

Sustainability Evaluation in Ecovillages

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ABSTRACT: Sustainability guides the activities in ecovillages since its conception, through implantation, use, until management. These communities incentive to look for a sustainable way of living, giving to the dwellers harmony between people and the nature. This work deals with ecologic sustainability applied for ecovillages, by the symbolic, human, technical, environment, economic, and social performances; besides their shelter, access, and tenure dimensions; the Relative Satisfaction Degree and Critical Success Factors. This study shows a performance evaluation methodology, which was adapted to these settlements, to measure the sustainability levels reached by them. The method was applied in a Brazilian ecovillage to evaluate the user satisfaction to the sustainability and settlement management and includes quantitative and qualitative researches for a better analysis and result. The Critical Success Factors investigate what are the most relevant aspects for the settlement to improve and make easier ecovillage management. From this study it is possible to verify the real situation of ecovillages sustainability, due to set the mentioned concepts leading the performance evaluation and management of these settlements. This method can be expanded to communities, districts and cities to evaluate the sustainability and other attributes as well.

Keywords: Sustainability management, ecovillages, evaluation method, user satisfaction, Critical Success Factors

1. INTRODUCTION

To a systemic approach of nowadays' urban comprehension it is necessary to understand that the city is part of the nature as well as the ambience where the city is inserted so that it is a relevant factor on the way the city is built and maintained. In addition to that one have to consider society's conditions related to healthcare, security and welfare of each citizen.

Unfortunately, along the history, mankind put the city against the nature and the nature against the city due to the common sense that the first was disaggregated from the second or even opposite to it. This sense interferes on the way the city is perceived and affects the way it is built, bringing uncountable urban problems: polluted water, polluted air, resources shortage, frequent floods, energy demand boost, among many other issues [1]. Those problems use to be seen as if they were isolated incidents and not as interconnected and resulted from human's intervention without caring about nature's processes.

Thus, nature has been seen as a superficial beautifier, not as environment's essential part. On the other hand, the city is not considered nature's part as well and is not conceived, planed, designed, and managed under that condition. The city, its periphery and the countryside have to be seen as a single system in evolution inside the nature and nature's social power must be used instead of fought.

Interactions of human's activities with the natural environment produce a different ecosystem from that in place before the city's construction. It is a system that relies on massive energy input and raw material

where human's cultural processes led to something completely different from the untouched nature. Many environmental challenges facing cities are more significant today and their comprehension demands more dedication, too. As cities grow in size and density the many changes are produced on the air, ground, water and on life itself worsening environmental problems affecting citizens' welfare [1].

Ecovillages has emerged as a new paradigm in answering to that unsustainable cities panorama. This kind of settlement aims at preserving nature and bringing man's built spaces closer to the natural landscape on a harmoniously way, complying with sustainable values. This study shows a performance evaluation method that was adapted to these settlements, intending to evaluate the sustainability levels reached by them. This paper intends to fulfil an existent gap and thus help managing the subject of environmental study, and brings scientific approach for ecovillages empirical side through the use of performance evaluation concepts.

2. ECOVILLAGES CONCEPT

According to its most acknowledged definition, an ecovillage is a complete settlement of human handled proportions that integrate human activities in the natural environment without degradation and supporting human's health development on a continuous and permanent way [2].

As per Centro de Vivências Nazaré [3] *"ecovillages define sustainability by incorporating*

environmental, social, economic and spiritual aspects.”

This concept has been implemented by groups spread around the globe, many times depending on limited resources and with almost no institutional or governmental support. Those settlements can be rural or urban, can be built for that specific purpose (see Figure 01) or even occupy some inhospitable place as, for example, the Los Angeles Ecovillage, established in a violent county (see Figure 02) and ecovillages in Germany built at former concentration camps. Being citizens' initiatives and have no financial dependence from Government (at least, the great majority), those settlements show that the common people's will has significantly changed the way of living and observing the nature, through a respectful and harmonic relationship with environment.



Figure 1: Community Centre in Findhorn [4]

The ecovillages are a product of social, political and economic forces coming from the contemporaneous urban ambience and can be spirituals, spontaneous, informal, creative and experimental. Ecovillages are usually set independently from each other, but when many of them are implemented forming an interconnected network sharing the same urban space, they can be an answer to the sustainable urban planning question.

The conventional concept of sustainable city is translated to the biological diversity preservation and the air's, water's, ground's and life's quality, thus preserving the humanity welfare and respecting the Nature. Sustainable development is only possible if resources consumption and population growth are adjusted to the ecosystem's capability, having no sense if not linked to social equality and justice. Sustainability is one of the greatest challenges to our cities either in poor or developed countries.

