Understanding transitions in a rural Indian building typology in the context of well-being

Kumari Moothedath Chandran, Nallaval Chinnaswamy Balaji and Monto Mani*

Indian Institute of Science, Bengaluru 560 012, India

Rural settlements in Karnataka in India predominantly use locally available resources to build their dwelling units. The houses are constructed either by the villagers themselves or by local masons skilled in traditional architecture. However, traditional houses and lifestyle are slowly giving way to modern concrete dwellings and a new lifestyle. To analyse this trend of transition to modern dwellings in rural settlements, a case study was conducted in three villages near the city of Bengaluru in Karnataka. The present article discusses this transition in the context of sustainable well-being of rural settlements.

Keyword: Building typology, modern dwellings, rural–urban transition, sustainable well-being.

Introduction

BUILDINGS and lifestyle of rural settlements near Bengaluru, India, are undergoing a transition from traditional to modern. Bengaluru with a population of 11 million people in 2011 (ref. 1), provides new employment opportunities leading to migration from rural to urban areas. Tumkur District adjacent to Bangalore, has 10 Taluks (Taluk is an administrative unit) and a population of 4 million (ref. 1). Our study area is in Ungra Panchayat, Kunigal Taluk, Tumkur District, which has a population of 0.2 million (ref. 1). The presence of a metropolitan city, Bengaluru, about 100 km to the east of Ungra, has influenced this village in many aspects. The population of this Taluk has declined in the past decade by 4.4%, suggesting migration to the city. However, the percentage of population in the urban area within Kunigal increased by 2.27% and that of the rural area within Kunigal decreased by 2.27%, which indicates intra-Taluk rural to urban transition of the population (Table 1). While the rural population decreased by 6.88%, the urban population increased by 12.55%. This statistic merits attention, as the change in lifestyle of the urbanizing rural population, and the shrinking rural population will reflect in the design and use of the built environment of this area.

*For correspondence. (e-mail: monto@astra.iisc.ernet.in)

The case-study areas are three villages, Bommanahalli, Bommanahalli 1 (two different settlements with the same name, Bommanahalli), and Pallerayanahalli (Figure 1). Data were collected onsite in April 2013 from these villages. This project is part of ongoing fieldwork in the area to study the rural to urban transition of building typologies observed in the village (Figure 2). The residents of Bommanahalli and Bommanahalli 1 have been living in these villages near their agricultural lands since ancestral times. Pallerayanahalli is a decade-old settlement laid out by the Government of Karnataka for tribes who had migrated from the forest or distant places. Every household (HH) in these villages has at least one person living in the city of Bengaluru for either work or education.

The present article focuses on the observed changes in architecture, building typologies and lifestyle in rural areas. It brings together the multiple well-being dimensions to define what sustainable well-being is and the need for a rural design agenda for sustainable well-being. Documentation of the building typologies and interviews with the villagers were carried out to understand why people choose these changes and how these associate with their well-being.

Transition of building typology

The traditional architecture (architecture passed down from person to person over generations, alternatively used term is vernacular architecture) of the villages in Kunigal is characterized by a single-room space with a gabled thatched roof, walls constructed from adobe or sundried bricks or straw bamboo reinforced adobe, and floors plastered with cowdung or mud. House construction with random rubble masonry (RRM) walls with stone flooring and clay tiled roofing is also in practice. The houses are constructed by the villagers themselves from locally sourced and prepared building materials. However, we observed a rise in the use of reinforced cement concrete (RCC) houses. In order to verify this transition, we compared aerial maps of these villages obtained from Google Earth for the years 2002 and 2013 (Figure 3). A close observation of the aerial maps of 2013 shows more number of white reflective surfaces which are rooftops

Table 1. Kunigal Taluk rural–urban demographics.

Kunigal Taluk	Total population	Rural	Urban	Density per sq. km	Percentage rural area	Percentage urban area
2001	236,030	205,687	30,343	241	87.14	12.86
2011	225,695	191,543	34,152	230	84.87	15.13
% increase in a decade	–4.38	–6.88	12.55	–4.56	–2.28	2.28

Source: Based on data from Census of India (2001, 2011)[1,43].

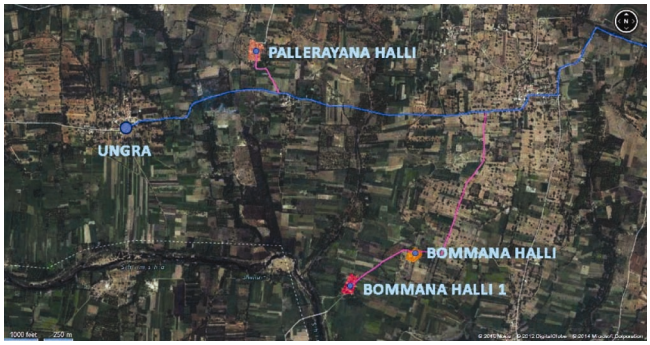

Figure 1. The case-study villages. Source: Base map from Microsoft. 'Ungra'. Bing maps (map), https://www.bing.com/maps/. Cartography by Nokia; retrieved 7 March 2014.

Figure 2. A sample of building types in Ungra village. (Left) Gabled roof adobe house, (Middle) Gabled roof brick-plastered house with verandah, (Right) Flat roof concrete dwelling with compound wall and parking space.

