

# A Trans-Disciplinary Approach for a Comprehensive Understanding of Sustainable Affordable Housing

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## Abstract

*Sustainable affordable housing is traditionally looked at as a way of satisfying certain indicators linked with performance criteria; be it environmental, economic, cultural or social. Current efforts are usually based on addressing multiple criteria in isolation and tend to overlook the process of achieving sustainability, hence affecting the success of a housing policy or a sustainable affordable housing project. This paper calls for a fresh look at an integrated approach necessary to capitalize on current efforts for creating sustainable built environments. By conducting literature reviews, the paper discusses the complexity of sustainable affordable housing s while critically analyzing different characteristics found in the bottom-up and top-down approaches adopted by the professional community to achieve sustainability. Based on the shortcomings found in these approaches, the paper introduces the trans-disciplinary paradigm that is based on transgressing the boundaries of different disciplines, which is essential to the creation of sustainable affordable housing environments. The inductive and conceptual analyses of the issues involved in sustainable affordable housing stimulated the development of a responsive approach, which is devised based on integrating multiple sets of issues while envisioning the way in which such an approach can be implemented in the planning and design process of a sustainable affordable housing project.*



## Introduction

Affordable housing has long been an important planning and design concern in large urban areas and around the peripheries of major cities where population growth has led to an increasing demand for decent housing environments. The issue of affordability has attracted researchers and scholars to explore planning and design determinants of sustainable housing environments, financing mechanisms, cultural and social issues, and construction and building techniques. This interest has been the case for several decades since affordable housing themes have offered a rich research area that involves many paradoxes. Housing costs are increasing in most cities and incomes are not increasing at the same rate. Governments, on the other hand, are unable to provide sufficient housing stock to bridge the gap between demand and supply due to decreasing housing budgets and the lack of investment. Taking the Gulf region as an example, one can argue that housing markets in many cities in the region including Saudi Arabia have witnessed a rising interest in the investment of creating housing environments of different qualities including affordable housing. Despite the current surge in the construction of housing environments in the Gulf, the quest for affordable housing remains elusive for large segments of societies living in this region.

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Sustainable affordable housing has been a major topic of national policy in many countries. Strikingly, scholars argue, and rightly so, that sustainable affordable housing is a poorly defined concept, both in scientific literature and in policy and guidance documents (Brook, 2005; Priemus, 2005). However, it would appear that sustainable affordable housing as a concept seems to mean everything; it is about ecology, environment, technology, social cohesion, community sustainability, and citizen participation. Hugo Priemus (2005) argues that sustainability of housing is profit, affordability, people, and the planet earth. In the broad literature, the term is also associated with many other issues including participatory design processes, economy, environment and health, nature conservation in urban areas, compact human settlements, and livable cities. This indicates that the term is complex and needs a comprehensive perspective.

Descent, sustainable affordable housing is emerging as a critical issue toward the social and economic well being of many nations. Demands for such housing continue to far outstrip supply and those projects that are currently built in many cities suffer from severe cost constraints, while lacking important technical, social, environmental, and cultural qualities. To many architects, engineers, and developers, the terms “*affordable housing*”, “*design*”, and “*environmental quality*” are exclusive and are looked at in isolation. Once the goal of providing quality design and once the goal of incorporating environmental and social concerns, or introducing the sustainable design issues enter the discussion, it is generally assumed that the cost will automatically increase. When production techniques are developed to provide genuinely affordable housing, effort is often focused on cost reduction only while other aspects are overlooked.

The affordability of housing involves many issues of concern to different stakeholders. Recent literature (Anderson *et al.* 2003; Burnham, 1998; Chatfield *et al.*, 2000; Lawrence, 1997) indicates that the issue of affordability has broader implications that go beyond building economics and include environmental, cultural, social, and legislative aspects, simply the major components of sustainability. Thus, the provision of sustainable affordable housing involves several factors that are basically governed by environmental, social, cultural, and economic constraints. Concomitantly, the need to address some of these concerns in relation to affordability in an integrated manner is clearly on the rise.

The basic premise of this paper is that sustainable affordable housing has not been addressed in a comprehensive manner; it has been approached from a professional milieu as well as from an academic perspective. At the two levels, it has been an issue of debate where numerous conferences, publications, and consultancy reports have addressed different aspects of affordable housing. Investigating the literature that has been developed over the past two decades reveals critical arguments on the way in which such an important subject has been approached in practice, or debated in academe over the years.

