: mutazioni culturali, nuovi equilibri geo-politici e di cambiamenti climatici. Tutti questi problemi appaiono anomali in un momento in cui la molteplicità di informazioni e conoscenze in rete dovrebbero moltiplicare le risposte, anche se in realtà non sembrano avere successo. Il ruolo del progetto è cambiato e il presente lavoro esplora alcuni approcci innovativi che il gruppo di lavoro ha adottato per la ricerca su questi argomenti.

Parole Chiave: Progetto di Parametric-Algorithmic, Codici/Protocolli di progetto, Net-Zero-Energy Buildings, Innovazione progettuale.

Abstract: Cities, as well as built territories, have recently undergone some major changes: cultural mutations, new geo-political balances and climate changes. All these issues appear anomalous in a moment in which the multiplicity of information and the networked knowledge should multiply the answers, though they don't seem actually to succeed. The role of the project has changed and the present paper explores some innovative approaches that the working group has adopted to research about these topics.

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Keyword: Parametric-Algorithmic Design, Design/Protocol Coding, Net-Zero-Energy Buildings, Project innovation

Introduction

This paper describes the research activities of the joint working group (Department of Engineering of the University G. D'Annunzio of Chieti-Pescara and College of Architecture of the FIU Florida International University of Miami, USA) about the topics of sustainable transformations within a time of great changes, to be intended not only as an energy-saving and environmental issue, but also as a socio-economic concern. The attempt is to investigate innovative design solutions, appropriate to different geographical, cultural, environmental, social and economic contexts; according with the need to reflect on new lifestyles and new desires induced by the global socio-economic conditions. The geo-political instability and the following emergencies (great migration, capitalism and widespread poverty, social exclusion…), along with environmental events not always predictable (earthquakes, floods, rising water levels, melting glaciers...) has directed the research within a wide framework of awareness about the existence of a large and consolidated information system and of a global scale data interchange (Smart City). In this sense, more space was allocated to the third chapter, whereas the contributions of the other three have been summarized.

The *first chapter* (*Mammarella*) explores the changing conditions of contemporary planning and designing, stating the need to seek new design paths within the awareness of new cognitive variables, tangible and intangible (construction and desire).

The *second chapter* (*Panarelli*) analyzes the design approach of the *Climate Responsive Architecture*, seen as the only possible way to operate within the current context of major climatic changes, technological innovation and computerization of processes.

The *third chapter* (*Spiegelhalter*), the largest, illustrates the current state of the ongoing research on *Climate-Responsive*, *Carbon-Neutral Architecture Protocols* and *Design/Built Projects*.

The *fourth chapter* (*Di Tonno*) identifies a natural bridge over the continuation of future research of the group, outlining (starting from the

author's doctoral work) the basis for new operating criteria (*SMART System* and *SMART Protocol*). It is currently in realization a web platform through which it is expected the checking and testing of the elaborated theories.

1.Transforming cities in the age of desire

Knowledge, awareness... doubt and desire.

Actually, it is difficult to imagine whatever kind of strategic planning, aiming to transform cities and territories, without a full capacity of thinking in terms of knowledge, awareness, doubt and desire.

However, let's go in order.

At the base of any further consideration, we should immediately agree – or at least understand each other – on the fact that since the second half of the last Century our civilization has experienced a radical change of its general cognitive conditions. A change which, consequently, has repositioned design and planning activities within an operative context someway unrecognizable from the one delivered to us by history and Western tradition.

After what Gertrude Stein has defined as the epistemological break of the postwar years, the certainties bred through nineteenth century science have been ruptured, destabilized; the idea itself of progress, with its secure relations of means and ends, thrown into radical doubt [1].

In architecture, these were the years of an unprecedented availability of materials and technologies, combined with an equally unprecedented wealth of needs, fed inside of a newborn– and yet hyper-pervasive – communication society. An evolution so extreme and irreversible from the Modern culture of the early Twentieth Century as to result as a kind of genetic mutation; far beyond – to be clear – from the product of a so-called International Style. A real paradigm shift.

A deep shift from the mechanical and rational sum of needs and numbers (human measured) to the integral of ambitions, dreams and subjectivities (universe measured – we may say, according with the Italian architect Carlo Belli, arguing with the rationalist Le Corbusier about sixty years ago) [2].

Knowledge and awareness, doubt and desire.