Figure 3. Aerial view of Bommanahalli in 2002 and 2013. Source: Google Earth. (Left) 2 April 2013 and (right) 3 March 2002. Bommanahalli: 12°48′13.31″N, 76°58′55.35″E, eye alt 2921 ft. NOAA, DigitalGlobe 2013; http://www.google.com/earth/index.html; accessed on 12 March 2014.

with RCC, asbestos corrugated (AC) sheets or galvanized iron (GI) corrugated sheets. The aerial maps show an increase in built spaces of the villages as well. We compared data collected onsite in April 2013 along with those of 1998. While the number of households has dwindled (Figure 4) from 1998 to 2013 for Pallerayanahalli, the site coverage has increased. This shows an increase in the area occupied per person.

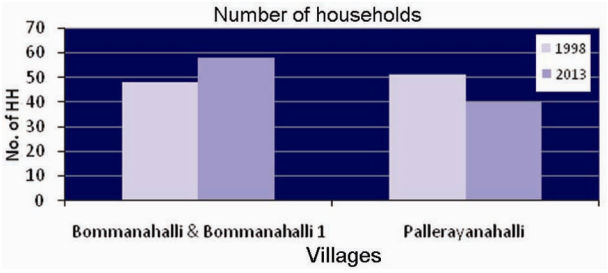

Figure 4. Total number of households (HH) in Bommanahalli, Bommanahalli 1 and Pallerayanahalli (1998 and 2013).

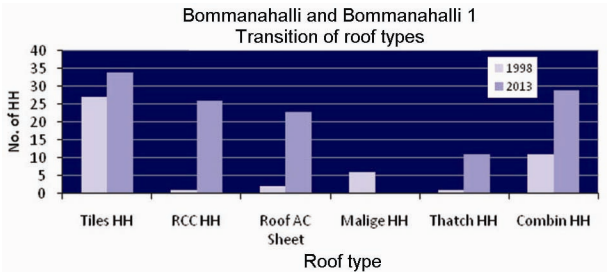

Figure 5. Roof types in Bommanahalli and Bommanahalli I (1998 and 2013) (Malige HH refers to 'malige mane' in Kannada, which means house with upper storey. Combin HH refers to households with a combination of different roof types.)

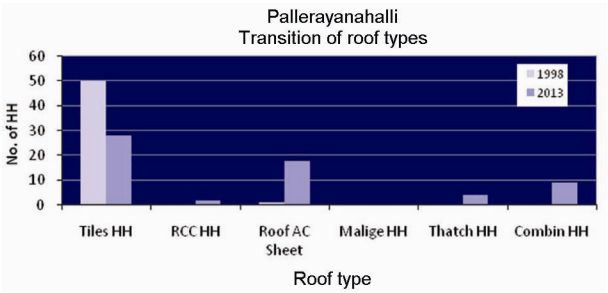

Figure 6. Roof types in Pallerayanahalli (1998 and 2013).

A statistical comparison between our survey on the building typologies conducted in April 2013 and data of this area from 1998 (ref. 2) shows that new constructions or modifications mostly have roofs which are of RCC, AC/GI sheets, as well as houses with a combination of traditional (thatched/tiled) and new (RCC, AC/GI sheets) roof types and materials (Figures 5 and 6). In Pallerayanahalli, Mangalore clay tile (or simply 'tiled') roofs have given way to AC sheets. Figure 7 shows a detailed distribution of roofs among thatched, tiled, RCC, AC/GI

sheet and combination roof types. The increasing number of combination roof types in 2013, which was absent in the 1998 study, shows incremental upgrading and modification of roofs by the residents.

Figure 8 shows the current distribution of roof materials for all three villages together. It can be seen from Figures 7 and 8, that in the last 15 years RCC and AC sheet together comprise 49% of roof types of all the households in the three villages together. The traditional thatched roof is used in only 10% of the houses, while the population and number of households have decreased in the last decade. This indicates that among the existing population, there is demand for refurbishment and preference for new building materials over traditional materials. Figure 9 summarizes the trend of transition with respect to roof types. This reflects a transition towards RCC roofs, departing from the traditional thatched roofs, with preference for tiled roofs and AC sheet roofs as well. A combination of two or more roof types can be seen where buildings have been partially refurbished, such as addition or modification of porches, sheds, verandahs, etc.

Figure 10 shows the distribution of building materials used for walls in the villages. The trends observed for walls include traditional adobe construction to RRM construction (with mud mortar and plastering); from RRM to RRM with cement mortar and plastering; from adobe to combination wall types with RRM in the outer walls; from RRM construction to burnt-brick masonry (BBM) construction with cement mortar and plastering (Figure 11). Figure 12 shows the distribution of flooring types.

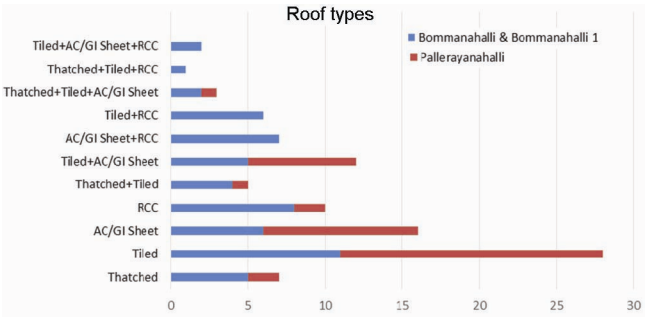

Figure 7. Distribution of combination roof types in the villages as of April 2013.