Ecovillages are communities that incite for sustainability direction and represent an applicable model in urban and rural environments [5]. On 1995, in a Conference of sustainable communities in Findhorn, Scotland, the concept of ecovillage emerged launched globally. This concept was incorporated by United Nations in the Sustainable Community Development Programme—SCDP [6]. Those communities grow in vertiginous numbers, from 9 on 1995, to 15,000 on 2002. For example, take the biggest member of the Ecovillages Network: The Sarvodaya Shramadana Movement, that is a

model based on social development established in spirituality as a philosophical guide that engaged 12,000 villages in Sri Lanka.



Figure 2: Los Angeles Ecovillage [7]

In Brazil these settlements are rural in majority and do not have a minimum of 50 settlers. The process is incipient because restrictions apply to become an ecovillage habitant because it is necessary to put aside the modern life style, going back to simplicity and a major contact with nature.

3. SUSTAINABILITY IN ECOVILLAGES

The sustainability levels defended by Ecovillages' Philosophy are their development goals. Each community has its base in one or several of these principles and not always is close to reach that goal, but they are in constant evolution and improvement to reach their objectives. There are three levels of sustainability that must appear and establish the harmony of these communities: ecological sustainability, social/communitarian sustainability and cultural/spiritual sustainability [5]. This study will focus only in ecological sustainability, that can be characterized by the sense of place; organic food production and distribution; recycle system; reduction of the consumption and the garbage generation; protection and conservation of water sources; use of biological systems in sewer treatment; use of renewable energy systems (solar, aeolian energy, geothermal sources of it) for heating and illumination of the community; use of the permaculture and bioconstruction (ecological constructions, including the durability, cost and availability of materials that preferentially, are not of industrial scale and can be found in local areas, aiming at lower levels of environmental impact).

4. PERFORMANCE MEASURING

According to Rosen & Bennet, mentioned at Luz [9] *“performance is product's ability to answer user's needs and environmental impact. It is the way to address all important requisite groups in benefice of customer (...) The performance concept is a basic tool for materials, products and systems evaluation and investigation when there are no known standards”.*

To evaluate a specific product that cannot be standardized it is necessary to develop performance

evaluation methods. This idea can be applied to ecovillages because the settlements do not use to show a configuration or construction pattern, as explained before. However, not all attributes must be seen the same way because some of them can become irrelevant.

Three dimensions are utilized for the constructed and urban environment: shelter, access and tenure and six attributes: symbolic, environmental, human, technical, economic and social, as following:

Shelter Dimension: It is related to dwelling and its local physical, technical, and human characteristics. On its physical aspect, the house must correspond to the aspirations and/or performance constrains required by users, taking into account security, physical and mental comfort [9].

Access Dimension: It refers to the men's right of having access to people, like their families, friends and neighbours, to places, like squares, parks, etc., to essential human activities, like labour and residence, to urban services, like financial, medical, educational, entertainment and religious and to information through the Media. This dimension encompasses the water, energy, and communication systems [9].

Tenure Dimension: It is about the way of utilization and occupation that human beings make of equipments, physical infrastructure and urban services. From this dimension it is possible to identify the extension and ways how persons make use of natural resources and materials from the environment. It is linked to the shelter and access dimensions [9].

Symbolic Attribute: it implies on how users perceive and make building's interpretation. It means that the urban environment, as a symbolic and generic object and due to its spatial configuration and distribution, must transmit security to citizens and promote familiarity with the place. This attribute makes it possible to evaluate if the space has being understood as a common environment by its users [9]. It is closely connect with sense of place.

Environmental Attribute: it refers basically to three topics: a) the user relationship to the available constructive materials from his environment (skills and material availability); b) the user relationship to constructive techniques in place (persons and intervention in the habitat); c) consciousness to sustainable environment maintenance (person's and environmental sustainability). This attribute is intended to assess users' consciousness and involvement with natural resources [9].

Human Attribute: it refers to measuring the effectiveness in order to address physiological necessities on the urban environment. In addition to the environmental and technical attributes, this one has vital priority for the human being. It encompasses both technical and subjective aspects [9].

Technical Attribute: It refers to measuring the impact of implanted technologies on urban settlements. It is linked to the environmental attribute [9].

Economic Attribute: it refers to scarcity of all sorts of resources that impacts on costs: it deals with scarcity. User's purchasing power will define its

yardstick. It has aggregative character and covers all the three dimensions and six attributes [9].

Social Attribute: it refers to two topics: a) extern environment: evaluate if the urban configuration propitiates people's socialization and, at the same time, preserves privacy; b) internal environment: evaluate if the dwelling propitiates people meeting, preserving their privacy [10].