Discussions, debates, and methodological research on housing in general and affordable housing in particular seem to have drifted into two domains that seldom meet (Serageldin, 1990): A) technical discussions about the problems of mass housing including land acquisition, services, credit, finance, and urban planning, or B) stylistic discussions of the cultural authenticity of housing production. However, issues are always addressed in isolation and many factors, critical to the success of sustainable affordable housing projects and essential for developing knowledge about existing projects, are oversimplified, superficially addressed, or ignored. Therefore, a new responsive approach is obviously needed; an approach that has the capacity to address multiple issues at a time while reflecting the

thinking spirit of the present era that is based on trans-disciplinarity; the integration of different types of knowledge.

## **The Complexity of Sustainable Affordable Housing**

Different authors (Maclennan and Williams, 1990; Freeman *et al.*, 1997; Chaplin and Freeman, 1999) have tried to develop working definitions for the term but there is no generally applicable definition since the term “affordable housing” is very broad and might mean different things to different people (Miles *et al.*, 2000). Affordability is mainly defined by the relationship between household’s housing expenditure and income. The United States’ federal housing programs define affordable housing as that which can be purchased by families earning 30% to 80% of the community’s median income (Chatfield *et al.*, 2000). All countries in the world do face a set of housing problems, both in provision and distribution of housing units. Therefore, the issue of housing affordability has become critical due to government disinvestment in public housing and re-placement of public housing mechanisms with market-driven systems (Whitehead, 1991). In the United States, Anderson et al (2003) highlighted that more than 14 million households – about one in eight – spent more than 50% of their incomes on housing in 1999 and three in ten households paid at least 30% or more of their incomes for housing. Thus, affordable housing can be defined using the standards most often cited in the literature and used by most scholars, government programs, as well as real-estate developers. It is that type of housing with rents or costs that are no greater than 30 percent of the area median household income.

Without reinventing the wheel and stating the typical definition of sustainable development, the authors would put the term in a nutshell. The concept of sustainability seeks to ensure that social, economic, and environmental implications of developmental activities are adequately considered during the planning and design processes. There is a growing interest to incorporate the principles of sustainability into urban development, including housing, as development activities have significant environmental impacts (Blair *et al.*, 2003). Sustainability in affordable housing research seems to encompass three dimensions; *the economic dimension*, for example, the financial costs associated with housing development, *the social dimension*, for example, the sense of belonging and the feeling of community among the inhabitants, and *the environmental dimension*, for example, encouraging water and energy conservation within the building.

International practices indicate that responsive master planning and building design could promote sustainability if the principles of sustainable development are incorporated into planning and design processes. Urban form, transportation, and housing density are some of the issues that are pertinent to sustainable housing development. In Britain, design guidance, *By Design: Better Places to Live* (DTLR, 2001) has been developed to promote affordable and sustainable housing by design. As well, in South Australia, the body in charge with housing development (Planning SA) produced a document, *Good Residential Design SA – a resource for planning, designing and developing neighbourhoods and homes* (Planning SA, 2001). The document intends to assist local government implements strategies for designing sustainable affordable housing (Blair *et al.*, 2003).

Apart from governmental documents that promote sustainable affordable housing by responsive planning and design, current research is focusing on the integration of the principles of sustainability into affordable housing design, the development of indicators and methodologies to assess the sustainability performance of buildings, and the development of prototype sustainable affordable housing. Gray (2002) and Sattler (2002) highlighted some of

the measures that should be considered to achieve sustainable affordable housing by developing prototype houses in Brazil and New Zealand, such measures include: zero waste during construction; use of recycled materials and waste products and design for recycling in future; minimum use of scarce resources and volatile compounds, poisons and pollutants; low embodied energy materials and processes; minimum disturbance of the land including minimum excavation; maximum interior volume for the materials used; maximum efficiency in spaces used for single purpose; multiple duty design – one product or system that serves multiple functions; inexpensive but robust materials, standard construction methods, simple detailing/finishes; wind generator and low-voltage electrical system and fittings, provision for solar power; Solar gain and insulation for warmth; rainwater storage/supply system; minimum waste off site during occupancy; careful avoidance of clues to ‘cheap’ construction; biological treatment of waste water; and landscaping with productive plants – xeriscaping.

