Ecopreneurship for Sustainable Development

The Bricolage Solution

Parag Rastogi and Radha Sharma

Contents

P. Rastogi (✉) · R. Sharma
Management Development Institute, Gurgaon, India
e-mail: parag.rastogi@gmail.com; radha@mdi.ac.in; radhasharma308@gmail.com

S. Dhiman, J. Marques (eds.), *Handbook of Engaged Sustainability*,
https://doi.org/10.1007/978-3-319-71312-0_46

Abstract

Sustainability is a critical issue across the globe, and the debate on sustainable development is still in its incipient phase. The purpose of this chapter is to add another perspective in this ongoing debate. Sustainability concerns have led several countries to introduce policy interventions to reduce carbon footprint. However, these policies are not enough to deal with the challenge. The chapter addresses critical sustainability issues through a detailed discussion on key concepts, methods, and lessons learned in operationalizing ecopreneurship as a solution for solving environmental concerns.

Using construction industry as an example, the chapter discusses ecopreneurship as a solution using the twin lenses of sustainability and environmental concerns. Buildings contribute to 24% of the world's CO_2 emissions. A developing country like India with resource constraints which added to the need to reduce the CO_2 footprint poses a significant challenge to building architects. This chapter encapsulates case studies of some Indian architects in sustainable innovation and development. Concerned with sustainability in their work, they face challenges and considerable risks. The chapter analyzes the barriers they encounter, how they view these risks, and the methods they adopt to mitigate the risks. The chapter examines in detail the existing definitions and typologies in dealing with sustainability, explores the motivational aspects for ecopreneurs, and researches the various parameters of operationalizing sustainable solutions. The chapter introduces a novel entrepreneur typology – a *bricoleur ecopreneur* – who uses bricolage as a solution to the challenges of sustainable development.

The chapter can be helpful for researchers in designing research in the overall context of sustainable development debate. Apart from researchers, this would also be useful for international institutions, NGOs, architects, developers, and building users.

Keywords

Sustainability · Entrepreneurship · Ecopreneurs · Bricolage · Environmental concerns · Building architecture · Bricoleur · Disruptive innovators · Construction industry

Introduction

Globally sustainability has become a critical issue, and researchers and industry practitioners are trying innovative solutions that are sustainable and protect the environment. Many countries have brought in policy interventions for reducing carbon footprint, waste material management, rainwater harvesting, and promoting the use of alternative energy resources and materials. United Nations Conference on Environment and Development (UNCED) in 1992 brought the focus on climate change and uneconomic growth (Elkington 1994).

At the global level, cities consume 75% of the world's energy and are responsible for 80% of greenhouse gas emissions. Buildings are responsible for 24% of the world's CO_2 emissions (International Energy Agency 2008). Building industry has a high level of impact on the economic growth on one hand and environmental impact on the other. According to United Nations Environment Program – Sustainable Buildings and Climate Initiative (UNEP-SBCI) report (2009), "the building sector contributes up to 30% of global annual greenhouse gas emissions and consumes up to 40% of all energy. . . if nothing is done, greenhouse gas emissions from buildings will more than double in the next 20 years."

Moreover, most of the energy from buildings (57% of domestic consumption) is used for space heating or cooling (Association for the Conservation of Energy 2004). This highlights the critical need for sustainability-driven designs of buildings. Given the criticality and the impact on environment it plays, there is an urgent need to study the construction industry from sustainability perspective. According to Jong and Muizer (2005), a study in which 58 different business sectors in Netherlands were studied based on their levels of innovative input, output, and future investing plans, the construction industry ranked 55.

Several studies have shown that many businesses view sustainable agenda as detrimental to their businesses and they are resistant to improve their environmental performance (Revell and Rutherfoord 2003; Tilley 2000). This is truer for most owner-managers (Revell and Blackburn 2007). This chapter, in contrast, builds on the current knowledge about entrepreneurs who are working toward addressing the challenges of sustainable development. In this chapter, we discuss entrepreneurs who take considerable risk to aggressively pursue sustainability agenda. These entrepreneurs use bricolage as a solution for overcoming the challenges of sustainable development.