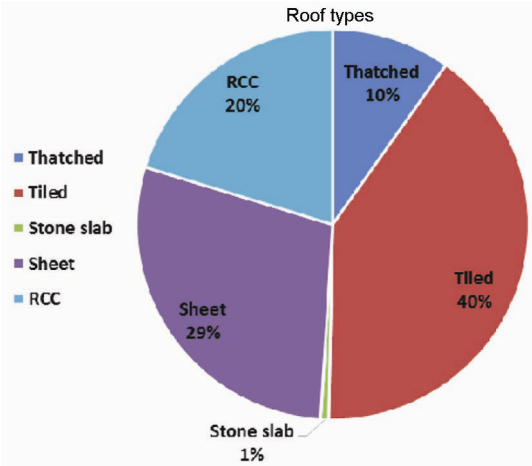

Figure 8. Distribution of roof materials in the villages as of April 2013.

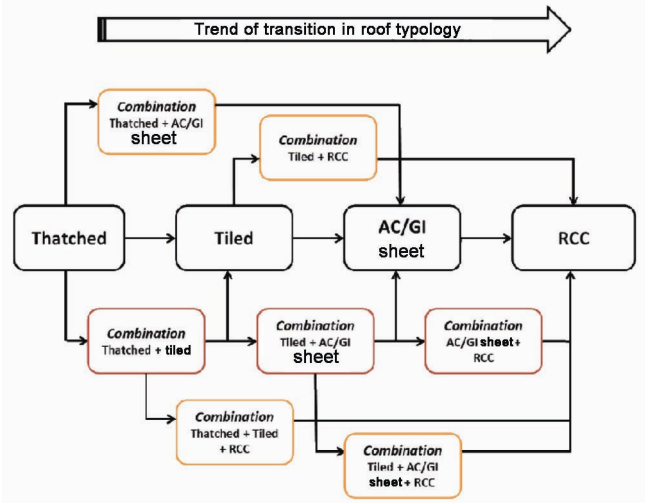

Figure 9. The trend of transition of roof typology in the villages.

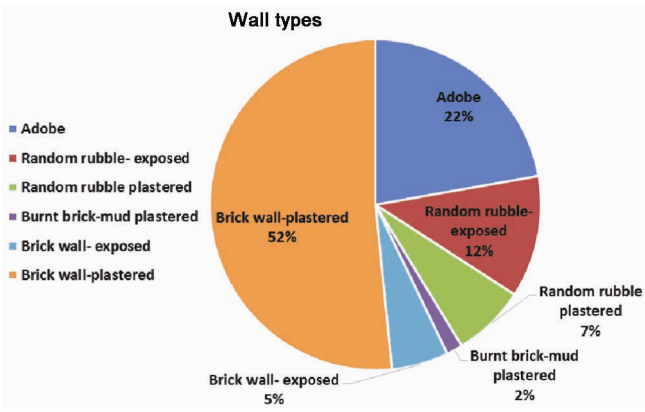

Figure 10. Distribution of wall types in the villages as of April 2013.

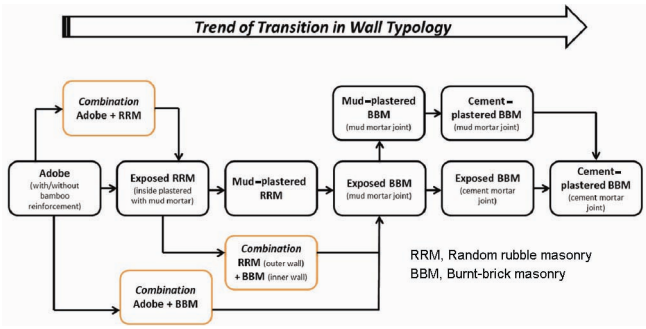

Figure 11. The trend of transition of wall typology in the villages.

Sustainable well-being

We have demonstrated that building typologies are now adopting modern construction materials in rural settlements in Tumkur. To understand how these changes reflect in the well-being of people of these villages, it is important to understand what well-being means as a construct and what is sustainable well-being.

Human well-being is a complex concept that cannot be easily defined[3,4]. Well-being literature is spread across different constructs and there is no commonly accepted definition or understanding on what is sustainable well-being and how 'design' can play a role in it. For this purpose, we will look into current literature for definitions of well-being in order to understand the construct of well-being.

Constructs of well-being

According to Şimşek[5] there are two competitive approaches to well-being in research area: subjective well-being (SWB) and psychological well-being (PWB)[6,7]. SWB focuses on hedonic elements of life such as positive affects, lack of negative effect, and life satisfaction, whereas PWB focuses on eudemonic dimensions of growth, meaning and direction[5]. SWB is often used analogous to happiness[8,9], life satisfaction and quality of life[9]. Durayappa[9] lists some of the theories of SWB from the field of psychology which include the liking, wanting, needing theory; the top-down/bottom-up factors; the multiple discrepancy theory; the orientation to happiness model; and the mental health continuum model. Şimşek[5] explains the two dimensions to SWB – cognitive dimension and affective dimension. Cognitive dimension of SWB refers to judgment of individuals concerning their own lives[5]. Emotional well-being is defined as the affective dimension of SWB, which refers to positive and negative moods in one's immediate experience[5,10,11].