5. METHODOLOGY

The ecovillage chosen for Case Study was the Fundação Terra Mirim, in a city called Simões Filho, State of Bahia, located at Northeast region of Brazil. It is to consider that this place ought to be registered in the Global Ecovillages Network, having as parameters the sustainable principles also as goal of the settlement. This community has as base the social sustainability and not the ecological one; thus, it is interesting to verify the dweller satisfaction for ecological sustainability. This ecovillage has (by the time of this work, year of 2004) only 15 inhabitants; meaning that in the beginning of 2003 ten inhabitants had decided to change themselves of the place. This place use to promote courses and lectures about its Philosophy for outsiders in order to have some money to help its budget, so that its administration use to bill lodgement as well. The settlement is 8 km far from Simões Filho downtown and is placed in the edge of a federal highway, connecting Salvador, the Capital to Camaçari, great Chemical Industrial Pole.

The method needed some improvement since its based on a different scope, so that it happened during field experience while the definitive questionnaire was being applied. However it was not adopted a participative research, where commitment and researcher empathy either in the activities or in social and political relationships. Those relations are considered a corner stone of the study object. It has contributed for complying with "lifestyle in ecovillage". The observations were part of the qualitative survey research.

The organization chart on Figure 3, considered by Zapatel (1992), illustrates on graphical form the activities developed in the research.

This organization chart shows an integrated evaluation of quantitative and qualitative surveys crossing the information for studied area analysis. These surveys had involved queries with community's key-people, researcher remarks about sustainable aspects and questionnaire application that had enclosed general and specific, objective and subjective questions, for an ample ecological sustainability evaluation of the settlement and its satisfaction for the inhabitants.

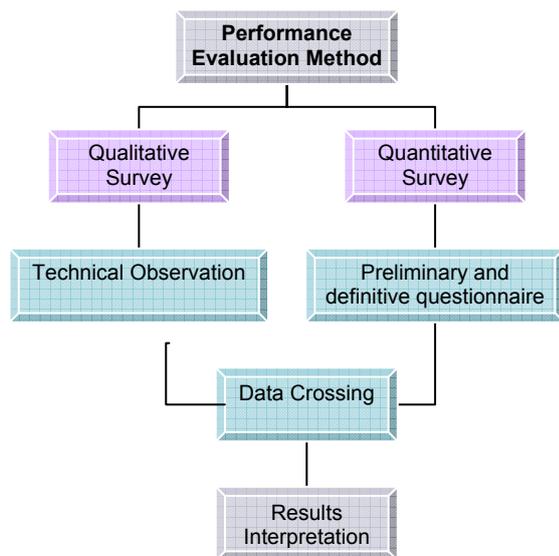


Figure 3: Organization Chart Adaptation [11]

5.1 Evaluation Matrix

The relation between attributes and dimensions with ecologic sustainability is proposed in this study on an evaluation matrix, as first elaborated by Oliveira [12] (it associates attributes with dimensions), however reviewed for ecovillages (associating dimensions and attributes with the ecologic sustainability), to characterize the factors to be evaluated. It will be possible to identify the major characteristics on taking administrative and management resolutions for ecovillage.

From Table 1 it can be established the common factors between intersections (cell) or mutual influence exerted between these qualities that represent the relation between the main aspects, the limitations and dimensions involvement, attributes and ecologic sustainability. These cells will be the base for satisfaction degree analysis and the dweller satisfaction index about the environment.

Based on ecologic sustainability principles considered by these communities and from the intersections definitions of Table 1, topics were defined to be utilized on the questionnaires. An ecologic sustainability evaluation in ecovillages is considered approaching the questions that refers to residential unit, the community, and ecologic sustainability. The interactions between human being and environment, built or not, favourable or unfavourable attitudes about the dwelling, the community and the ecologic sustainability will indicate the user satisfaction about his ecovillage.

Data was personally collected with inhabitants expecting spontaneous cooperation during the questionnaire fulfilment. The researcher observed dwellers' receptivity in this data-collection type, and the perception about ecovillage characteristics, its distribution and the utilization of ecologic sustainability concepts in ecovillage. However, only 11 of 15 questionnaires had been delivered for data analysis. The table is presented below:

Table 1: Relationship between ecologic sustainability attributes and dimensions. Evaluation Matrix including Relative Satisfaction Level.

