

Operative Public Space for Rural Brazil Strategies for Starting Up Economic, Social and Environmental Development of Rural Communities in Emerging Countries: The Goiabeira Case

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Abstract—This article stands in the context of rural communities in Brazil, where, like many others emerging countries, the overwhelming increasing markets and the overcrowded cities are leaving behind informal settlements based on obsolete agricultural economies and techniques. The pilot project for the community of Goiabeira reflects the attempt to imagine a development model that privileges the actual improvement of living conditions, the education and training, the social inclusion and participation of the dwellers of rural communities. Through the inclusion of operative public space, the aim is for them to become self-sustaining, encouraging the use of local resources for appropriate architectural, ecological and energy technologies and devices, that are efficient, affordable and foster community participation, in the respect of the surrounding environment.

Keywords—Economical development, environment conservation, local resources, participation and social inclusion.

I. INTRODUCTION

MARKETING people are beginning to talk about a “Latin American decade”: if the region can keep up the growth of the past few years, it will double its income per person by 2025, leading Brazil to be one of the world's biggest economy. Nevertheless, around half of all economic activity takes place in the informal sector and, despite some recent improvement, its income distribution is still the most unequal anywhere, dragging on growth and causing political conflict [1]. The economic growth of Brazil has focused mainly on the agricultural sector, but without bringing effective benefits for the families who live on subsistence farming in rural areas (about 19% of Brazilian population). Among these people, the poverty rate is far higher than the national average (64% vs. 35%) and food insecurity is widespread: about 3.7 million homesteads generate only 4% of agricultural production, a clear sign of multinationals’ control and non-competitive levels of productivity [2]. In the last ten years, Brazil has undertaken a tough fight against the basic social, economic and environmental challenges of rural poverty: high rate of

demographic growth; threats to ecology and agriculture sustainability; inequitable access to water and health resources; inefficient energy solutions and underuse of local energy potential; lack of education and technical training; poor mechanization and quality of working techniques and tools; weak mobility systems and difficulty for exchanges and communications; insecurity of living conditions, lack of access to housing and total absence of public space; migration and loss of labour-force. Another important feature to highlight within Brazil is a changing mainstream of the population shifts. Since the 1980s new axes of displacements toward medium-sized cities are bringing to the emergence and growth of small urban centres, such as rural habitats, mining cores and large enterprises enclaves, together with an increased importance of commuting as well as the depletion of expansion of the agricultural frontier [3].

Migration, unnecessary from the economy and detached from opportunities of social advancement, can turn to be negative for the individual [4]. The real challenge for the future will be a rural habitat ecologically sustainable, yet capable to generate sustenance and income, assure healthy and comfortable living condition and the possibility for further development of the communities [5]. This article is an intervention in the strategies of rural settlements’ development and, through the analysis of the consolidated approach, it seeks to understand whether the introduction of public space, can trigger social dynamics, environmental conservation and economic engine to foster a resilient and sustainable society against the informality and disadvantage of rural realities.

For this purpose, the article is primarily concerned with setting a conceptual framework of meta-criteria for sustainability and innovation, in accordance with Amartya Sen's well-known conceptualization of development as the expansion of the freedoms that people have reason to value based on social values and prevailing mores, asserting as well that this expansion is at the same time the primary end and a fundamental means to development [6]. In his interview for the exhibition “Design with the other 90%”, Edgar Pieterse points out 4 indivisible key principles, that he calls “Ethical Touchstones”, to pursue simultaneously sustainable infrastructure, the inclusive economy and efficient special form (or land-use), glued by processes of democratic political

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decision-making [7].

He talks about *resource efficiency* through more efficient and waste-free means of increasing economic output while decreasing the rate and the intensity of non-renewable sources extraction and consumption.

The second principle is *inclusivity*, meaning providing every resident with a fundamental set of rights to healthcare, education, land, and social space to exercise ‘cultural freedoms’ [8]. Susan Cozzen and Judith Sutz, recommend a definition of *inclusive development* that encompasses actions that are both by and for currently marginalized groups: it draws into view processes in which marginalized groups are “agents, not patients”. They also talk about the theories of *collective action*, calling attention to “strength of motivation” and “trust relationships” as crucial variables, as well as modes of interaction among participants in the innovation process. [9]. The United Nations Development Program also gives a definition of *inclusive development*: “inclusive development is development that marginalized groups take part in and benefit from, regardless of their gender, ethnicity, age, sexual orientation, disability or poverty. It seeks to address the deepening inequality across the world that has arisen despite unprecedented economic growth.” [10]