The preceding measures are applicable at the individual building scale. However, mixed development of affordable and market-rate housing (Tiesdell, 2004), mixed land use development, medium density housing, and multi-modal transportation are some of the strategies that have been developed for housing development at the neighbourhood scale and beyond. In the arena of sustainability assessment, quite a number of assessment methodologies and tools have been developed to measure the environmental performance and sustainability of affordable housing (Alshuwaikhat, 2006). Blair et al (2003) highlighted the tools that include; economics assessment tools (cost-benefit analysis), material and energy accounting tools (life cycle analysis, material flux analysis and ecological footprint), building assessment tools (building decision support tools and whole building assessment systems), indicators sets and frameworks and triple bottom line assessment. Still, the social dimension appears to be missing and the underlying necessary tools seem to be ignored.

The previous review points out to the fact that creating sustainable affordable housing environments is a complex process. It involves a wide spectrum of economic, social, and environmental variables that necessitate a comprehensive approach that goes beyond typical approaches to achieving sustainability in housing environments.

## **Typical Approaches for Addressing Sustainability: A Critical Perspective**

The complexity involved in the process of planning and designing for sustainable affordable housing mandates a clearer understanding of the typical approaches of addressing sustainability and its underlying aspects - in planning and design processes. Therefore, a critical argument based on the reviewed literature is developed on that basis. Such an argument is centred on introducing a critical vision of current approaches while establishing patterns, tendencies and problems of current guidance documents.

### **Approaches to Sustainability**

When investigating recent literature on sustainability, it is believed that there are two major approaches. The *Top-Down* approach aims at developing policies, strategies, and standards. However, this approach was heavily accused of being more evaluative than informative, and that it relies on forcing the professional community to be aware of sustainable planning and design issues before responding to them. The *Bottom-Up* approach aims at building public and professional awareness, while providing feedback mechanisms. It is more informative than evaluative and relies heavily on developing a common understanding, a common language, and develops a sense of responsibility toward the environment. In recent years

however, emphasis was placed upon the *Top-Down* approach while ignoring or oversimplifying the *Bottom-Up* approach. In this respect, it can be argued that both approaches are needed and none of them can replace the other (Salama, 2002).

### **A Critical Vision of the Top-Down and Bottom-Up Approaches**

During the last decade many conferences, symposia, and colloquia have addressed sustainability issues on the policy-making levels. Law, policy, and decision makers have tailored lengthy regulations, or developed a continuous process of massaging current standards and codes to maintain a sense of responsibility toward the environment. All of these issues represent the *Top-Down* approach, however, the question that can be raised here is “have these policies, strategies, and guidelines been transformed into real practices?” Simply, the answer is that very few examples exist, and many in the professional community agree upon that. Again, the question here is “why do we not find as many examples as we find this accumulation of green knowledge that pertain to sustainable planning and design literature, which was developed in the last few years? The answer lies in the following critical statement.

Guidelines are always rough, “not-illustrated”, mainly address quantitative aspects, and more importantly they do not leave enough room, or give enough direction for the creativity of the planner and the architect. Guidelines are always generic and in many cases they do not address a specific building type or introduce specific actions in certain planning and design phases. In most guidelines, users and building occupants are always taking a back seat. Some scholars believe that guidelines represent the end of the process and by developing guidelines socially and environmentally responsive built environments can be realized. In this respect, the authors argue that no guidelines are ever final; they evolve over time according to the changing circumstances. Therefore, they have to be strategically developed based on contextual measures that respond to emerging needs and to the nature of the users (Kulman and Schurke, 2001). In fact, guidelines do not provide blue prints on how sustainability can be achieved; only a good pretty picture of what the future might be.

The *Bottom-Up* approach was also criticized in terms of time consumption. Some argue that the time invested in training programs, and awareness campaigns, is excessive. Although the results of implementing this approach are far reaching, the process takes time while developing positive attitudes toward the environment, and establishing and configuring a new culture of sustainable planning, designing, building, management and operation.

### **Patterns, Tendencies, and Problems of Current Guidance Documents**

An investigation of five sustainable design guidance documents was undertaken by Salama and Adams (2004). These were: Leadership in Energy and Environmental Design (LEED - National), Triangle Region Public Facilities High Performance Guidelines (North Carolina - NC), Commonwealth of Pennsylvania Guidelines for Creating High Performance Buildings (Pennsylvania – PA), High Performance Building Guidelines (New York - NYC), and the University of Minnesota Sustainable Design Guide (Minnesota - MN). The objective was to test several assumptions about the value and role of these documents and their implementability; these are: current guidance documents are not clear about the intended stakeholders who are expected to use them; they do not equally address project delivery processes; they do not address sustainability early in these processes; they do not provide tools for architects and engineers to utilize in real life practices; and that there are difficulties in implementing those guidelines (Salama and Adams, 2004). The results of this analysis are outlined in Table 1.