To investigate and to plan strategies and methods, as well as the final figurative layouts which better embody the spirit of the Twenty-First Century, thus implies the reinterpretation of its possible transformations in light of this shift of paradigm.

A shift which is probably the core of what may today be defined as the dual problematic dimension of contemporary design and planning.

On the one hand, there is the compelling influence of the Rational equipment, still trusting in the infallibility of the Number: volumetric index, distances, financial statements, transports flows... the last heritage of a positivistic age, yet fully operative into all our currently available instruments (plans, surveyings, zoning...).

On the other hand, the spread of a general condition of subjectivity and permanent doubt in which the technical proposal as much as the more specialized determinations fade and dissolve into a generalized and widespread confrontation between the many actors involved and potentially entitled to participate in any process of transformation (committees, associations, administrators, groups of citizens, stakeholders, technicians, civil servants ...).

It is – in this latter case – the success of an overarching dimension of radical doubt and subjectivity, largely and progressively developed in almost every field and activity; supposedly produced into the dynamics of a *contemporary capitalism* – to say it with the French-Italian philosopher Maurizio Lazzarato [3].

If subjectivity has currently became the 'key good' produced within a collective concatenation of economic, social, communicational production (thus including space, architectures and artefacts), we have to face the fact that the economists have probably already understood – although not always fully consciously – that the rules of production are well beyond the defined needs of Social Theory of the Nineteenth Century. Indeed, they all seem to be engaged in what Michel Foucault called the *aesthetic of existence* [4] and Felix Guattari called the *aesthetic paradigm* [5].

Nowadays, the rules of the 'production of self' (of subjectivity) are no longer those written and described by the systems of Power, but the 'optional' and procedural ones that are invented establishing *sensitive*

territories [6], producing the otherness of an *other life* and of an *other world* [4].

In these terms, the most powerful agent of our epistemologic dynamics (and, consequently, of those ones transforming space and territories) is *Desire*. In many ways, capitalism's production – always according with Lazzarato's theory – doesn't seem to lie primarily in the division of labour, in specialization, competition or knowledge, but in the fact that it activates, captures and exploits an *economy of the possible*, an *economy of desire*.

We have desires only when there is a possible, a proliferation of possibles, only when, starting from the break of previous balances, relations appear that were impossible before.

Desire thus means acting far from equilibrium; just as – we may say – projecting and planning.

This radical condition of subjectivity and desire probably constitutes the most interesting and prolific field of research that architecture, urban planning and academy in general should actually try to investigate.In other terms, we might say that the necessary step to guarantee the implementation and effectiveness of any transformation of our cities and of our territories has to include the processing of complex responses to a complex contemporarity where - inevitably - the architects are called to operate.

Not so much and not only to define those that the same Lazzarato calls "the conditions of a break", nor to identify "the specific tools to escape the industrial and serial manufacturing from the state" [7], but rather to develop a model of proposal and reflection about the world which, starting and sharing the current state of the art, it is likely to include the project of architecture among its more actual and aware tools. Supposedly halfway between personal aspirations and self-interest capitalist, between Companies, State and inhabitants of what we could now definitely call the *city in the age of desire*.

2. Technological innovation and Climate Responsive Architecture Approach in the project

Climate and social change, quantity of data, material innovation, new systems and methodologies have direct impact on the way of designing the city of tomorrow. Climate-responsive architecture can be defined as architecture aimed at achieving occupant thermal and visual comfort with little or no recourse to nonrenewable energy sources by incorporating the elements of the local climate effectively [8].This refers therefore to architecture that reduces the negative impact on the environment & sustains the ecosystem of which it is a part[9].identifies the main paradigms of Climate Sensitive Architecture as: (a) Energy Efficient Design (b) Preservation of Natural Ecosystems (c) Use of Renewable Energy (d) Water Resource Management (e) Use of Eco-friendly materials (f) Ecological Landscape Design (g) Solid Waste Management and Healthy Indoor Environment. Köppen climate classification is one of the most widely used climate classification systems. It was first published by Russian German climatologist Wladimir Köppen in 1884, with several later modifications. The system is based on the concept that native vegetation is the best expression of climate. Thus, climate zone boundaries have been selected with vegetation distribution in mind. It combines average annual and monthly temperatures and precipitation, and the seasonality of precipitation.

The Practical Approach. Having established that design with climate is essentially driven by planning a proper projection, a practical approach is to carry out a stage-by-stage phased approach to design schemes. Haruna describes architecture as being successful if it acts well and does the thing it is required to do [10].