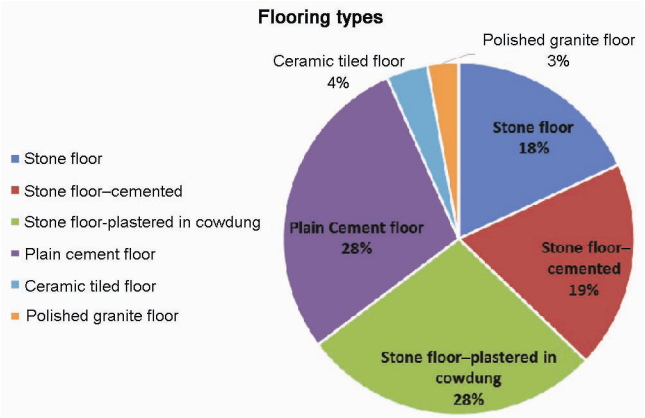

Figure 12. Distribution of flooring types in the villages as of April 2013.

Şimşek[5] points out that there is no clear theoretical base on which we can explain how life satisfaction and emotional well-being are integrated within the concept of SWB. Problems arise for researchers from the absence of a theory explaining the basis of the SWB construct[5,12].

SWB is often defined and categorized into material well-being and non-material well-being. Material well-being refers to the physical support to life and to the attainments which make acquisition of physical attributes possible, such as education, economic power, good health, etc.[13]. Non-material well-being refers to the psychological dimension of living, satisfactions, happiness, enjoyment etc.[13]. The multiple well-being constructs found in the literature are summarized in a tree diagram (Figure 13), which will help in identifying the well-being dimension that researchers are focusing upon.

Sustainability and development

The above constructs of well-being are focused on measuring the quality of life and satisfaction of an individual or a group of individuals. We find these approaches inward-looking, i.e. looking at the well-being of individuals or a group of individuals in isolation. An aggregation of well-being of individuals is assumed to sum up to the well-being of a group of individuals. However, it is counter-intuitive that in sustainability literature we often find that one's well-being is at the cost of environment somewhere at some point of time. This means that a group of individuals with individual positive well-being may not add up to be net positive well-being of the community. It is thus important to look at the entire sequence of actions before and after an action that leads to an individual's well-being to assess the aggregate well-being of human beings as a whole community.

The transition from traditional to modern is often termed as 'development' and is associated with growth and well-being of a society. Modernization theory contends that development is 'unidirectional, progressive, and gradual, irreversibly moving societies from a primitive stage to an advanced stage, and making societies more like one another as they proceed along the path of evolution'[3,14–16]. The term 'sustainable development' is

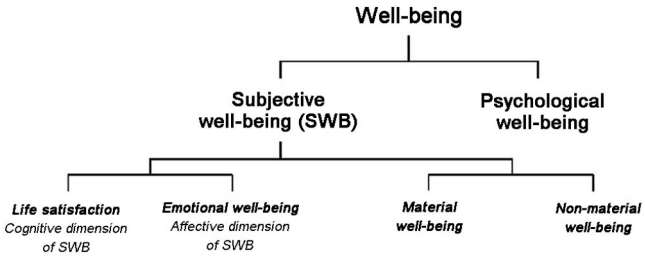

Figure 13. Multiple constructs of well-being as found in the literature.

defined as a 'development that meets the present needs without compromising the ability of future generations to meet their own needs'[17–20]. The multiple dimensions of sustainability which are called the triple bottom line are environmental, economic and social domains[17]. These three domains are inter-related[17,21]. According to Mutisya and Yarime[22] a well-balanced integration of the social, economic and environmental pillars is important for urban sustainability, which is applicable to both developed and developing countries. However, they suggest that urban sustainability in developing countries should be discussed with particular attention to the fourth pillar, i.e. governance. For building a holistic urban sustainability framework, they identify key dimensions for each of the domains. These are social: population, education, health, housing, energy, solid waste, crime, conflicts, social capital, and knowledge; economic: employment, income, entrepreneurship, access to financial services and assets; environmental: ecological degradation, pollution, topography, urban disasters. Even though, this is explained for urban sustainability, it seems suitable to the rapidly changing rural environment of a developing country like India.

Design and sustainable well-being

As this article is on settlements, we refer to well-being as a concept which incorporates both individual well-being and that of the community (here, community is referred to as a collection of individuals). Since we are looking at transitions of rural settlements, our interest is also on sustainability of these transitions and sustainable well-being.

Integrating the well-being and sustainable development dimensions will give us a holistic framework for sustainable well-being. The individual centred well-being aspects (physical, mental and emotional well-being) and sustainable development dimensions (economic, social and environmental sustainability) are interdependent for sustainable well-being. Sustainable well-being is hence an interdependent network of individual aspects – physical, mental and emotional, and collective aspects of a community – social, economic and environmental. In Figure 14, these six aspects are represented as part of a hexagon, with the interconnections between the vertices together representing sustainable well-being. Table 2 gives the indicators of sustainable well-being for each of the six aspects collated from well-being and sustainability literature. Quality of life is synonymous with the term 'well-being'. Sustainable well-being will then be that quality of life which can continue to survive and remain in the long term for the future generations by the resources available on our planet.