The analysis provides insights into the understanding of major trends and patterns observed in the documents; these are outlined below:

- *Addressing Sustainability Early in the Process:* All documents emphasize this aspect where the greatest opportunities for project success rest in its initial stages. However, this was not clearly translated in terms of measurements that address upfront design phases.
- *Awareness and Involvement of Clients and Users:* The documents place emphasis on sensitizing clients and users toward understanding the key issues underlying sustainability. However, they do not clearly explain how the awareness and involvement processes might occur as part of the overall master planning and pre-design processes.
- *Partnership and Team Building:* The documents orchestrate a concern for the team approach while building partnership with stakeholders. They all emphasize that in the sustainable design process the focus should be shifted from a linear-compartmentalized process to an integrated process. Goal setting sessions and workshops involving client representatives are envisioned at the early stages of design.
- *Relationship between Technical Issues and Project Phases:* The documents were not “clear enough” in explaining how technical issues related to the surrounding context, building systems, site, waste, water, energy and other sustainable planning and design issues are linked to each phase. However, all have emphasized the value of the integrated step-by-step process. Also, they have not addressed the nature, structure, and content of the deliverables required in each phase of the project.
- *Relationship between Sustainable Guidance Documents and Other Documents:* All documents have not addressed aspects that pertain to the implementation of the guidelines in connection to other documents that involve other requirements or building bylaws. The NYC Guideline is the only document that addressed this relationship where other documents developed at the city planning level are referred to in an attempt at integration.

On the other hand, the analysis reveals some fundamental problems that have not yet been addressed adequately; these can be exemplified as follows:

- Current guidelines, use prescriptive, point-based, and proxy measures that simplify both compliance and enforcement but in many cases do not relate to real human, community, environmental, and life-cycle economic outcomes and in some cases may lead away from desired results.
- The life cycle costs and benefits of sustainable design strategies are not well documented or available early enough in the process to affect significant improvements.
- There is no planning framework or process that allows the client together with the feasibility analysts to actually make sustainable choices during project initiation and budget planning.
- Guidelines are not always regionally/locally appropriate and are not applicable to all housing project types in all cases.
- Fixed standards are rarely right for every housing project or every user population and in every location.

## Models of Knowledge Production

Planning and architecture, like other fields of vocational expertise, can be classified as professional disciplines, especially when we regard them as fields of inquiry (Becher, 1989). Ulf

Sandström has followed the development in profession-related studies since he identified two trends in research and knowledge production in the field of professional expertise: one is oriented towards the production of mono-disciplinary academic knowledge, and the other is directed towards subjects derived from concrete life situations, these being solution-oriented (Woyseth, 2002).

King and Burnell offer a broad and convincing representation of what constitutes an academic discipline. They propose several aspects that include a community, a network of communications, a tradition, a particular set of values and beliefs, a domain, a mode of inquiry and a conceptual structure (Becher, 1989). Another definition, by Toulmin, focuses more on epistemological considerations, presenting disciplines like this “...each is characterized by its own body of concepts, methods and fundamental aims” (Becher, 1989). In his important work on trans-disciplinarity, Gibbons (1994 and 1996) describes two parallel and competitive modes of knowledge production; outlined in Table 2.

The definition of Mode 2 introduces the notion of trans-disciplinarity that can be described like this: Trans-disciplinarity is a new form of learning and problem solving involving cooperation among different parts of society and academia in order to meet complex challenges of society. Trans-disciplinary research starts from tangible, real-world problems. Solutions are devised in collaboration with multiple stakeholders. Thus, trans-disciplinarity is about transgressing boundaries of disciplines.

As a practice-oriented approach, trans-disciplinarity is not confined to a closed circle of scientific experts, professional journals and academic departments where knowledge is produced. Through mutual learning, the knowledge of all participants is enhanced, including local knowledge, scientific knowledge and the knowledge of concerned industries, businesses, and non-governmental organizations. The sum of this knowledge will be greater than the knowledge of any single partner. In the process, the bias of each perspective will also be minimized (Klein, 1998; Klein *et al.*, 2001).