If this success is to be achieved, a staged approach (referred to as Phases 1 and 2) is suggested and it involves investigation/evaluation and synthetic application of design responses [11].

Phase 1: Investigation & Evaluation

Clearly, any analysis carried out will give specific results depending on the factors determined by local conditions. The deductions from the information in Stage 1 should guide the architect subsequently.

Phase 2: Synthetic Application

This involves the application of various measures to deal with the problems identified by the analysis and evaluation process. Basically this means taking measures to address Passive Cooling, Orientation, Shading, Insulation, Thermal Mass, Passive Solar Heating and Renewable Energy.

Building form together with plan geometry, building orientation, surface to volume ratio, mass, service and natural ventilation are fundamental elements for the design choices included in its climatic context.

Building envelope is the interface of the building with the exterior surroundings determining the exterior appearance but mainly plays the role of regulating the thermal exchange, exactly how the skin of the body. The proper selection of walls, roof and floor system (materials and technological systems in general) are important components of energy saving strategy. The use of material for construction building causes consequences for the impact which follows in the environment.

Together with reflections on known themes (building form, building envelope, materials, wall system, et.) new scenarios for the project are opened thanks to the logic of the algorithms, the different scales, building, urban, territorial. Some important experiments are conducted on different scales, the most interesting surely Fibrocity project (Cameron Newnham) [12].

This project attempts to use algorithmic means to imbue the intent of the designer into the project. It attempts to challenge the normality of simply applying existing algorithms architectural problems. In this sense, it becomes sculpting through lines of code and tweaks of parameters attempting to remove the ‘manual’ input. In this sense, it becomes scupting through lines of code and tweaks of parameters attempting to remove the ‘manual’ input. It is, therefore, an attempt to highlight the difference between an architectural algorithm versus an applied algorithm. It begins with an agent-based algorithm, those generally used to simulate things such as schools of fish or flocks ofbirds. This is used due to the ability to make many complex decisions at a local scale and have emergent global outcomes. In this case the simplicity of the highway infrastructure means programmatically the algorithm is dealing with sound attenuation walls and pedestrian bridges.Through a highly technical feat, the algorithm performs and responds to FEA analysis,

locally attempting to alter its form to allow greater structural performance.The last factor is simply that of personal taste, or beauty, which in this case is an attempt to create highly excessive and complex form that still is cohesive across scales. Through this we propose that algorithmic design currently leans far too heavily on simply application of existing systems. Algorithmic design should take into account a much greater spectrum of architecture, not just beauty, and be intricately tailored to a project, rather than found and applied.

3. Climate-Responsive, Carbon-Neutral Architecture Protocols and Design/Built Projects.

3.1 What is the Problem to Achieve Carbon Neutrality?

The average temperature of the Earth's surface has increased by about 0.85°C in the last 100 years. Thirteen of the fourteen warmest years were recorded in the 21st Century, with 2015 on course to set another record. Scientists believe that human caused Greenhouse gases (GHG), mainly carbon dioxide, released from society's activities such as resource use in industry, agriculture, cities and buildings, transportation, etc., are adding to the natural greenhouse effect. These human activities such as burning fossil fuels like coal, oil and natural gas are increasing the amount of carbon dioxide (CO2), the main greenhouse gas responsible for global warming. Carbon-absorbing forests are also being cut down. The concentration of CO2 in the atmosphere is now higher than at any time in the last 800,000 years and reached a record high in May 2015 this year. How can society stop and mitigate this trend of global warming and climate change?

A recent deal to limit the rise in GHG and global temperatures to less than 2° C by 2050 has been agreed during the climate change summit of the 21st Conference of Parties (COP21) in Paris after two weeks of negotiations on Saturday, 12 December, 2015. Nearly 200 countries have been attempting to strike the first climate deal to commit all countries to cut emissions, which would come into being in 2020. The agreement is partly legally binding and partly voluntary [13]. The draft now goes to

government ministers and different countries to perform challenging ratification procedures back home.

The first kind of protocols to address the reduction of GHG's at many UNO conferences before the recent GOP21 were in Stockholm in 1972 and later the Brundtland Report in 1987, the Environment Summit in Rio de Janeiro 1992, the 3rd UN Climate Conference in Kyoto with the first binding protocol, the World Summit of Sustainable Development in Johannesburg in 2002, the Bali Roadmap in 2007, and the 15th UN Climate Conference in Copenhagen in 2009.