The Context

There is an increasing interest in linking entrepreneurship and sustainability. However, theoretical understanding of the link is only emergent. The study by York and Venkataraman (2010) posited "although there has been recent interest in the concept of environmental or sustainable entrepreneurship, under what conditions and how entrepreneurial action can address such problems remains unclear."

Entrepreneurs have the unique ability to combine self and circumstance (Anderson 2000). There has been a focus on understanding entrepreneurship as a potential mechanism for sustainable development (Harbi et al. 2010). We have used multiple-case approach to develop deeper understanding and build theoretical knowledge of environmentally sustainable entrepreneurship. These case studies seek to expand our understanding of how building architects can play a role in environmentally sustainable entrepreneurship.

The case studies encapsulate experiences of few architects/entrepreneurs from India who are concerned about sustainability in their work, the barriers they encounter, how they view these risks, and innovative methods they employ in mitigating

these risks. These cases help in understanding the concept of sustainable entrepreneurship from a resource-based perspective in a country like India, where resources are limited. The focus is on the actions taken by the ecopreneurs in the process of sustainable innovation and development.

These case studies seek to answer the following questions:

1. How can building entrepreneurs contribute to sustainability?
2. How can the concepts of sustainability and entrepreneurship be linked with resources?
3. How can entrepreneurial actions address sustainable requirements in construction industry?
4. Is bricolage a feasible option in building (construction) industry that can address sustainability concerns?

Bricolage: An Introduction

Bricolage was first introduced by Levi-Strauss (1967) as a theory of how meanings are assigned to objects (or resources) and the institutional rules of when and what combinations can be applied in society. Levi Strauss proposed a bricoleur (a person that engages in bricolage) as one who is "trying to make his way out of and to go beyond the constraints imposed by a particular state of civilization."

Since then, bricolage has been used from its structuralist anthropology origins to cognitive science, information technology, innovation, and organization theory (Duymedjian and Rulings 2010). We find that bricolage can be a viable method to relate entrepreneurship to sustainability.

Sustainable Entrepreneurship

Sustainable entrepreneurs are those entrepreneurs who combine various aspects of sustainability and have a different organizing logic to more conventional entrepreneurs (Tilley and Parrish 2006). These entrepreneurs operate their businesses in ways that are counter to conventional entrepreneurial behavior (Hart 2006). According to Parrish (2006), these entrepreneurs seek to perpetuate resources focused on sustainable development. They play a critical role in bringing a paradigm shift to a new form of development. According to Beveridge and Guy (2005), such development can alleviate global warming and other negative environmental impacts.

There have been several ecological advancements that have happened in the recent years. Modernization efforts like hybrid cars, solar power, and windmills combine new technologies and even trigger changing institutions. Such ecological innovations are getting into the mainstream now through commercial ventures. Dean and McMullen (2007) have used this evidence to argue that there is an increasing importance for environmental entrepreneurship. Willis et al. (2007) have called such

entrepreneurs "disruptive innovators" – implying that established business models and user expectations are transformed by such innovations. Further, Schlange (2009) has posited that "sustainability-driven entrepreneurs view their ventures as integral parts of a larger societal context in which they are able to contribute to the improvement of life conditions in the most general sense."

Ecopreneurship

The term "ecopreneurship" is a combination of two words, "ecological" ("eco") and "entrepreneurship." Ecopreneurship can thus be roughly defined as "entrepreneurship through an environmental lens." According to Dean and McMullen (2007), ecopreneurship is a "sustainable and environmental entrepreneurship which detail how entrepreneurs seize the opportunities that are inherent in environmentally relevant market failures." Schlange (2006) has suggested that "ecologically driven entrepreneurship has *sustainability* as a key element to *motivate* its basic approach."

Hence, ecopreneurship is different from other forms of corporate environmental development by the company's commitment to environmental progress and its desire for business growth. Ecopreneurship has its own characteristics and the associated business risks which are different.