The trans-disciplinary type of knowledge is partly based on epistemological research. While mono-disciplinary and multi/inter-disciplinary research is clearly encompassed by Mode 1, trans-disciplinary knowledge production is the very essence of Mode 2. Gibbons maintains that Mode 1 has its role mostly for providing a stable basic educational training and for instilling in individuals a sense of disciplinary identity. On the other hand, he argues that there is a demand for the aptitude to co-operate with experts from other fields and for the ability to see problems in a complementary manner. Such faculties rest upon the capacity to assume multiple cognitive and social identities. Thus, both modes of knowledge production are in demand and should find a mutual balance (Gibbons *et al.*, 1996; Sommerville and Rapport 2002).

**Table 1: Results of the content analysis of the five sustainable design guidance documents (Salama and Adams, 2004). Shaded cells indicate that an examined aspect is covered in the body of the guidance document.**

<b>Goals explicitly stated in the guidance documents</b>	<b>LEED</b>	<b>NC</b>	<b>PA</b>	<b>NYC</b>	<b>MN</b>
Provide step by step guidelines for energy and resource efficient buildings	Shaded				
Encourage change to produce sustainable built environments		Shaded	Shaded		
Educate the professional and client communities about the value of sustainable design			Shaded	Shaded	Shaded
Provide a framework the guides design and construction decisions	Shaded	Shaded	Shaded	Shaded	Shaded
Facilitate input from clients and users				Shaded	
Help different parties understand their roles throughout the process				Shaded	
Create resource adaptable to changing circumstances allowing input of new experiences					Shaded
Create information gathering mechanism that supplies a "lessons learned" database		Shaded			
Promote environmentally sound building construction	Shaded	Shaded	Shaded	Shaded	Shaded
<b>Placing value on the process</b>					
Specific chapter on the process under different headings	Shaded	Shaded	Shaded	Shaded	
Process diagrams graphically describing sequence of activities		Shaded			Shaded
Emphasizing team building and goal setting		Shaded	Shaded	Shaded	
<b>Phases addressed</b>					
Advance planning/Pre-design			Shaded	Shaded	Shaded
Design (Schematic-Development-Construction Drawings)	Shaded	Shaded	Shaded	Shaded	Shaded
Construction	Shaded	Shaded	Shaded	Shaded	Shaded
Operation and Maintenance			Shaded	Shaded	Shaded
Deconstruction and Demolition					Shaded
Commissioning/Project Management	Shaded	Shaded		Shaded	
<b>How project delivery phases are addressed</b>					
Technical issues are linked to project delivery process phases	Shaded			Shaded	
Checklists of requirements in each phase	Shaded			Shaded	
Emphasis on addressing sustainability early in the process		Shaded	Shaded	Shaded	
<b>Documentation required throughout the process</b>					
Scope of work/work plan/statement of intentions	Shaded	Shaded	Shaded	Shaded	Shaded
Site ecology report	Shaded				
Programming assumptions report	Shaded	Shaded		Shaded	
Building systems integration drawings			Shaded		
Construction waste management report			Shaded		
Project budget report		Shaded			
Implementation strategy report				Shaded	
Owner operation manual				Shaded	

Commissioning report				
<b>Description of the nature, document, structure of documentation</b>				
Explanation of how documents and reports should be delivered				
<b>Relationship to other state documents</b>				
Reference is made to other documents at the city or state levels				
<b>Compliance tools</b>				
A rating system is an essential part of the document				
A scoring system to assess compliance				
Reference to LEED rating system as a national measurement tool				

**Table 2: Definition of modes of knowledge production.**

<b>Modes of Knowledge Production</b>	<b>Descriptive Definition</b>
Mode 1 Mono-Disciplinary Multi-Disciplinary	The complex of ideas, methods, values and norms that has grown up to control the diffusion of the Newtonian model of science to more and more fields of inquiry and ensure its compliance with what is considered sound scientific practice.
Mode 2 Trans-Disciplinary	Knowledge production carried out in the context of application and marked by its: trans-disciplinarity; heterogeneity; social accountability and reflexivity; and quality control, which emphasize context – and use-dependence. It results from the parallel expansion of knowledge producers and users in society.