But the recent treaty in Paris is the first signed by nearly 200 countries and the major measures of the new GOP21 agreement contain:

• To peak greenhouse gas emissions as soon as possible and achieve a balance between sources and sinks of greenhouse gases in the second half of this century

• To keep global temperature increase "well below" 2C and to pursue efforts to limit it to 1.5C

• To review progress every five years

• $100 billion a year in climate finance for developing countries by 2020, with a commitment to further finance in the future.

All these GOP21 milestone measures will with certainty support multiple efforts to further develop and implement design protocols, laws and ordinances for carbon neutral cities and buildings.

3.2 How do the Climate Change Analytics and Actions before the GOP21 and after Translate into Green Building Practice?

United Nations Climate Change scientists and policy expert's state to fulfill the GOP21 targets it would require the world to move off fossil fuels between about 2050 and the end of the century. To reach the more ambitious 1.5 degrees Celsius goal, some researchers say the world will need to reach zero net carbon emissions or carbon neutrality sometime between about 2030 and 2050.

Conversely, this is nothing new and was an urgent agenda decade before the GOP 21 in Paris for the most innovative architects, engineers and industries worldwide. Furthermore, the carbon neutrality targets until 2050 match well already in place implemented mandatory and voluntary

commitments of several European Countries such as France, Germany, Denmark, Sweden and Ireland.

The question is how carbon neutrality in architecture can and city planning better be design coded and automated, included in ordinances of planning permit processes and finally built and periodically benchmarked? It is uncontested that the automation of green practice is the most successful pathways of interoperable computation for design workflows towards carbon neutral architecture. Major international agreements, before and besides the GOP 21 in Paris, that set new mandatory targets for achieving Net-Zero-Energy-Buildings, Infrastructures, and Cities by 2018-2030 are and will be a major driver of process automation with integrated project delivery in the Architecture, Engineering and Construction (AEC) industry. While there is a growing number of software applications and countless methods for writing custom applications and programs capable of leveraging the use of learning algorithms for many tasks within design process, there is still a very limited understanding of how to integrate and adapt these capabilities into fully automated design factory-file workflows. It is also known that the most improved predictive systems in international design/built examples are the most automated ones. The present generation of computational design optimization tools with whole-project analysis platforms, manufacturing and building automation as they are currently used in the practice of engineering and architecture will change in the next decade. The next generation of design tools will be a type of Green Automation, where designers and engineers deal with graphical descriptions of system and complex cloud software with machine learning algorithms that automatically translate repeatedly new models into optimized executable software. This new era will reorder the global AEC business for decades. The AEC industry that capitalize on these changes across their entire development will set the tone that others will be challenged to follow to remain competitive [14].

3.3 First Net-Zero-Energy Building Design Movements and Workflows

Worldwide, so-called net-zero fossil energy or carbon-neutral buildings and cities are still statistically pioneering concepts with some exceptional, mandatory, national or local code and design protocol implementations in the European Union. Historically, several German municipalities started early with politically driven low-energy and passive house concepts and local ordinances as part of their green party policies and building permitting processes. The imperative for such alternatives to radically design/built energy efficient architecture was mostly supported by grass root movements and alternative anti-nuclear movements with new research eco institutes throughout the nation during the critical phases of the energy crises between the 1970s and 1990s.

With the German renewable energy Feed-In-Tariff (FIT) advanced renewable tariff or renewable energy payments major policy mechanisms and incentives were designed to accelerate investment in renewable energy technologies and low-energy, passive or plus energy building typologies since 1990. These incentives led to innovations in experimental building and city planning by offering stable long-term contracts to renewable energy producers in short pay back periods, typically based on the cost of generation of each technology and applied or integrated in buildings and all kind of types of infrastructures

Almost a decade later, in November 2009, the European Parliament and the European Commission agreed to recast the Energy Performance of Building's Directive (EPBD) from 2003 to make it mandatory that all new buildings in the European Union must use nearly net-zero fossil energy with feed-in-tariffs or onsite renewable energy generations by 2018-2020. The following diagram illustrates the adapted Net-Zero-Energy (NZE) building design, NZE balance line, and benchmarking flow.

3.4 What are Interoperable, Automated Carbon-Neutral Design (CND) Workflows?

The real world planning activities and research and development of CND's to support the targets for carbon neutrality can temporarily be accomplished through interoperable parametric-algorithmic design optimization processes to predict the future of the operational resource use of buildings. These design workflows also incorporate total life-cycle scenario tools for performance, material properties and resource use, and design-to-factory procedures.