Then it comes what Pieterse calls “*human flourishing*”, a safe and nurturing context to come into one’s cultural fullness – the magic vitality that makes all cities and places unique and connected. Mostly alongside with the role played by *education* and *social networks*, it’s usual to find the concept of *participation*, intended as ‘taking part in’ the social/architectural processes. According to Paul Jenkins and Leslie Forsyth, widening social participation, or *community design*, has an essential value in the process, people being in control of decision making process related to their communities, and there’s an urgency to reassess the relationship between architects and other stakeholders (weather users or wider society), as architecture has an important social function often ignored in the profession [11]. As Nina-Marie Lister claims, “*adaptive design* emerges from a deliberative –approach to planning, design, and management. The adaptive context is one where learning is a collaborative and conscious activity, derived from empirically or experimental acquired information, which in turn is transformed into knowledge through adaptive behaviour” [12]. “A pro-poor innovation system could ... be defined as a multi-stakeholder social learning process, that generates and puts to use new knowledge and which expands the capabilities and opportunities of the poor” [13].

Finally, the last touchstone show us how informal communities represent an *economic opportunity*, pursuing more inclusive and fulfilling forms of economic development and growth to address the labour “excess” of two billion people in the contemporary global economy. The International Labour Organization defines this “informal economy” as “the activities of the working poor who were working very hard but who were not recognized, recorded, protected, or regulated by

the public authorities” [14]. Talking about economy, it should also be recognized that people can only grow and develop if they don’t suffer from *basic needs supply*: the social and economic development and self-fulfilment of communities depends on access to food, safe water, sanitation services and shelter. These are not only mandatory preconditions for survival – they also lay the foundations for the personal development of an individual [15]. Today, the basic needs approach has become an integral part of theories about human motivation, social and economic development, particularly in the context of development in low income countries, as, in our time of pretended progress, it’s definitely the house and the food to be missed [16].

To sum up, looking for an innovative concept that embraces this all paradigm of principle that has been displayed, it seems appropriate to introduce the term of *operative public space*. Alicia North, talking about community landscapes, describes them as operative public space able to develop adaptable and resilient ecologies, capitalize on innovative technologies, advance economic restructuring, reclaim and remediate spoiled lands, improve and reimagine antiquated and over-engineered infrastructure, built and strengthen social and cultural capital. “...the public spaces where people interact provide a shared sense of ownership, and the qualities of these spaces influence how the communities operate and evolve. (...) public space designed as the core for directing successful community development, is increasingly prevalent, making use of a landscape framework to support an operative landscape [17]. Charles Waldheim talks about the operative potential of landscape, as the “medium through which the contemporary city might be apprehended and intervened upon” [18]. Jorge Mario Jáuregui, specifically on Brazil, calls “active public space (...) a type of public space that has the power to act as a social articulator, integrating residents internally, within the favela, as well as externally with the larger city as a whole” [19].

II. OBJECTIVES OF THE RESEARCH

Following this lead, we formulate the hypothesis that *operative public space* can act as key player in the regeneration of informal and disadvantaged contexts in emerging countries. It is a premise to the growth and resilience of rural communities:

1. If the design strategies that integrate education and training to production, meet in an environment that fosters trades and social interaction the community becomes *self-sustaining*.
2. If the resource management is based on *public interest* and solidarity through cooperative production and storage the inhabitants gain a secure source for basic needs [20].
3. If the architectural project involves the community at all stages of the process - design, construction, management - promoting *participation* and *inclusive development*.
4. If it encourages the use of *appropriate* architectural, ecological and energy *technologies and devices*, which

should be efficient, affordable and foster community participation.

In an effort to increase the living standard (Fig. 1), the aim of the research is *the revitalization of the rural economic system*, through the introduction of new sources of income and the creation of a surplus of production that allows the active participation in trades with neighbouring communities; through improved efficiency in the use of traditional technologies and in the exploitation of local energy sources within environmental conservation and ecological balance, for the satisfaction of inhabitants' basic needs (food - water - shelter). *The seek of community emancipation*; activating social and cultural exchanges; providing basic education, environmental and health education; including cultural and recreational activities and shared-places for working and learning; and supporting self-management through technological exchanges and vocational training.