Relative Satisfaction Level (RSL)		
Dimension/Attributes	Ecologic Sustainability (ES)	
Shelter (SD)	Dimension	RSL _{ES x SD}
Access (AD)	Dimension	RSL _{ES x AD}
Tenure (TD)	Dimension	RSL _{ES x TD}
Symbolic Attribute (SA)		RSL _{ES x SA}
Environmental Attribute (EA)		RSL _{ES x EA}
Human Attribute (HA)		RSL _{ES x HA}
Technical (TA)	Attribute	RSL _{ES x TA}
Economic (ECA)	Attribute	RSL _{ES x ECA}
Social Attribute (SA)		RSL _{ES x SA}

5.2 Relative Satisfaction Degree

The RSD for a determined dweller is the sum of values attributed for him/her to a certain number of questions that correspond to one specific dimension or attribute intersection with ecologic sustainability. The calculation of those ecovillage's evaluation indices was based on mathematical formulas, developed by Onibokun [8] whose studies were about Housing Evaluation in Canada and cited by Luz whose studies the habitability of public habitation projects in Canada and cited by Luz [9]. On mathematical expression, it is:

$$RSD_x = \frac{\sum_{i=1}^N q_i}{\sum_{i=1}^N Q_i} \quad (1)$$

RSD_x = relative satisfaction degree of any inhabitant in relation to any intersection x;
 N = number of questions involving intersection x;
 q_i = notes attributed by inhabitant, inside the scale of values adopted for the questions that represent intersection x;

Qi = maximum result possible, inside the scale of values adopted, for the questions involving intersection x.

5.3 Critical Success Factors (CSF)

After GSR calculations, it has a resultant evaluation matrix that, by visual analysis, can be extracted the Critical Success Factors (CSF) for each inhabitant. Critical Success Factors in this work is understood as attributes that are relevant as per se and two or three of them are enough to guarantee project success. In this work, the procedure to know the CSF was through an inhabitant's averages matrix. The CSF will be the cells whose RSD have been lower or inside of low satisfaction degree region. For the first case, the factors identified must be decisive on planning for a specific and local situation. On second case, the utilization considers management aspects of ecovillages as a whole, improving the quality of life for the inhabitants in the community.

6. RESULTS AND ANALYSIS

Table 2: Evaluation Matrix with RSL from 1 to 11 dwellers, RSL (averages) and final (average)

		Relative Satisfaction Level (RSL)											average
		Dwellers (values in %)											
RSL	ES	1	2	3	4	5	6	7	8	9	10	11	
				83,7	72,5	85,0	78,7	83,7	87,5	81,2	72,5	77,5	85,0
	ES	83,7	72,5	85,0	78,7	83,7	87,5	81,2	72,5	77,5	85,0	78,7	
	ES	71,7	65,0	70,0	73,3	73,3	70,0	63,3	73,3	70,0	76,7	66,7	
	ES	71,7	65,0	70,0	73,3	73,3	70,0	63,3	73,3	70,0	76,7	66,7	
	ES	73,3	64,0	69,3	69,3	73,3	68,0	65,3	69,3	72,0	74,7	72,0	
	ES	73,3	64,0	69,3	69,3	73,3	68,0	65,3	69,3	72,0	74,7	72,0	
	ES	75,5	64,4	72,6	72,6	76,3	74,8	68,1	71,1	70,4	79,3	69,6	
	ES	75,5	64,4	72,6	72,6	76,3	74,8	68,1	71,1	70,4	79,3	69,6	
	ES	80,0	68,7	75,3	76,0	78,0	75,3	71,3	75,3	74,0	84,0	70,7	
	ES	80,0	68,7	75,3	76,0	78,0	75,3	71,3	75,3	74,0	84,0	70,7	
	ES	72,4	63,8	71,4	68,5	75,2	72,4	70,3	63,8	69,5	76,2	67,6	
	ES	72,4	63,8	71,4	68,5	75,2	72,4	70,3	63,8	69,5	76,2	67,6	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
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	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
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	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
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	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	84,6	72,3	80,0	72,3	78,5	78,5	73,8	80,0	78,5	81,5	78,5	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	69,1	63,6	67,3	67,3	70,9	69,1	56,4	67,3	67,3	71,0	61,9	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	96,7	83,3	86,7	76,7	85,0	88,3	81,7	90,0	78,3	86,7	81,7	
	ES	84,6	72,3	80,0	72,3	78,5							

network. This situation happened with water conservation that got 54.54% of notes for unsatisfied too. Questions about permaculture and recyclable and sustainable materials utilization in the buildings and garbage recycling inside of ecovillage also have low satisfaction index, evidencing that community does not have the approach in the ecologic sustainability.

Technical Attribute

For the technical attribute the table 2 shows 70.10% of satisfaction (0.2 standard deviation) and 42.78% of answers to very unsatisfied, unsatisfied and intermediate. This attribute verifies the impact of technologies implanted in ecovillage.