The intended interoperability for these building information model (BIM) platforms is the capability of autonomous, heterogeneous systems to work together as seamlessly as possible to exchange information in an efficient and usable way. The advantage is described that these 3-D/4-D/5-D-BIM design platforms links variables, dimensions, and materials to geometry in a way that when an input or simulation value changes, the 3-D/4-D/5-D model automatically updates all life-cycle scenarios and components simultaneously [15].

Some of those interoperable BIM platforms allow free plug-ins for several CAD tools (Graphisoft, ArchiCAD, Autodesk's Revit Architecture & MEP, Rhino, SketchUp, Grasshopper, Bentley, etc.). However, the major problems with this plug-ins are the inconsistencies in the non compatible format exchange between different platform applications. Other limitations are the missing graphical human-computer interaction (HCI) user interface capabilities to allow easier and faster input and output of data with simple automated adjustments and improvements via learning algorithms. Cloud-based service for architects that enables data exchange capabilities in gbXML format for automated building thermal geometry zoning, energy, water, carbon, and life-cycle analysis. The Cloud service engine imports any space type, usage, schedule, systems, components, and location. It automatically accesses over a million virtual real-time data-collecting weather stations worldwide. The analysis runs automatically through multiple parameters and algorithms of international, national, or local code compliance.

In general, each of these BIM engines generates predictive statistics and can compare baseline parameters with selected or customized Energy

Star, LEED, DNGB, UK-BREAAM, CASBEE or UNFCC Carbon Emissionsratings nearly all aspects of a building life-cycle during the design and planning process.

However, most of these Cloud services or BIM platforms for architectural design workflows depend – for example – on DOE-2, Energy Plus, or TRNSYS software algorithms and therefore inherit several of their problems and limitations. In particular in academic or professional further education procedures cumbersome software glitches or incompatible software files hinder knowledge transfer and updates in implementing carbon neutral design flows.

3.5 Space Planning with Synthetic User Experience

Another example of semi-automated design represents Christian Derix's developed "Space Planning with Synthetic User Experience" at the Computational Design Research (CDR) group of Aedas|R&D. It features early forms of semi-automated design flows during 10 years from 2004–2014. The group focused on developing design methodologies that would provide architects and stakeholders with new real-time, algorithmically semi-automated driven design flows and representations of space planning. Both types of models—syntactic spatial analysis and epistemic generative design—have always run in parallel and recently also synthetically, being the first models that integrate the two approaches. Fig. 1 shows an example of an initial random placement of accommodation units for a Building in Abu Dhabi with interactive and semiautomatic ordered layout, block model visualization, and second skin developments for final envelope optimizations and scenarios [15].

Fig. 1, Space Planning with synthetic user experience by Christian Derix, AEDAS: Abu Dhabi Education Council competition, Abu Dhabi, UAE (2009). From left to right: Initial random placement of accommodation units; interactive semiautomatic ordered layout; block model visualization; second skin for final envelope extends. (Courtesy of Aedas Architects, Christian Derix, 2014.)

3.6 Game Engines for Real Time Space Planning and Knowledge Transfer

Another example of real-time space planning is games engines, such as Quest3D® fed by 3D-data resulting from multiple scenario inputs of Built Environment Modelling (BEM) tools. Today we can create navigable, immersive integrated 3D urban models that illustrate potential flooding, adaptable infrastructures and buildings, cities, storm, humidity and air movement, and people or vehicle circulations using false colour. Based on information from Geographical Information Systems (GIS) databases and accurate physical analyses, these quantitative interactive 3D environments provide unified, multidisciplinary representations of proposed urban development and building walk troughs [16]. They help to analyze increasing environmental challenges that require that stakeholders and planners share knowledge and work together to reduce and mitigate environmental, economic, and social degradation induced by climate change.

The SLR design concept was based on the fact that as people finally accept sea level rise, because it's too late for sea walls or horizontal retreat. Designing and building a safe upper level above the existing flood

zones, away from direct SLR impacts, waves or storm surge, water supply and salt water intrusion into the sediment geology, is the only feasible option as the inundation increases in Florida. By the time polar ice caps have melted and the Russian taiga zone releases dramatically methane gases, the elevated landscape city is complete. The project was shown at a two-day national Rising Sea Summit in Boston in December 2015 featuring international, national and local macro-scale to micro-scale approaches for the resiliency of urban environments and energy and transportation systems.