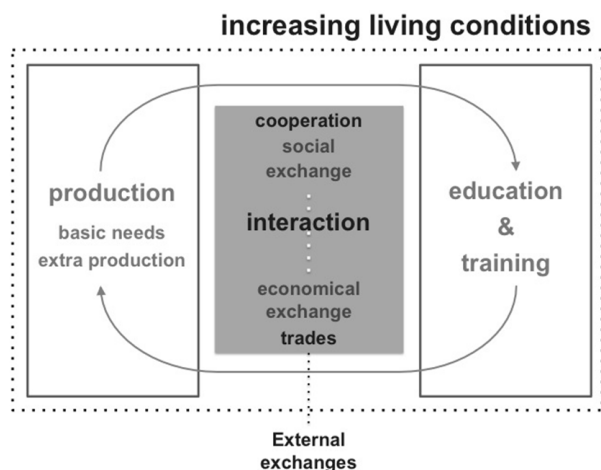


Fig. 1 Interaction of leading criteria for the community development

III. METHODOLOGY

In order to organize a paradigm of approaches and design tools to achieve our goals, we gathered and analysed a group of case studies aimed at the revitalization of communities through the inclusion of operative public space. Our second step was to study the relevant literature and common practices of participation and social inclusion for community development, extracting the widespread methodology for the educational processes and the contributions of community design. Eventually, a selection of appropriate technologies in the field of architecture, ecology and energy, have been collected and evaluated according to the criteria of efficiency, affordability and participation, for the construction and self-sustainability of the centre.

To formulate a framework of design strategies for the creation of operative public space that needs to be both functional and closely related to the local context and the needs of the community [21], it's possible to envision a design methodology that involves the inhabitants from the very first step until the management of the complete work. "By

accepting that open space evolution builds stronger communities, community landscape can be designed as dynamic systems through an understanding of the phases of a project and the impact that each design phases has on community development, including how the community can be involved. This furthers the notion that (urban) open space is an ideal mean for community transformation, in its ability to be continually remoulded and shaped to suit community needs" [17]. Our methodology can be summarized as follows:

A. Multisystem Analysis of the Project Site

An integrated analysis with overlaying information about the ecological factor, social factor, anthropic factor, and economic factor will help determine conflicts and confluences, challenges and potentialities of the site itself. Community involvement in this early stage will bring additional input to the assessment of the context.

B. Participatory Planning

Through consultation, the designer defines the needs, problems and desires of the community. Discussion, questionnaires, brainstorming, helps engaging the community members to draw their visions. The intervention of different stakeholders can help foster a mutual trajectory, especially when the needs and interests of the community are very diversified.

C. Preparation of Project Proposal

It is structured by a team of professionals, invested with new role of coordinators of the needs and capabilities of the community. The complexity of community planning, involving conflictive interests and concerning the management of overlapped themes (vegetation, building, interaction, mobility, waste, water, and energy systems) and increasingly complex when considering the economical factor, requires a multidisciplinary design team with experiences in areas of advanced technologies, ecology, social demographics, economy restructuring, agriculture technologies.

D. Development of the Project Proposal

It is the presentation to the community and evaluation, drafting of the final project with the consensus of community, stakeholders and contractors, and definition of the strategies for the social, environmental, energy, and economic system.

E. Appropriate Technologies

Definition of a scenario that promotes appropriate technologies for the construction of the centre, trying to combine efficiency, affordability and participation is given. Efficiency includes the devices that promote energy performances in the production and in the running process, fostering innovation or new uses for traditional techniques and local materials [22]. Affordability includes the devices that are suitable both economically and environmentally, considering the community's financial possibilities in affording construction and management costs. It also considers the characteristics of the surrounding environment for the finding

of raw materials. Participation includes the involvement of local communities in the processes for the construction of devices, both because are easy to build, or can be self-produced or somehow reread constructive historical tradition. A framework of appropriate technologies for the management of the architectural, ecological and energy systems should be provided.

F. Self-Construction Training

It is the training of the community on the building techniques and start-up of the self managed construction site under the supervision of a team of professionals. Self construction conveys the constructive practical aspects of the work with encouraging the cost-effectiveness of the system, promoting the appropriation of public space as well as the community's sense of belonging and mutual help, and generating new professionals through its training aspects.

G. Self-Management Training

It is the training of the community on the management and start-up of a cooperative. The involvement of designers normally ends after construction, leaving to the users/owners the process of maintenance, management, and design adaptation. With the dissemination of knowledge to the community and authorities involved in the upkeep of the public space or through the resilient design of the framework itself, the project is allowed to be flexible, resilient and adaptable.

IV. PRESENTATION OF THE PILOT CASE: THE RURAL COMMUNITY OF GOIABEIRA

Goiabeira is a small rural community located 20km away from Vitoria da Conquista, a mid-sized city in the South-West of the State of Bahia, Brazil. The project for the construction of the Multipurpose Centre, fostered by 'La Luce' NGO with the professional consultancy of Department for Design, Architectural Technology, Land and Environment - DATA of the "La Sapienza" University of Rome and the Faculty of Agriculture of the Universidade Estadual do Sudoeste de Bahia - UESB, aims at the promotion of socio-economic development and enhancement of the condition of disadvantage and informality of the community. Through educational activities, vocational workshops, the start of farming and small craft businesses, it is possible to provide the Community with specific development tools that can restore and enhance the local culture.¹