In relation to sustainable design and building, Steemers[23] defines well-being of people in terms of 'health, comfort and happiness as lying on a well-being spectrum from the directly measurable (e.g. symptoms, body temperature, blood chemistry, etc.) to the unmeasurable (quality, delight, etc.)'. It can be said that these are the individual aspects physical, mental and emotional of well-being. Duijvestein[24] mentions quality of life as one part of sustainability. He explains that quality of life focuses on the here and now, while sustainability is also about the future. He emphasizes the necessity to broaden the sustainable building and adds design to the sustainability triangle of people (society), planet (environment) and prosperity (economy). The fourth design-centred dimension, 'Project', forms the tetrahedron of sustainable building[23,24]. With respect to our well-being model (Figure 14), Duijvestein[24] brings in the collective aspects of well-being – social, economic and environmental. Both Steemers[23] and Duijvestein[24] link the role of design to well-being and sustainability with respect to architectural design.

Raibley[25] explains well-being as agential flourishing, which is closely related to a postulate of Ryan and Deci's[27] self-determination theory. According to this theory, well-being is an outcome promoted by 'satisfaction of needs for competence' and individuals are naturally oriented towards satisfaction of needs as well as toward 'growth' and 'integration of themselves into larger social structures'[25–28]. These are universal as it is built into human nature and their behaviour will be characterized by choice and volition, the result will be high levels of life satisfaction and well-being[25,26].

From Ryan and Deci's[27] theory, it can be seen that 'satisfaction of needs' is a driving force for growth. Growth requires an 'intervention' to 'change the current situation'. An intervention in the form of human-made (or altered) objects, or services leads to growth, which in turn leads to satisfaction of needs. The authors here call this human intervention as design, and it is thus a design intervention which leads to growth, satisfaction of needs, and hence well-being (Figure 15). The universality of the need of humans for integration into larger social structures is to be noted here as one of importance, with this case study being on a rural settlement. From the data presented in this case study, it can be observed that people are choosing more durable materials, which require less maintenance. Is durable design an indicator of sustainable design? Duijvestein[24] gives an example: 'preserving wood makes the wood by impregnation with copper arsenic compounds especially durable but definitely not sustainable'. Wood waste treated with copper–arsenic compounds (CCA) has been classified as hazardous waste by the Department for the Environment, Food and Rural Affairs in the United Kingdom[29,30]. Hence, sustainable design should aim at the sustainable well-being of the people. And, the authors here define design for sustainable well-being as that design which can provide sustainable well-being, which is quality of life in the long term

Table 2. Indicators of sustainable well-being

Sustainable well-being					
Well-being dimensions			Sustainability dimensions		
Physical	Mental	Emotional	Economic	Social	Environmental
Health	Comfort	Happiness	Employment	Population	Natural resources
Hunger	Needs	Mood	Enterprise	Public health	Ecological degradation
Shelter	Goals	Satisfaction	Income	Education	Pollution
Clothing		Enjoyment	Assets	Social capital	Topography
			Savings		Disaster
			Economic power		

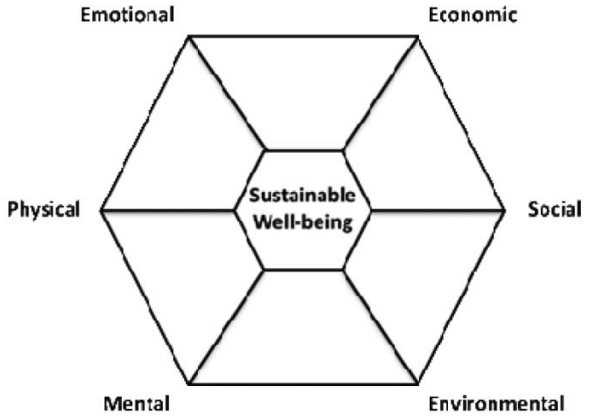

Figure 14. Dimensions of sustainable well-being.

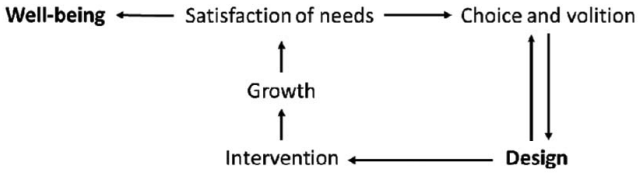

Figure 15. Design leading to well-being.

for the future generations by the resources available on our planet.

Understanding cause and effect of transitions

The data presented earlier in the article reveal that the preferences of people have been changing from traditional to modern. To understand the cause of these transitions we collected data on surface temperature of each type of house and conducted surveys to obtain answers to the following questions: (a) Is this change a preferred one or an induced one? (b) If a preferred one, is it giving comfort and satisfaction, and hence improved well-being? (c) If it is an induced one, is it improving their well-being? (d) Is this change environmentally sustainable?

The above points and the transitions observed in the case-study villages will be discussed and analysed in this section from the perspective of well-being and sustainability.

Understanding cause of transitions

Occupant thermal comfort: Tumkur district has an average maximum temperature of 34°C and an average minimum temperature of 12°C (ref. 31). To see if the preferences for new materials are adding to thermal comfort, the infrared (IR) thermography imaging technique was adopted to evaluate the surface temperatures of the building envelope. The IR system used was FLUKE TiR 32 IR Fusion Technology. Table 3 lists the surface temperature of six typical wall types as on April 2013 noon. From the table we can see that BBM cement plastered has the least surface temperature with a difference of 6°C from adobe construction. The choice of surface paint colours in the newer constructions is found to vary the surface temperatures by 2–3°C. However, a similar study conducted in Sugganahalli village, located in the same Kunigal Taluk, found that the indoor temperature increase by 7–10°C in the summer months in modern constructions[32]. The authors here are undertaking a year-long data logging of indoor temperatures in these houses to arrive at a conclusive evaluation of indoor temperatures.