The author also presented semi-automated "what-if-design-scenarios" that involve relinquishing space to water and integrating the natural regenerative potential of low-lying regions with adaptive, amphibious blue infrastructures. He mandated that holistic parametric-algorithmic planning with design agents should take full advantage of the dynamic relationship between land and water for flexible, carbon-neutral lifework hydro-geographies. These new geographies are more adaptable to climatically changing tides and seasons. Built carbon design protocols that demonstrate floating and renewable energy and water producing infrastructures and aquatic lifework networks with alluvial sponge combs to mitigate floods [17].

3.7 The Next Generation of System Integrated CND platforms and executable software

The next generation of system integrated space planning and CND platforms will be a type of inclusive automation, where computational programming and carbon neutral manufacturing will be completely processed within the automation domain and not anymore in terms of computer systems. Designers and engineers will use flexible and easy graphical descriptions of the used system model and then there will be a more complex portion of software with integrated high-speed machine-learning and data analytics algorithms that automatically translate in real-time new models into executable software. Another change will dominate the future will be that the process of computation will be replaced by model-driven developments toward the use of conceptual models of applications rather than by concepts of computation.

In addition, the next generation of platforms will also include personal supercomputer systems and interoperable Cloud-service worldwide. With such high-speed Cloud-service supported super computers, sensor infrastructural polling in event-driven architecture simulation will eventually update or replace all the fore mentioned data exchange BIM platforms, which are currently only, based on fixed or variable time step simulation concepts. Today many sophisticated software applications are available to design and engineer infrastructures, buildings, and industries. For example, Siemens AG, a German multinational engineering and electronics conglomerate headquartered in Munich and Berlin, already uses and further develop the latest parametric-algorithmic and automated 3D/4D optimization tools and how they are utilized to plan and operate entire factories and production lines in the automotive and transportation industry. SIEMENS works in the divisions of Industry & Factories, Energy, Healthcare, Infrastructure & Cities, and Siemens Financial Services (SFS). Siemens broad range of existing activities includes digital factory design and real-time operation with PLM software. Many automotive industries from the Volkswagen Group, Mercedes or BMW use their Tecnomatix robotic simulation tools, genetic algorithms (GAs), neural networks, and wasp swarm optimization of logistic systems and automation. [18]. The revolutionary SIEMENS digital (Self-Learning) Factories and Automation showcases just the latest parametric algorithmically driven multidimensional optimization tools in industrial design and in the automotive and transportation industries. For example SIEMENS PLM and Tecnomatix tools with integrated machine-learning data analytics algorithms renew and optimize constantly the software models during design, manufacturing, assembly, and operation.The PLM capabilities offer open event architecture with multiple interface support, value stream mapping, and automatic analysis with constant optimizations of simulation and measured results to produce and deliver products and systems just-in-time (JIT) or just-in-sequence (JIS) [19].

3.8 Human-Computer-Interface in Green Building Automation Systems and Manufacturing

Today's building automation systems (BAS) are centralized, interlinked, and sensor driven human-computer-interface (HCI) networks of hardware and software. They monitor, control, and optimize in real-time the environment in residential, commercial, industrial, and institutional facilities. Whilemanaging various building systems, the learning automation system ensures the operational performance (transportation, light, water, HVAC, energy generation, storage and distribution, etc.) of the facility as well as the comfort and safety of building occupants.Today, most BAS operate with intelligent agents (IAs) and machine learning algorithms by identifying patterns for real-time optimization potential including time scheduling and trend logging and verification of building automation process. Intelligent agents in a BAS are sensors and effectorsthat interacts with their environments. The systems topology of most BASs include the real-time generation of knowledge patterns and locations in multiple data scales that reiterate, change, and optimize automatically new building energy, resource, security, circulation peak load, and user comfort management processes.For example, Siemens uses wireless, automated, self-learning two-position algorithm sensor infrastructures that constantly control and fine-tune building spaces and zoning conditioning demand. Today, fully integrated multidimensional trend data processing allows effortless event-driven polling and analysis of real-time (online) data and (offline) historical data in compliance with multiple standards. Any energy/water/resource use and cost reports including CO2 or net-zero-energy building (Net-ZEB) benchmarking values can be assembled and polled in real-time at any time during the operation of buildings [18]. For example, the Q1 Thyssen-Krupp headquarter in Germany shows how a real-time SIEMENS total green building automation system (BAS) performs with intelligent control feedback loops and learning algorithms for constantly optimized building performance, security, and user comfort operation. This system also includes a wireless environmental management system to ensure trend analysis and optimizations toward yearly mandatory net-zero-energy certifications.