V. ANALYSIS OF THE RESULTS

Hereafter, we'll analyse the results of the application of the

¹ The project has been designed working closely with the community, with the aim to reinforce their ideas of economic and social development. The community centre stands out for the strong presence of the mill for the production of cassava. This crop is of primary importance for the local people and it is a primary source of nourishment. At the present moment, the project area includes the mill, a school and a well, built in 2001-2002, a carpentry and another well, built in 2011.

methodology. While the analysis and design strategies, described below, have been structured in the project area, the invariants and criteria can be considered universal and applicable in different emerging contexts. They contribute to the implementation of sustainable environmental, social and economic levels, indissolubly linked to each other.

In the first step, *the multisystem analysis of the project site* - conducted with and on the community - determines the factors to consider for the identification of design choices. The information has been collected into five groups: the environmental factor, that considers both bioclimatic and biophysics aspects; the social factor, relating to the social organization and to cultural and demographical matters; the anthropic factor, related to the transformations that humanity has operated on the landscape over time; the economic factor, and therefore the livelihood and income sources.

Starting with the *environmental factor*, from the analysis of the biophysical sphere it emerged that Goiabeira is located on a plateau at 1000 metres on the sea level. The vegetal system consists of virgin forest and fields for farming and plantation². The water supply is potentially supported by two main rivers, although none of them gets in the inner part of the territory (Fig. 2). Regarding the bioclimatic sphere, the closest weather station is located in Vitoria da Conquista, and it reveals that we are in a tropical savannah climatic area, characterized by relatively dry with temperatures, moderated by the quite high elevation³ (Fig. 3).

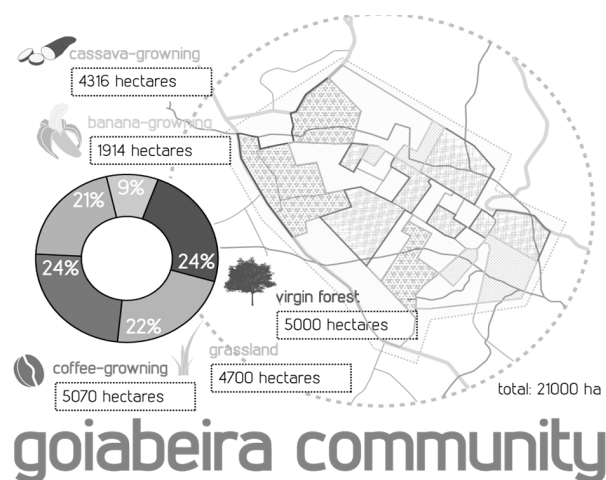


Fig. 2 Environmental factor: the biophysical system

The analysis of the *social factor* reveals that in Goiabeira live approximately 480 people. Demographic studies show

² The total area of Goiabeira is 19.290 ha. The green system consists of: 5000 ha of virgin forest, 4700 ha of farming fields, 5070 ha of café fields, 4316 ha of cassava fields, 1914 ha of banana fields.

³ From April to August rainfall is often characterized by light rain and fog, whilst from October to March they are more torrential. The average rainfall ranges is 17.9mm in July to 127.8 mm in December. The average temperature varies from a minimum of 17.8°C in July to 21.8°C in March. Altogether the temperature range varies significantly between summer and winter seasons. Source: <http://www.eurometeo.com/>; www.wikipedia.com; www.windfinder.com.

clear signals of the hardness of life conditions⁴, low levels of education, and difficult access to medical care⁵. The society seems to be characterized by a poor sense of community, diffuse low incomes⁶. Due to the small size of the community and the distance from the main urban centres, there is no evidence of criminal organization (like prostitution or drugs dealing), generally diffused in Brazil. On the other hand, alcoholism is rather common, especially among man, and domestic abuse is also increased by social distress and overcrowding. Children abandonment, especially orphans, is quite frequent. The poor sense of cohesion implies difficulties in team working that might become conflicting. The presence of a catholic and an evangelist church detects a plurality of local religions.