### **The Impact of Trans-Disciplinary as a New Form of Knowledge on Understanding Sustainable Affordable Housing**

The preceding discussion on trans-disciplinarity as a thinking paradigm reveals that “trans” in trans-disciplinarity is about transition and movement where the rigor of research and knowledge production is matched by the concerns for establishing connections and inter-relationships. This means that there is a “middle zone” of exchange between disciplines. It also means shifting the grounds of research in both the sciences and the arts from a concentration on disciplinary needs and history of things/issues, to an emphasis on how needs of one discipline are connected to knowledge goals and aspirations of other disciplines. In other words, it can be argued that no discipline can make strong claims anymore about its own direction, value, and output in isolation from what is happening in other areas of research.

Looking at the latest literature on sustainable affordable housing as a field of research, one could trace its trans-disciplinary nature (Beer, 2004; Buki, 2002; Chatfield et al, 2000; Hall and Pfeiffer, 2000; Munoz, 2003; PDC, 2003; SCAH, 1999; and Vittori, 2002). It involves research paradigms that range from policy making, economics and financial concerns, to environmental and cultural aspects, to planning, design, management, and operations. This is due to the fact that the provision of sustainable affordable housing is always constrained by the need to consider social, environmental, and economic implications.

Affordable housing can be viewed as a web of influences and inter-relationships of a wide spectrum of issues and this reflects the trans-disciplinary nature of sustainable affordable housing investigation or development. For example, it is acknowledged in the literature that the morphology of residential production influences the development of cities and concomitantly generates environmental impacts and infrastructure stress. It is also acknowledged that the typology of houses influence the social and environmental performance of neighbourhoods. These inter-relationships mandate a comprehensive understanding of sustainable affordable housing where the creation of trans-disciplinary tools of inquiry would be indispensable.

Within the preceding context it should be noted that while research studies on affordable housing highlight the multifaceted nature of the process of investigating or creating affordable housing projects, little emphasis was placed upon addressing the social, environmental, cultural, economic aspects in an integrated manner and the way in which they influence one another as different disciplinary issues. This is clearly evident where one could see studies that place emphasis on policy and economic issues without looking at the impact on other critical concerns such cultural and environmental aspects. On the other hand, the authors notice other types of studies that place emphasis on the physical characteristics of dwellings or neighbourhoods, again, without clear indicators of how physical aspects can be linked to social and environmental concerns (Salama *et al.*, 2005).

While social and cultural issues are introduced in the literature as successful determining factors, very little is offered on how to introduce such issues either when investigating sustainable affordable housing in a research process, or when attempts are envisioned to develop sustainable affordable housing projects in a developmental process. The fact that affordable housing is always defined in economic terms or by the relationship between household's income and expenditures does not mean that other issues, such as social and environmental concerns including people preferences, lifestyles, and cultural aspirations are oversimplified or addressed in isolation. This suggests that creating affordable housing projects and that producing knowledge about affordable housing requires a new paradigm of thinking, which is based on trans-disciplinarity that crosses the boundaries between wide spectrums of issues that stem from different disciplines. In this context, the authors assert that the typical approach for investigating sustainable affordable housing adopts the perspective of cost reduction only as one single determinant, while other critical determinants such as the lifestyles of the targeted populations, their satisfaction of their current houses, and their preferences of the future houses are typically absent from the inquiry process. Therefore, emphasis is placed upon integrating economic, cultural, social, and environmental aspects in addition to other contextual measures within which sustainable affordable projects are created.