Post and Altman (1994) have identified three main drivers of change from an external perspective:

1. *Compliance-based*, which emerge as an outcome of government regulation and legislation
2. *Market-driven*, with environmentally beneficial behavior coming as a result of profit motivation
3. *Value-driven*, with environmental change coming in response to end-user demands

Schaltegger (2002) has posited ecopreneurs do more than just a change and that they "destroy existing conventional production methods, products, market structures and consumption patterns and replace them with superior environmental products and services." In a similar context, Walley and Taylor (2002) see ecopreneurs as "crucial change agents" or "champions" of "collective learning process."

For ecopreneurs, "market creation is even more difficult for environmental business ideas than it is for non-environmental business ideas" (Linnanen 2002). Randjelovic et al. (2003) have pointed out that ecopreneurial development may require longer gestation periods to achieve market breakthrough than conventional entrepreneurial activity, and this long period can deter investors ("Green VC") looking for a quick return on their investment. Further, Randjelovic et al. (2003) have proposed that ecopreneurs "need to develop competences on environment-related strategies and practices, which can create economic value *and* reduce environmental impacts/risks."

How Entrepreneurs Can Contribute to Sustainability

There are certain types of entrepreneurial actions that are particularly conducive to the creation of sustainable solutions (Dean and McMullen 2007). Sustainable entrepreneurship research has primarily focused on how entrepreneurs can work on profit opportunities within a market which are environmentally friendly.

Ecopreneurship explores various forms of entrepreneurial action that are resource oriented and seek to make the most of the resources at hand (Baker and Nelson 2005). Ecopreneurship stresses on parsimony in usage of resources. Application of bricolage in ecopreneurship is premised on the *frugal use of resources* as well as *usage of resources which are available currently* to the entrepreneur.

Entrepreneurship and Sustainability

For environmentally sustainable entrepreneurial action, Pacheco et al. (2010) identify two types of actions. The first type of actions is taken by the entrepreneurs who identify and exploit opportunities that are environmentally sensitive. This entrepreneur could be a profit-seeking entrepreneur (Kirzner 1973) or in the nexus perspective of entrepreneurship (Shane and Venkataraman 2000). Second-type actions are taken by the entrepreneurs who create the opportunities for sustainable entrepreneurship through institutional entrepreneurship (Aldrich and Fiol 1994).

Profit-Seeking Entrepreneur

Pacheco et al. (2010) have used the metaphor of "green prison" and using the prisoner's dilemma construct argued that there are situations where actors necessarily take the less environmentally unsustainable option, e.g., because it is cheapest or easiest, even though in the long run it may be less rational. An example of this could be over-exploitation of natural resources where over-exploitation in short term can result in long-term scarcity of the resource.

Institutional Entrepreneur

The term institutional entrepreneurship refers to the "activities of actors who have an interest in particular institutional arrangement and who leverage resources to create new institutions or to transform existing ones" (Maguire et al. 2004). Moreover, such an entrepreneur can "create a whole new system of meaning that ties the functioning of disparate sets of institutions together" (Garud et al. 2002). "Institutional entrepreneurs act to change the incentives of the institutional setting by reducing the benefits of environmentally unsustainable strategies and/or enhancing the benefits of the environmentally sound strategies" (Pacheco et al. 2010). Dean and McMullen (2007) further suggest that the elimination of environmentally damaging government subsidies is perhaps the most important form of sustainable institutional entrepreneurship.

This does not imply that institutional entrepreneurs are not driven by profit. At times, the opportunities created through institutional change are exploited by the very same individuals or organizations that acted as institutional entrepreneurs (Dean and McMullen 2007; Pacheco et al. 2010).