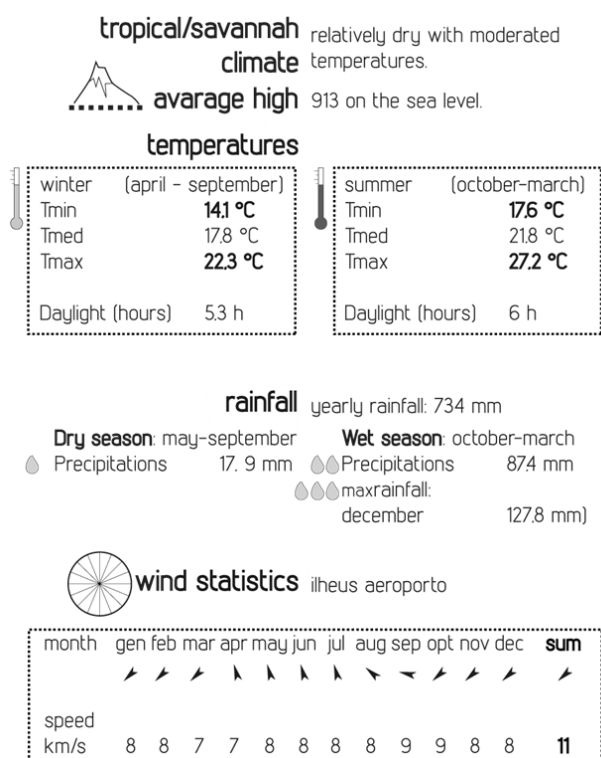


Fig. 3 Environmental factor: the bioclimatic system

Regarding the *anthropic factor*, the families received the soil in concession from INCRA, which remains the land

⁴ The community comprehends approximately 80 families, with an average of four children per family, we estimate a population of 480 people. The rate of infant mortality is around 20% and life expectancy is around 65 years.

⁵ The nearest health care structure and public schools are located in Vitoria da Conquista: this implies no possibilities for medical care or education, assumed the difficult connection with the city due to the shortage of transports and the diffuse bad conditions of roads. Furthermore local people lack general health knowledge that could help them to prevent the diffusion of common diseases - generally due to polluted water.

⁶ Because of the shortage of general resources, we can't detect significant economical differences among people. From interviews, it emerged that the community has not a clear social hierarchy, probably because of a poor sense of cohesion.

owner⁷. In the current situation it can't be detect any organic scheme of building system: generally, the materials employed for housing are low quality and often unhealthy⁸. The infrastructure system is as much informal: building grids is a slow process taking place in Goiabeira's territory development, but a systematic network organization is still missing⁹.

Eventually, the study of the *economic factor* tells us that, thanks to fertile soil, agriculture is widespread and constitutes the main source of support and income¹⁰.

Proceeding in the participatory design phase, "La Luce" Association has chosen to intervene creating a multifunctional community centre integrated in the agriculture hinterland, counting on education and training facilities and a productive area that orbit around the core for social interactions, the town *piazza*, which host social, cultural and economic dynamic relationships, that activate trades and technological exchanges for a self-sustained town in ecological and cultural equilibrium. The outcome of the community design workshops, interviews and brainstorming, the meetings with stakeholders, together with the consultation with a multidisciplinary team of professionals for the management of the complexity of design, has been hereafter summarized with the strategic/functional framework of the centre and the elaboration of a *master-plan*, as the most appropriate tool to control the environmental, social and economic overlapping systems. The structure could seem rigid, but it is necessary to control the design phase. Systems follow the analysis: the collected data are part of the critical process concerning the elaboration of design solutions. The master-plan consists of the following systems: the *buildings system* (described by functions and their interactions); the *mobility system*; the

⁷ Originally the whole Goiabeira territory was a single wide estate, belonging to Mr. Jesulino José Da Silva Filho. The land property situation changed after INCRA (Istituto Nacional Colonização e Reforma Agraria) intervention, when the estate was gave out and divided in parts of 19 ha approximately. Families received the soil in concession from INCRA, which remains the land owner. It was the same INCRA institution to donate a 2 ha soil (a squared piece of 150 per 150 metres) for the construction of the centre.

⁸ The roof present two pitches, due to the huge quantity of summer rain. The most common technology employed is adobe, consisting of compressed bricks made of row earth. The foundation, when present, is made of dry stones covered with sand and concrete, a system that helps to dissipate humidity. Local housing typologies, poorly diffused on the area, have a frequent organization scheme composed by two different entrances leading to a living area and a service area where a controlled fire, with either a cooking and heating function, is placed.

⁹ The electricity grid has been installed in 2008, but not all the houses are reached by it. Waste is collected in superficial holes in the ground and burned without any sorting or recycling process. There is no water nor sewage system and the rainwater is collected in tanks but there's no process active to make it drinkable; 'La Luce' recently provided a well for drinkable water. The mobility grid can count on a poor presence of asphalt roads, mainly located along Goiabeira's boundary, and several unmade inner roads. Consequently, connections to and from Vitoria da Conquista are difficult especially within raining seasons. No public transportation is present.

¹⁰ The mainly diffused agricultural productions are beans and cassava, whilst bananas and coffee are less present. The farming is also an important source of support and the animals present on the territory are chickens, sheep and cows. Income is mainly related with the trade of agricultural and farming products.

ecological system – including the *vegetation system*, the *water system*, and the *waste system*; the *energy system*. These components are described individually and they represent the synthesis of the research.