Survey on choice of building materials and aspirations: If the newer constructions provide more occupant comfort, and hence more satisfaction and well-being, it would be interesting to know if this choice was preferred or induced and what other factors contribute to this choice. Interviews with local people were undertaken to understand this.

Thirty-two participants below poverty line (note 1) participated in the survey. Among these, 22 residents were from Pallerayanahalli, and five each from Bommanahalli and Bommanahalli 1. The interviewees work in agricultural fields and are more than 50 years old. The interview was undertaken as a conversation with the residents by the present authors in their local language (Kannada). There was a challenge in conducting a formal survey, as most participants shied away from interacting

Table 3. Average surface temperature of each wall type from FLUKE TiR 32 IR Fusion Technology

Wall type	Average surface temperature °C through IR imagery (during April 2013 noon; 11.45 am–1 pm)
Adobe wall with mud plaster	38.40
RRM without plaster	34.99
RRM without plaster	34.35
RRM cement-plastered	36.25
BBM cement-plastered and white-washed surface finish (exposed wall)	33.94
BBM cement-plastered and white-washed surface finish (shaded wall)	32.57

with the research team. Hence we chose a conversation approach with one of the authors who speaks the local language.

The choice of the new type of construction was based on resources available in the nearby town of Huliyadurga (10 km away from the villages), the availability and affordability of three-wheeler and four-wheeler small-sized goods and passenger vehicles for transportation of construction workers and materials, and less effort required in construction with ready-to-use materials, e.g. asbestos and GI corrugated roofing sheets, steel channels and pipes. Most people aspire to build new houses, especially houses with RCC roofs. Nineteen out of 32 participants expressed their wish to build RCC houses, three opted for AC/GI houses, two for tiled houses and two responded that they would like to build a big house. The aspiration and motivation for a modern-style house come from seeing the new houses of their neighbours or new constructions in and around the villages for 23 participants. Three participants mentioned their motivation was from seeing buildings in the city (Bengaluru). Those who could not afford a new house opted for partial refurbishment of their existing houses. When adobe/RR masonry walls deteriorate, the home-owners often replace them with brick masonry walls. Old walls are plastered with cement mortar to avoid erosion. People also wish to have similar kinds of exterior paints as their neighbours' homes, in vibrant shades of yellow, green, blue, etc. When roof tiles break, maintenance-free AC/CI sheet roofing will be used to replace existing tile roofs. Local vendors offer several-day payment period for materials purchased, which makes this construction easier to manage financially. People do not consider spatial configurations, the orientation of houses, or plot coverage. They wish to live without any worries, in safe and maintenance-free houses. A small percentage of people (mostly those influential in society) wish to show-off their wealth with their buildings.

The skilled masons who carry out the traditional RR masonry and adobe constructions are available in and around the villages. Most of them do not prefer practising their traditional skills in construction. Instead, they work as masons in modern construction sites, where they earn daily wages of INR ~250–500.

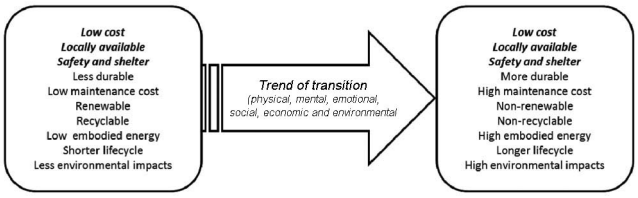

Figure 16. Trend of transition from traditional houses (left) to modern RCC/AC sheet houses (right).

Hence, it can be seen that people choose modern materials for social, economic and emotional reasons. How these choices affect the buildings' thermal comfort or environment is not a consideration for them when planning new construction or refurbishment. If one considers only the environmental aspects of roofs, aluminium and concrete have higher embodied energy values as opposed to straw/bamboo (aluminium = 227, concrete = 1.30, straw bale = 0.24 MJ/m^3)[33]. Based on the interviews and data, the aspects leading to people's choices and the induced aspects due to those choices can be summarized in a trend of transition diagram (Figure 16). It can be seen that the common factors here are low cost, locally available (materials and labour), and safety and shelter. Is this trend leading to sustainable well-being of the individuals and the villages? Looking back at Figure 15, the choices people make reflect in the design and in the satisfaction of needs, leading to well-being. Here, the choices, hence design, are leading to growth and satisfaction of needs, and hence some dimension of well-being (emotional, social, economic) will be achieved; but, not all the dimensions of well-being. Is well-being then important to the people who are making the choices?

'Well-being is important in the thinking of a benefactor and in moral argument because of its importance for the individual whose well-being it is'[34,35]. The claims[34,35] on whether well-being is important to the individual whose well-being it is, are: (a) It seems unreasonable to mention that individuals have no reason to be concerned with their own well-being. (b) This is because it seems to imply that they have no reason to be concerned with those things that make their lives better. (c) Clearly they do have a reason to be concerned with these things. (d) But in

Figure 17. Semi-private spaces.

regard to their own lives they have little need to use the concept of well-being itself, either in giving justifications or in drawing distinctions. The concept of one's overall well-being does not play as important a role as it is generally thought to do in the practical thinking of a rational individual.