The future of green building automation will be cloud-computing controlled buildings. Cloud-controlled buildings provide the flexibility to expand wireless infrastructures with sensor-collected trend data and self-programming data analytics algorithms. The cloud will be where the applications run and where the data is analyzed and acted upon as it arrives. Digital data is changing; we are moving into a world with an ever growing number of data sources. As the amount of the data and the requirement for algorithms that act on the fly increase, a green BAS cloud will be able to automatically do real-time stream analytics of different variables in seconds and expand itself to accommodate the operation and peak load control needs on any scale from buildings to cities.Another example is that flexible automation with self-learning robots in mass customization will also usher in a new era of green choice and flexibility for manufacturers and clients in the AEC industry. Sustainable traditions from the craftsman era that were either lost or underscored during the era of mass production can now be individually integrated in green manufacturing and 3-D and 4-D printing settings. The fourth Industrial Revolution is under way through the increased use of cyber physical system and new degrees of complexity (Fig. 2).

Over the next couple of decades, we will see major enhancements in the use of cyber physical systems and automated scenario network planning and in high-speed cloud computing that will further improve resource innovations and flexibility.

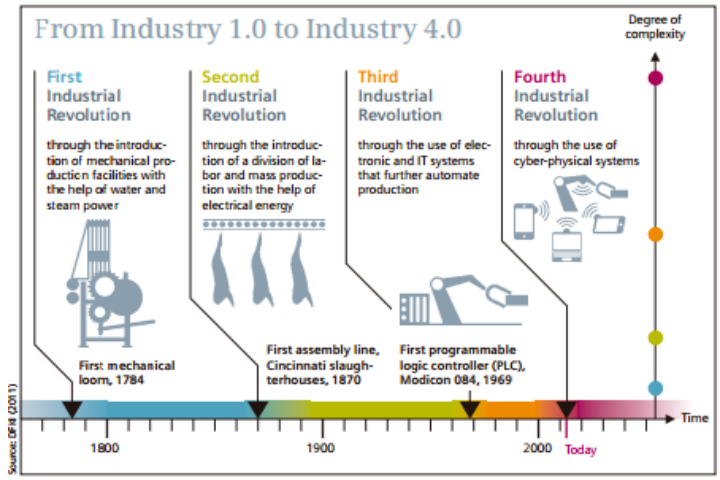

Fig. 2. The German Research Center for Artificial Intelligence (DFKI) is demonstrating how such a system of Industry 4.0 can work in practice in a smart factory in Kaiserslautern, Germany, which was built in cooperation with 20 industrial and research partners, including Siemens. (Image Courtesy SIEMENS, 2013.) [20].

Fully automated production control and optimization will boost factory productivity. With fewer inputs to make more outputs, managers and production workers will naturally still be in charge, but they will be controlling automated software and processes rather than the self-learning machinery, robots, and sensor-driven intelligent agents. Increasingly, 3D printing technology will create complex building materials, components, and systems in multiple programmable scales. Even further advances in multidimensional printing technology scales are enabling mass customization at increasingly granular levels including the design of the properties of materials even at the macroscopic, atomic, and molecular levels [14].

3.9 Conclusion

Green automation applied for design optimization, manufacturing and life-cycle sustainability will increase in the next decades. Certainly the related works presented here are neither complete nor exhaustive. It

only shows some samples that demonstrate the significance of self-organizing systems and green automation in the present and in the future.We are on the verge of a paradigm shift as Katrin Nikolaus in her essay "Building the nuts and bolts of self-organizing factories [21]. Already, software using architects have migrated from the old error, prone paradigm of programming to the "new world of system integrated and model-driven development, that is, the use of conceptual models of applications rather than computing concepts" [22].

In the future, computational programming will happen in terms of the automation domain and not in terms of computer systems. The next generation is a type of green automation, where designers and engineers deal with graphical descriptions of system and complex cloud software with machine learning algorithms that automatically repeatedly translate new models into optimized executable software. If countries, companies, architects and engineers want to stay competitive, they have to adapt to this new era of creative green automated virtual-design-to-real manufacturing, assembly, operational control and benchmarking, that will reorder the global AEC business for decades. The transformation of the AEC business will also include a shift toward digitally and biologically controlled design-to-file-manufacturing that will change the traditional role of designers and contractors.