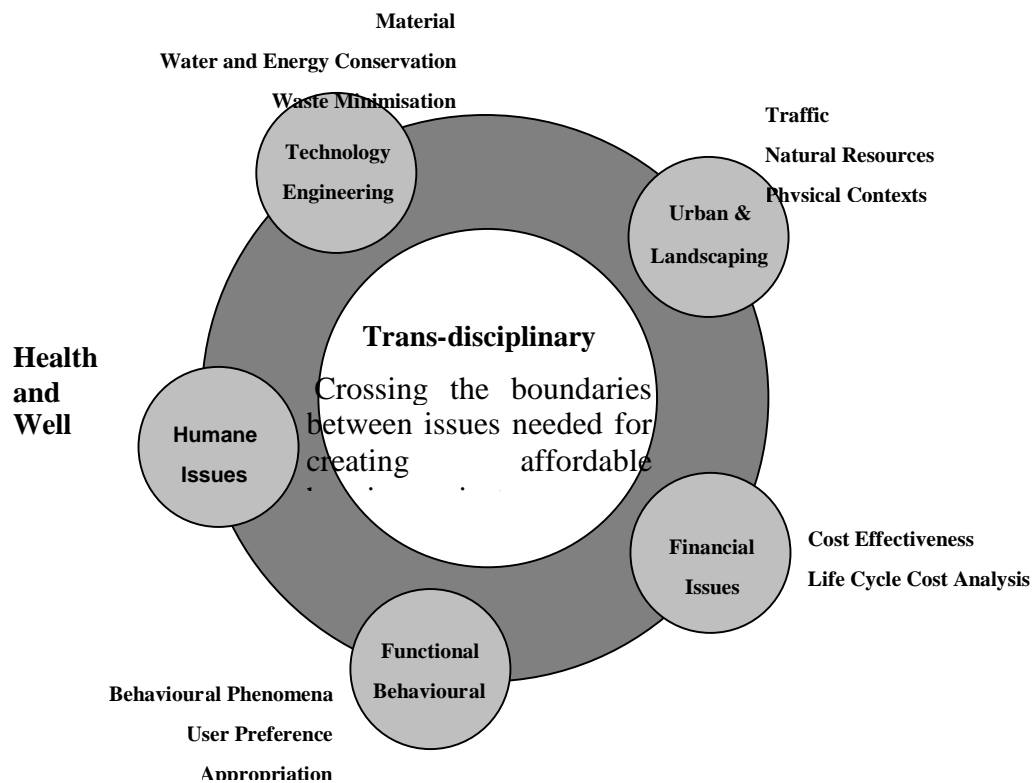
## **A Response Approach: The Trans-Disciplinary Paradigms and Sustainable Affordable Housing**

Despite the honest attempts of professionals to tame the development and growth processes, they tend to work on isolated islands, without having enough concern for developing a common language. In response, the proposed approach has three major qualities that can be exemplified as follows:

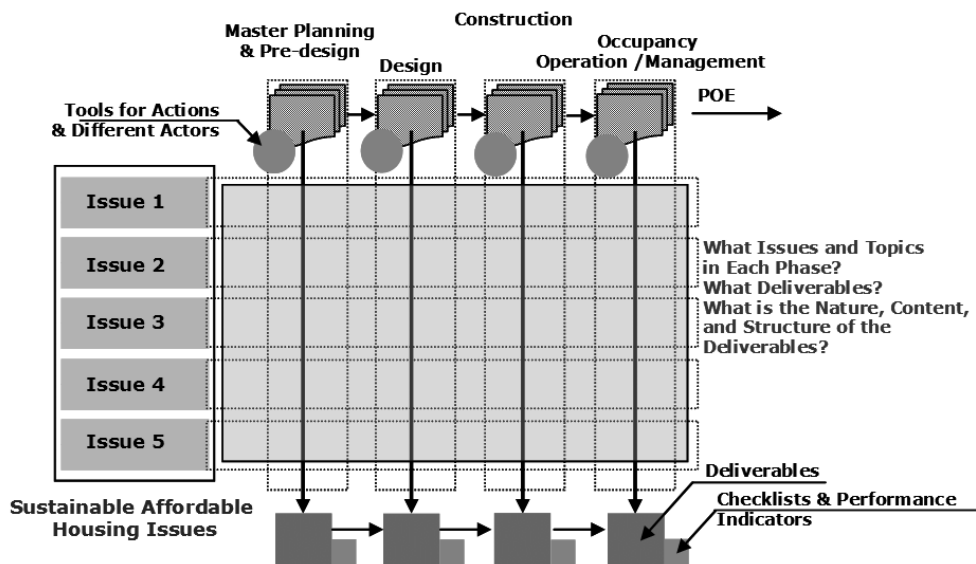
- *Comprehensive*, since it addresses different phases of the development process
- *Trans-disciplinary*, since it crosses the boundaries between different fields by utilizing interdisciplinary knowledge based on the issues that need to be addressed in the development of sustainable affordable housing.
- *Collaborative*, since it involves teams of experts throughout the process, while involving stakeholders in the early stages of this process.