Getting to the fifth step, the sustainable design strategies have been investigated looking through the technological devices regarding the architectural system, the ecological system (waste & water cycle) and the energy system. The adopted technologies are part of a scenario seeking a balance between effectiveness, affordability and local involvement, setting a virtuous example for social and economical development of communities, in an attempt to maximize reuse and recyclability, components durability and renewable sources, reduction of energy and materials consumption and CO² emissions¹¹ [23].

The *development proposal* tries to systematize the outcomes of the participated design with the recommendations on the employment of appropriate technologies. It seeks to meet the basic needs of the community, providing livelihoods and access to good quality water within the community, and ensuring every household a shelter that meets the basic conditions of health and comfort, providing constructive models attentive to maximize energy performance and comfort in relation to climatic conditions in the effort to reduce the waste of natural resources and trying to limit local environmental risks.

The layout of the *buildings* (Fig. 4) plays an important role. Buildings are grouped by functions and disposed considering the relative open spaces. The plan clearly dedicates an area to the production of goods and the opposite area to education and vocational training. The two parts meet in the central social-ground, meant to be the core of cultural, technological and economical exchanges. The disposition seeks to ensure local people education; to turn on the awareness of community identity, involving local people in the project realization and

respecting local traditions, culture and society; to transfer know how, regarding food production and management and construction methods. The production band is separated from recreational and training functions through a transversal orchard crossing the area. It represents a visual and acoustic filter and a connecting mean between the green areas around it¹². The recreational and educational functions intensely interact with the open space; their disposition ensures the distance from the roads for vehicles and differentiated outdoor areas in close pedestrian communication. Public services¹³ are located in the centre with a very close relationship with the public open space. The educational facilities¹⁴ are mainly organized according to a central courtyard, to have private open spaces for educational purposes. In the matter of the consideration of the bioclimatic factors in the design of the construction system, some simple attentions are necessary to assure the microclimatic comfort of public spaces, and to maximize the exploitation of bioclimatic components of the sun and wind for passive cooling and heating of the buildings. Tall buildings occupy a board position to block southeast winter winds and the all intervention is completely open to the northeast to have a natural cooling during the summer. The morphology of the buildings is designed to optimize sustainability and energy efficiency.

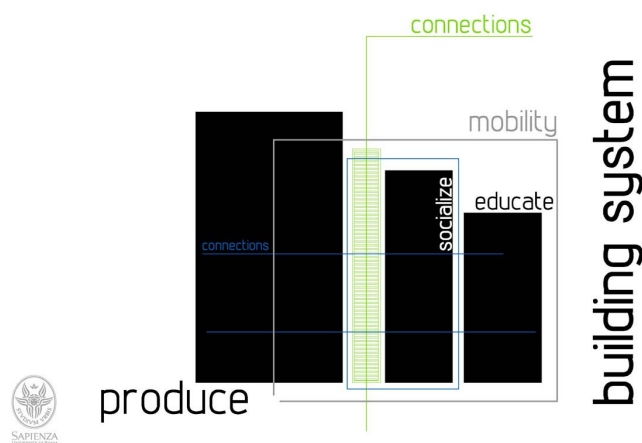


Fig. 4 Master-plan development: the building system

The *mobility system* (Fig. 5) follows the built system. Among the objective of some basic operations there are: to find a hierarchy between pedestrian and vehicle paths, the elimination of car flows within the recreational area, the rationalization of accesses and stopping points and the

¹¹ Following the leads of United Nations Environmental Program about sustainable and eco-efficient development, the maximization of reuse and recycling, was pursued with flexibility and adaptability to future reuse and renovation of spaces, environments, and also the materials and components recyclability. For the durability of components and products, we adopted high performance solutions and we privilege the use of renewable resources and energy assets. To ensure the achievement of thermo-hygrometric comfort, we favoured technological solutions with high inertia and thermal storage, also in consideration of the local day-night temperature range. In order to reduce harmful emissions, it has been chosen to control the settlement activities to limit atmosphere, water and the soil pollution. To optimize the aspects related to mobility, it has been decided to separate the vehicular and pedestrian-cycle fluxes, focusing on the last ones in order to make them recognizable, appropriate and safe with an adequate lighting system, in terms of accessibility for the community and for any emergency vehicles. Another key-objective has been the water optimization through the differentiation of pure and waste-water flows, their collection, purification to conclude with the re-entry of rain and waste water and the disposal of the dirt one. Two other important cycles to optimize have been the waste and the energy ones. In the first case it has been chosen to adopt solutions for the collection and reuse of inorganic solids waste as construction materials, compost or that used in biogas production. To optimize the energy cycle, however, we adopted a solution of low-power plant and low cost production of energy from renewable sources, production of sanitary hot water, passive heating and cooling air.