4. New instruments supporting design, planning, maintenance and transformation of the territory (Climate Responsive Architecture, SMART System, SMART Protocol). Self-sufficient emergency modules.

The major changes in climate, economic, social and territorial in general (often cause of real emergencies) have led to reconsider the tools supporting design and planning with a new attention to geological aspects, not always taken into due consideration and with the objective of promoting the maintenance of land and works of defense, as essential elements to ensure the gradual improvement of security conditions and of the environmental quality of the territory [23].

The study of the different approaches (protocols) has made emerge the fact that, in addition to the large number of protocols in use (in different regions and further) – in Europe there are about a dozen in use – these systems are often highly specialized (for measuring/containment of energy consumption, for evaluating the degree of sustainability, etc), but rarely taking into account social, economic or managerial factors (indicators).

An interesting experiment is represented by the protocol Estidama drawn from public office in Abu Dhabi in 2010 [24].

Estidama, which means 'sustainability' in Arabic, is the initiative which will transform Abu Dhabi into a model of sustainable urbanization. Its aim is to create more sustainable communities, cities and global enterprises and to balance the four pillars of Estidama: environmental, economic, cultural and social.

The aspirations of Estidama are incorporated into Plan 2030 and other Urban Planning Council (UPC) policies such as the Development Code. Estidama began two years ago and is the first program of its kind that is tailored to the Middle East region. In the immediate term, Estidama is focused on the rapidly changing built environment. It is in this area that the UPC is making significant strides to influence projects under design, development or construction within the Emirate of Abu Dhabi. One of Estidama's key initiatives is the Pearl Rating System.

The Pearl Rating System for Estidama aims to address the sustainability of a given development throughout its lifecycle from design through construction to operation. The Pearl Rating System provides design guidance and detailed requirements for rating a project's potential performance in relation to the four pillars of Estidama.

The Pearl Rating System is organized into *seven categories* that are fundamental to more sustainable development. These form the heart of the Pearl Rating System:

1) Integrated Development Process: Encouraging cross-disciplinary teamwork to deliver environmental and quality management throughout the life of the project.

2) Natural Systems: Conserving, preserving and restoring the region's critical natural environments and habitats.

3) Livable Buildings: Improving the quality and connectivity of outdoor and indoor spaces.

4) Precious Water: Reducing water demand and encouraging efficient distribution and alternative water sources.

5) Resourceful Energy: Targeting energy conservation through passive design measures, reduced demand, energy efficiency and renewable sources.

6) Stewarding Materials: Ensuring consideration of the 'whole-of-life' cycle when selecting and specifying materials.

7) Innovating Practice: encouraging innovation in building design and construction to facilitate market and industry transformation.

Many protocols used are "hard", not open (non-upgradeable) to the constant changes and the continued growth of data that the "Smart City" provides to the networks well as being frequently "impersonal" with respect to the specificity of the transformation to deal with.

Hence the need to rethink an "Intelligent System" (SMART – also intended as an added value), able (through an appropriate protocol, adaptive and updatable) to examine the different strategic topics (environment, social, economic, management), in order to provide the best possible response to the intervention to be carried. The new SMART System flows into a web platform, able to absorb the existing data available in the network and those who, after scientific validations made by specific bodies, could then contribute to the updating thereof.

Environmental retrofit to change urban devastated land into environmentally compatible environment is a huge market and a great occupational opportunity should the macro-economic key for its opening be operated. Urban retrofit: the transformation of decayed highly polluted and polluting urban crusts into organic tissues, energy wise and climatologically reactive will supply a market and push research for alternative knowledge and materials. A sector which we can call territorial maintenance technology will require huge investments in the coming years and the preliminary signals are now emerging: continuity is entering the shift stage.

Fig.3. Model of SMART System© and SMART Protocol© (Di Tonno)

Important applications of this supporting methodology are the aim of the study of some self-sufficient modules in different contexts [25]. Important case study are: Ecos PowerCube® [26] is the world's largest, mobile, solar-powered generator. It runs on high power photovoltaic panels that extend from its container combined with an easy to set up wind turbine. Energy is stored in onboard batteries and Techstyle Haus together with many experiences of Solar Decathlon competition [27].

In this paper:
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§ 3 Thomas Spiegelhalter; § 4 Clarissa Di Tonno.

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