It can be argued that incompleteness in achieving overall well-being aspects is due to the unidentified needs of people that should be satisfied, and which must be reflected in their choices, and hence in design interventions. Here, people are not completely aware of their needs, and do not identify those needs which can satisfy them, which when met by design interventions, can satisfy them and continue to satisfy them; not only those needs, but all the other needs which lead to well-being. Hence, a design should take into consideration not just the immediate requirement for satisfaction, but a holistic understanding of what a person's needs are and his other needs as well, so there is no conflict with each other.

Rodogno[35] supports Scanlon's claim that 'concern for well-being is important in moral argument because well-being is indeed important to the person whose well-being it is as the basis for those rational decisions in which she alone is concerned.' From the case study presented, it can be concluded that well-being is important to the person. However, not only do people have unidentified needs, but they are also unaware of what leads to their overall well-being and to the collective well-being of the community. Hence, designers have an important role to play in society, as they have an understanding of the holistic needs of both the individual and the community. Designers therefore need to think in two scales, one at an individual level (people), and two at a collective community level (people–people interaction). The next section will discuss how the community design aspects can play a role in individual as well as collective well-being.

Understanding effects of transitions: change in lifestyle

We have shown how changes induced by aspirations and the need for increased comfort are inducing changes in architecture and building typologies. This section will discuss the changes in lifestyle induced by the changes in architecture and vice versa. Examples of some design elements are taken from the traditional and the modern houses to demonstrate this (Table 4 and Figure 17).

Need for a sustainable rural design

This case study of the villages has shown how buildings can shape the way people live and interact with their environment. The role played by people's aspirations to match an urban lifestyle is important here. It is also important to satisfy people's needs, and provide a sustainable way of living for their well-being. Understanding current lifestyle is important, rather than imposing a new, alien lifestyle. For example, in Figure 18, a woman is washing kitchen utensils in the verandah of a newly constructed house in the manner that it is usually done in the

Table 4. Transition in lifestyle and activity spaces

Traditional house	Modern house
Transition spaces The transition space(semi-private space outside the house) is usually a verandah, or a knee-high platform shaded by the eaves of the roof. It acts as a resting place for people from outside and as shaded sitting space for residents. It is also used for spreading and drying crops. In the evenings, women sit and chat, and children play. At night it acts as an open sleeping space during summer months.	Compound walls and RCC verandahs New houses are barricaded with compound walls which are 1.5 m high plastered and painted brick walls. It marks the plot boundaries. It is observed to have no other function like in urban areas which are for providing security against theft, barriers to noise from traffic and visual barriers from strangers. RCC-roofed verandahs (inside the compound), are not used in the same way as the ones in traditional houses, but are more private.
Cattle sheds In the traditional houses, sheds for cattle are integrated with the houses, where they are fed.	Parking spaces Even though no one owns a car, most new constructions have RCC roof parking space for cars and motorbikes. Cattle and agricultural equipment are left outside the compound wall, even though parking spaces are empty.
Passive design Traditional houses have lower indoor temperatures than modern houses[32]. Occupants require no active ventilation, even in summer, although some houses have ceiling fans.	Active design New houses have ceiling fans. People own electrical appliances like air-coolers and refrigerators, even though the villages have access to only 6 h of electricity per day.

Figure 18. Modern-style houses.

transition spaces of traditional houses. Reduced social interaction will also lead to people finding other modes of entertainment, such as watching television, as most of the houses own a DTH (Direct-To-Home) connection. Design should enhance people's standard of living providing long-lasting comfortable buildings, and allied infrastructure and spaces as demanded by their lifestyle and work. Not only is that attention to building design important, but we also need to consider design at street and village levels. A design solution which can work at both people- and village-scales is required. The concept of urban design (the process of designing and shaping cities) as a domain has been existing for quite a while for shaping cityscapes. However, there has not been an equivalent for rural settlements. Even though the term 'urban design' can be used for rural settlements, the word 'urban' could mislead people to think that our final objective is to 'urbanize'. Replacing 'urban' with 'rural' will give a new term 'rural design' to help explain better what we are proposing here. Rural design would hence be designing of rural streetscapes, common spaces, open spaces, public spaces and their spatial configuration and massing of the

settlement as a whole. The term 'rural design' has been used by Thorbeck[36] as a new research discipline dealing with rural issues, with his work focusing on rural areas in North America.

The need for a sustainable rural design is important in the context of villages undergoing transition in India. The spending capacity of rural households in India has been increasing, as more than 70% of the total income of migrants from villages working in cities is remitted to their homes[37]. With respect to the area investigated in this case study, an industrial estate is proposed in Tumkur district[31], and further urbanization trends in rural lifestyles can be expected. The rural power consumption has doubled between 2008 and 2011 in the areas around Bengaluru and farmers have begun running irrigation pump sets even during the night hours[38]. With respect to groundwater, 16% of the area of Kunigal Taluk, and 55% of the area of Tumkur district are overexploited[39]. Sustainable solutions are needed to meet the demands of the rural areas. The following can be considered for sustainable rural design.

Design recommendations for sustainable well-being

Public spaces and market squares: The public spaces in villages where people interact while performing activities like feeding cattle, washing clothes and kitchen utensils are near water sources. Places near local stores where people meet and chat and open spaces near trees at temples where children play, also act as public spaces (Figure 18). While these are unplanned public spaces, designed public spaces (like playgrounds for children) can make these places rich in character, improve people's outdoor experiences and encourage interaction in the community. Designing small market squares allows businesses to prosper, considering the increasing purchasing power. It can drive the local economy with small cafes, eateries and shops selling commodities. Sustainable rural design should be for rural public spaces and activities, understanding the rural lifestyle typical in each village.