¹² The production area includes: a carpentry, a coffee warehouse, a mill for cassava production, an area for the production of compost, a bio-digester for the production of bio-gas, a recycling centre and a deposit. The guardian's house is located in a strategic position for the night supervision, together with administration and technical offices.

¹³ The core of the centre hosts the community hall for meetings and celebrations, the *churrasqueria* for outdoor parties, and a laboratory zone for the production and selling of handcrafts.

¹⁴ Educational facilities include a nursery and a space for assisted study, a library, laboratories for crafts, a first aid station and a residence for troubled teens.

connection from the community to the closer towns¹⁵.

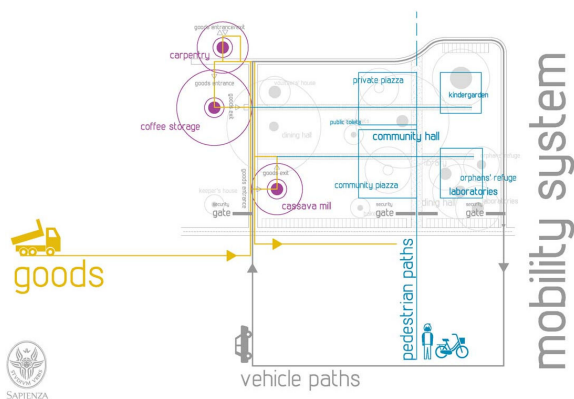


Fig. 5 Master-plan development: interactions and the mobility system

Regarding the *ecological system*, the vegetation layer (Fig. 6 (a)) is characterized by a central strip of orchards with the function of connecting the production zone with the recreational area. The strip crosses completely the lot, ideally connecting the natural boards of the area. The gardens are part of the open space system and have a demonstration and educational purpose. Fields for crops and the northeast forest belt are located along the perimeter of the community centre. The belt covers the function of cooling summer winds. The southeaster boundary of the area is lined with a wooded strip in order to have an additional screen to mitigate winter winds.

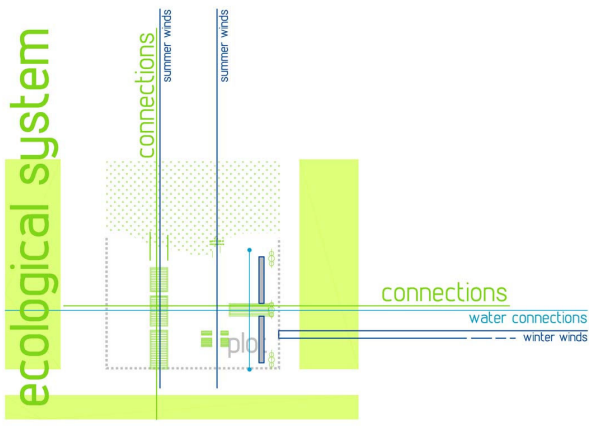


Fig. 6 (a) Master-plan development: ecological system_ vegetation

¹⁵ The community centre presents three main accesses, one is central and pedestrian and the other two are parametric and for vehicles, they describe a ring around the pedestrian area, allowing supervised entrances and the positioning of collection points for the sorting and the disposal of solid and organic waste. The driveway crosses the production zone to allow loading and unloading of goods, it is independent from the overall driveway system to avoid acoustic discomfort and danger. Some pedestrian connections, partially covered for protection during the abundant summer rains, cross the whole lot and connect the production area with the other functions.