The questions about residential unit query construction techniques that evaluate the temperature in summer and winter; the ventilation; illumination; electric and hydraulically installations; noise insulation and the questions about community inquire to its planning; localization and organization; to communitarian construction form and ecovillage integration within neighbours. These questions salient that the community does not have adequate internal and external noise insulation, because of the ecovillage localization near a highway brings about nuisance from an intense truck and other's vehicles traffic.

The community does not make use of alternative technologies considering the ecovillage principles. The institution and dwelling rely only on electric energy and sewer treatment proceeding from State and caught drinking waters of artesian wells.

7. RESULTS AND ANALYSIS

This work had as main objective to develop a method to assist the ecovillages performance evaluation and involved theoretical and methodological studies intending to supply data for interpretation about real conditions of ecologic sustainability on studied area. This work, therefore, is presented as an initial first attempt to the development of research theme based on the lack of a ecovillages performance evaluation by a scientific tool, as well similar quarters, communities and also to measure cities sustainability, tropical or not. On the other hand, this method can also be viewed as a way to manage any other settlement in order to keep them on track according to their principles.

The ecologic sustainability was focused in this work and this concept was analyzed considering the ecologic sustainability concept displayed by the Global Ecovillage Network as well. So, it was possible to elaborate questions to evaluate this sustainability level relating it with dimensions and attributes concepts, extending and deepening the existing evaluation performance method.

The application of this method on Fundação Terra Mirim showed that this community has a major social and educational performance and it was proven through questionnaire data analysis with the sample dwellers satisfaction in relation to common areas, celebrations, spirituals practical places, where its

courses and events are given. The landscape is another positive characteristic, the presence of green areas and conservation of environment had gotten good user's satisfaction. By living in community, the social aspects are emphasized and sociability between dwellers creates an affective bond between people and between dwellers and environment and explains the fact of high satisfaction with settlement, as it shows the absence of Relative Satisfaction Degree below average references.

Analyzing the ecologic sustainability level, however, this work shows the community fragility because of the lack of bio-architecture techniques, permaculture and alternative energy technology utilization, fact displayed on the determination of Critical Success Factors. Data evidence the community emphasis on social sustainability, however, salient that it needs an integration amongst three sustainability pillars (ecological, social/communitarian and cultural/spiritual) to guarantee a future with a real ecovillage sustainability.

REFERENCES

- [1] Spirn, Anne William. 1984. *The Granite Garden: Urban Nature and Human Design*. New York: Basic Books.
- [2] Soares, André Luís. *O que é uma ecovila*. [cited 01 November 2002] Available from World Wide Web: <<http://www.rbc.org.br/feijao/ecovila2.htm>>
- [3] Centro de Vivências Nazaré. *Ecovillages Training Apostil*. Level 1. 2002. *Eco-vilas e o paradigma emergente*. São Paulo.
- [4] Findhorn Foundation, The. *Photo gallery*. [cited 28 September 2001] Available from World Wide Web: <<http://www.findhorn.org>>
- [5] Jackson, Hildsur & Svesson, Karen. 2002. *Ecovillage Living: Restoring the Earth and Her People*. Devon: Green Book and Gaia Trust. United Kingdom.
- [6] Braun, Ricardo. 2001. *Desenvolvimento ao ponto sustentável: novos paradigmas ambientais*. Petrópolis: Vozes.
- [7] Los Angeles Eco-Village. *First fruit tree at Ecovillage corner*. Images of Ecovillage. 2002. [cited 01 November 2002] Available from World Wide Web: <<http://www.ic.org/laev/lmg/bldg19.jpg>>
- [8] Onibukun, Adepoju Gabriel. 1974. *Evaluation consumer's satisfaction with housing: an application of a system approach*. *AIP Journal*. Washington
- [9] Luz, Gertrudes. 1997. *Desenvolvimento de Metologia para avaliação de ambientes urbanos*. MSc. diss. Universidade Federal de Santa Catarina.
- [10] Rocha Meira, A. and Oliveira, R de. 1998. *O usuário da habitação no contexto da APO*. Niterói: Paper presented at ENEGEP, Brazil.
- [11] Zapatel, Juan. 1992. *Elaboração de um Método para a Avaliação Pós-Ocupação (APO) de Edifícios Habitacionais situados nas Superquadras de Brasília*. MSc. Diss. Universidade de São Paulo.
- [12] Oliveira, Roberto de. 1996. *Fatores Críticos do Sucesso (FCS): Uma ferramenta para projeto e construção*. Paper presented at ENEGEP, Brazil.