Movement: More number of cars and other personal vehicles into the rural settlements can be anticipated with the increased rural income and building of new houses with parking spaces. Care needs to be taken to avoid mistakes made by planners in Indian cities which ignored pedestrian comfort and cycling-friendly streets. Designing cycling-friendly streets will promote cycling within villages and also to nearby villages. Providing resting places on streets (like street-side benches) will encourage walking as a means of transport. Improving public transport to nearby towns will improve accessibility and reduce the need to own personal vehicles.

Trees and landscapes: While trees in village temples act as traditional meeting places with the platform they provide for sitting, more trees could be planted to provide adequate shade and protection from the Sun for people and cattle. Designing open spaces, with trees as a meeting and resting place, will improve social interaction among people in the villages.

Recommendations for administrators and policy makers for sustainable well-being

Waste management: The traditional practice of handling waste is to feed kitchen waste to cattle, and to use agricultural waste like straw for roofing and fencing. Packaged consumables in plastic sachets are popular in rural areas. The empty sachets are often thrown into empty plots along with other organic bio-degradable waste like fallen palm leaves. It is eventually burnt in the open, leading to pollution. Excreta of animals were traditionally used as manure, but are now thrown into open drains. Sewage in open drains breeds mosquitos and leads to the spread of infectious diseases. Waste segregation and disposal practices at the household level should be promoted. Policies and infrastructure needed for the treatment of sewage and other waste should be built.

Educating design practitioners on environmental design: The new concrete dwellings are designed by engineers or contractors who are not trained in environmental design or architectural design. Traditional masons are not formally educated in architectural design, but practice based on knowledge passed on over generations. Educating the traditional masons about modern building design constructions will help them use modern materials innovatively along with their traditional knowledge. Engineers and contractors who practice architectural design must have knowledge in traditional architecture and understand environmental design considerations. Current construction practices emphasize on standardized design with little concern for the local climate and environment. Local administration could register the masons with them and provide a forum for learning from and meeting with engineers, and vice versa. Local administration can empower the masons by providing them with other work when there is no construction activity in the village, or help architects in nearby cities use the masons' knowledge, providing work for them in the cities during the off-season. Co-ordinating masons and engineers will help produce designs that can be constructed using traditional materials in a modern way so that traditional buildings can be made more durable to satisfy the needs of the people.

Promoting the use of renewable resources: Policy decisions are needed to promote the use of renewable resources by design practitioners. Efficient use of local materials and technology can be achieved by newly

trained practitioners consisting of a team of masons and engineers. Concrete dwellings might be more affordable, as resources are available to purchase locally. However, moving away from traditional construction to concrete dwellings, means dependency on externally sourced construction materials than locally sourced ones. This will make building houses less affordable to the villagers in the future. The construction industry has already started facing a shortage of skilled workers by a figure of 40%, and the prices of cement, steel rods, bricks and other input materials have steadily increased by over 30% since 2009 (ref. 40). It is important to preserve and document the knowledge of traditional masons, and encourage them to practice in the new rural environment. The Rural Housing Scheme (Indira Awas Yojana) by the Ministry of Rural Development, Government of India emphasizes using of cost-effective, disaster-resistant, and environment-friendly technologies[41]. However in the same year (2009), the Ministry of Steel, Government of India, which is responsible for developing iron and steel industry in the country supported – 'Promoting, developing and propagating the proper and effective use of steel and increasing the intensity of steel usage, particularly in the construction sector in rural and semi urban areas'[42]. How both measures can go hand in hand is not explained, and such lack of coordination and clarity among Government bodies must be looked into by administrators and policy makers.

Community awareness and participation in rural design: Awareness on sustainable living and the environmental impacts of modern construction materials could be imparted to the villagers. It is important to interact with them and understand their needs in order to create sustainable design.

Conclusion

Well-being is often not understood by people as to what is good for them. This reflects in their choices and eventually in the designs they adapt. With respect to building architecture and rural design, planners have an opportunity to design for rural settlements from a clear slate. It is an opportunity to undo the mistakes made by planners in the cities. The well-being of people should be considered in design through educated analysis, rather than well-being as perceived by the people themselves. Designing rural areas for the well-being of the community while not compromising on well-being of individuals is important for the sustainable well-being of rural areas. Design practitioners should educate the people by showing them the problems associated with their choices, by involving them in the design process, and by discussing their needs and understanding their lifestyles. The Government should intervene by making coordinated policies across concerned ministries to promote sustainable development and growth in rural areas, and not just economic growth and income. Change is constant, and changes in building design styles and practices have been happening over centuries. Modern architecture in the villages studied takes no inspiration from traditional architecture; an approach where both traditional and modern architecture take inspirations from each other is what is required for design in transition. This will require creative designers, to break the mould of classifications and typologies, and design buildings for the climate that draws on the strengths of both the traditional and the modern. Community participation, responsible designing, knowledge and awareness of people, designers, local administrators and policy makers on sustainable growth and development are key for the sustainable well-being of a community.

Note

1. Below poverty line is the poverty threshold of Govt. of India which below INR32 per day in rural areas.

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