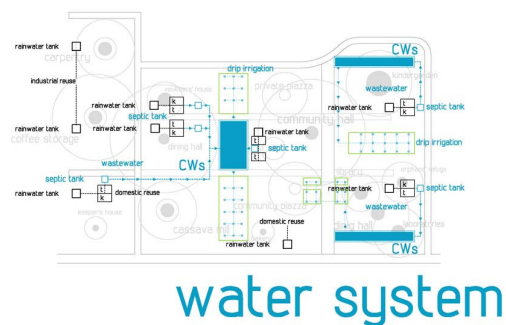


Fig. 6 (b) Master-plan development: ecological system_ water

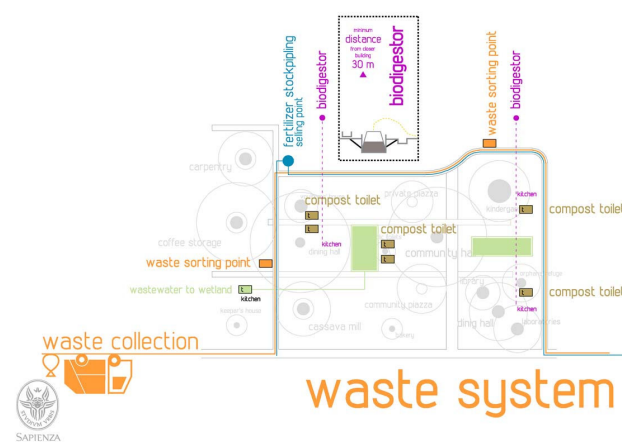


Fig. 6 (c) Master-plan development: ecological system_ waste

The *water layer* (Fig. 6 (b)) is managed through rainwater collection for domestic and agricultural purposes, through purification treatments (pasteurization and clarification). Also wastewater goes through a purification cycle for agricultural irrigation, with septic tank and constructed wetland¹⁶.

The *waste layer* (Fig. 6 (c)), resulting mainly from cultivation and management of agricultural products, can be employed for various productive purposes, such as pasture, fibre weaving, construction materials, natural fuel for cooking and heating (pellets, or biogas). Waste coming from other productive activities or from “common use”, is recycled and re-used in apposite laboratories and sold in the centre core. All this processes increase the resilience and sustainability of the community and foster manual labour experiences.

The *energy system* (Fig. 7), as well as the others, uses low cost technologies, easy to assemble and to find, efficient for their management and maintenance. Besides an efficient energy and heat distribution system that tries to avoid load losses, it's advantageous to promote the use of sustainable, zero emission technologies for the production of energy, such

¹⁶ In this particular context we chose a technology of subsurface constructed wetland: this technology allows the exploitation of the soil surface for recreational purposes and the possibility of increasing public green areas.

as systems deriving from waste re-use, solar cookers, self-made solar panels for sanitary hot water and integrated heating systems.

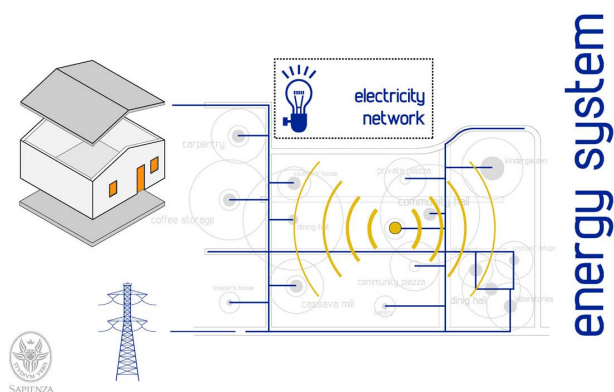


Fig. 7 Master-plan development: energy system

The *self-supporting, empowering and strengthening of the local community* have been the fundamental objectives of social sustainability. The educational program is thought to improve health conditions and to extend sex education. Education is considered the primary vehicle to transfer self-consciousness and to free the population from poverty and social exclusion. It should be common practice to introduce training programs for staple food production and for the triggering of other sources of income, such as low-cost production of goods and energy from natural sources. To ensure the empowerment of local communities, it has been decided to include meeting spots and shared public spaces for working and learning. A real involvement of the Goiabeira community has been promoted, both in the design phase and in the construction of the centre.

As the ultimate step, it's important to define models to run the operative public space in a shared and collaborative management of resources, funds and possibilities, following the lead of cooperative values of "self-help, self-responsibility, democracy and equality, equity and solidarity" [24].

VI. CONCLUSIONS

The challenges faced in this project can as well be tracked in most emerging countries. Latin American researchers have identified six factors that can spell the difference between growth and stagnation in rural area: within a strong coalition of all stakeholders, it's fundamental to dispose of reasonably equitable land distribution and availability of natural resources, access to markets, a diversified economy, government investment in infrastructure and services, proximity to midsize cities. These factors "are key elements that allow a rural territory to grow with greater social inclusion and environmental sustainability" [13].

If we agree with the principle that formality generates formality, the creation of operative public space creates skills and triggers dynamics for the continuous enhancement of the community. The cooperation of inhabitants will create models

to redefine the living degraded standard of the community. The training courses and new incomes guaranteed by the introduced productive activities, will allow families to rebuild their homes with improved levels of comfort and health. The tool of community design will arise the awareness on the importance of living in a healthy, comfortable and beautiful environment. Changing the traditional single homestead lifestyle of the farmers, by providing a community public space that acts like an urban core, living and agriculture will improve output, in quantity as well as quality, with the help of autonomous cooperation, technologically enhanced work, a diversity of trades and exchanges. Thus, everyday life, based on division of labours, can become differentiated and productive, reduce the pressure for migration and further solidarity across generations without harm for man and environment [20].

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