It is believed that the proposed approach would act as a remedy for the problems of current approaches by dealing equally with the *Top-Down* and *Bottom-Up* strategies. It adopts the view that sustainability can not be addressed as one subject; it includes different disciplines and issues requiring systemic thinking. This can be achieved by investigating and addressing the key issues simultaneously, not dealing with them separately each at a time. It is envisioned that these issues would encompass technology and engineering issues including material, water and energy conservation and waste minimization; humane issues including the health and well being of occupants; functional, behavioural and cultural issues including behavioural phenomena, users preferences, appropriation, and place attachment; financial issues including cost effectiveness and life cycle cost analysis; and urban and landscape issues including traffic, natural resources, and physical contexts. It is also believed that these issues are addressed and acted upon within a political and comprehensive legislative process. Figure 1 illustrates the proposed approach based on incorporating the trans-disciplinary thinking paradigm for sustainable affordable housing.

**Figure 1: Incorporating the trans-disciplinary paradigm into a comprehensive understanding of issues involved in sustainable affordable housing.**



**Figure 2: Implementing the trans-disciplinary thinking paradigm in a sustainable affordable housing project planning and design process.**



In typical planning, design and building processes world-wide, advance planning, pre-design, programming, and post occupancy evaluation are not recognized as part of the practice culture. Therefore, the challenge is to conceive how such trans-disciplinary thinking paradigm can be implemented. Thus, the proposed approach is holistic in nature as it attempts to establish links between issues necessary to be addressed to create sustainable affordable housing environments. It involves definition of actors, and tools for actions and decisions to be made in each phase. It also includes deliverables documenting the application of the guidelines in each phase and checklists to be used by the owner representative, which are conceived as compliance tools. Figure 2 illustrates a conceptual matrix that integrates these mechanisms into a sustainable affordable housing project planning and design process.

In the proposed approach, it is crucial to define the target audience, the nature, dynamics, and characteristics of the project, the nature of users, and the activities taking place. The approach overcomes the shortcomings of the previous efforts. It views that guidelines should be illustrated and should address professionals and decision makers of different backgrounds, concerns, and agendas. In this respect, guidelines should be complemented by aspects of materials and technologies, and by conducting comparative analyses of case examples from places and/or countries having similar physical and operating environments.

In dealing with the bottom-up approach, workshops are envisioned as learning mechanisms where the essential characteristics of the project are abstracted for learning purposes. The aim here is to imbibe the enduring values of the concepts underlying sustainable affordable housing by involving the client, the user, and the facility manager in the process. Sensitizing building occupants toward the key issues underlying sustainability is an integral component of the proposed approach. In this respect, walking tour techniques can be utilized where users tour similar projects assessing their qualities from sustainability perspective. The objective here is to have them comprehend the existing status of the built environment while realizing ways in which this environment can be improved. Post Occupancy evaluation from both the users and the professionals' viewpoint is also crucial; the purpose here would be to establish feedback mechanisms for guideline development and to improve the quality of decision making.

## **Conclusion**

It is apparent that a new paradigm of thinking is emerging where no one theory or discipline would have the upper hand in developing a comprehensive understanding of sustainable affordable housing. In the old paradigm, the value of affordable housing is assumed to be in the quantifiable attributes of dwellings and their related cost, while in the new paradigm sustainable affordable housing can be viewed within relationships between the process, the product, and socio-cultural, environmental, and economic aspects. Simply, the old paradigm views affordable housing in terms of what it is, rather than what it does for the people and impact would it have on the environment.

This paper aimed at developing an integrated approach for sustainable affordable housing. Such an approach was based on introducing a new paradigm of research: trans-disciplinarity; a form of inquiry, professional practice, and knowledge production that crosses the boundaries of different disciplines. An argument on the impact of trans-disciplinary thinking on understanding sustainable affordable housing was conceptualized and juxtaposed within a critical analysis of the typical approaches for addressing sustainability. The proposed responsive approach was conceptualized based on integrating multiple sets of issues while

envisioning how such an approach can be implemented in the planning and design process of a sustainable affordable housing project.

The outcomes of implementing this approach would be: best practice manuals, illustrative guidelines, prioritized recommendations, assessment manuals, documented workshops and walking tours, implementation mechanisms, and performance indicators that need to take place throughout the planning and design process of an affordable housing project. It is believed that by implementing this approach together with a continued collaborative trans-disciplinary effort current unsustainable practices can be stopped and a process of real sustainable development at all levels (planning, design, construction, operation, and management) can begin to shape the future of the built environment. By addressing building users together with different stakeholders, sustainability will be a teaching tool for the public, and it will be transformed from being mere policy to the recognition of its value as a professional culture.

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