Resource-Oriented Entrepreneur

According to Stevenson and Jarillo (1990), entrepreneurship is "a process by which individuals – either on their own or inside organizations – pursue opportunities without regard to the resources they currently control." Can entrepreneurial action also be resource oriented? The concept of bricolage suggests that entrepreneurs take their starting point in currently available resources and create effects from these resources. Such entrepreneurs create opportunities from the resources at hand (Baker and Nelson 2005). This implies a bias toward parsimony in utilization of resources. Such entrepreneurs can focus on creative utilization of resources at hand so that action can take place in circumstances where the interest is in improving the environment.

How the Concepts of Sustainability and Entrepreneurship Can Be Linked to Business Models

Ecopreneurship deals with entrepreneurs focused on sustainability. How do we relate ecopreneurship to business models? Eastwood et al. (2001) proposed a business classification based on the types of green businesses. There are other proposed typologies that focus on the characteristics of the ecopreneurs. Linnanen (2002) has based the typologies on internal motivations and desires. Schaltegger (2002) classifies ecopreneurs based on the priority given by them to environmental issues as a business goal and their focus on the market effect of the business. Taylor and Walley (2002) have used influence of structural drivers and orientation toward sustainability or financial outcomes. Summary of these typologies is given in Table 1.

The ecopreneur typologies are not without criticism. Gibbs (2009) has extensively reviewed the ecopreneur typologies and critiqued ecopreneur literature that "it is heavy on speculation and extremely light on empirical evidence." Similarly, Beveridge and Guy (2005) have commented that these typologies "fail to fully engage with the processes involved in the emergence of eco-preneurship." Harbi et al. (2010) have concurred and concluded that very little empirical work has been done on ecopreneur typologies.

Harbi et al. (2010) did an empirical research based on Taylor and Walley typology on 56 Tunisian entrepreneurs and concluded that only "ethical maverick" type of ecopreneur is present in their sample. They found a profile resembling "innovative opportunists" and no presence of "ad hoc environpreneurs" and "visionary champions." This implies that Taylor and Walley typology does not capture all the types of ecopreneurs.

Table 1 Ecopreneur typologies

Reference	Parameters considered	Characteristics	Type of ecopreneur
Eastwood et al. (2001)	Types of green businesses	Owners in 11 types of green businesses	Green producer
Liannen (2002)	1. Desire to change the world 2. Financial drive	High on first and low on second parameter	Nonprofit businessman
		Low on first and low on second parameter	Self-employer
		Low on first and high on second parameter	Opportunist
		High on first and high on second parameter	Successful idealist
Schaltegger (2002)	1. Environmental performance goals are core to business	Combined with alternate scene away from market orientation	Alternative actors
		Combined with eco-niche	Bioneers
		Combined with mass market	Ecopreneur
Taylor and Walley (2002)	1. Influenced by structural drivers – hard (regulation, incentives, etc.) or soft (past experience, family, etc.) 2. Financial orientation or commitment to sustainability	Hard structural drivers and financial orientation	Innovative opportunists
		Hard structural drivers and commitment to sustainability	Visionary champions
		Soft structural drivers and sustainability orientations	Ethical mavericks
		Soft structural drivers and financial orientation	Ad hoc environpreneurs

How Entrepreneurial Actions Can Address Sustainable Requirements in Construction Industry

Yin (2009) points out that case studies are the preferred strategy when "how" and "why" questions are posed. Hence to explore the question "how do entrepreneurs evaluate risk?" we propose to use case study method – using the practitioners' experience/actions.

Building theory/model from case studies is a research strategy that involves using one or more cases to create theoretical constructs, propositions, and/or midrange

theory from case-based empirical evidence (Eisenhardt 1989). The theory-building process occurs via recursive cycling among the case data, emerging theory, and, later, extant literature (Eisenhardt and Graebner 2007). For phenomenon-driven research questions, a researcher has to frame the research in terms of the importance of the phenomenon and the lack of plausible existing theory (Eisenhardt and Graebner 2007).

Multiple-case studies typically provide a stronger base for theory building. They are chosen for theoretical reasons such as replication, extension of theory, contrary replication, and elimination of alternative explanations (Yin 2009). Adding three cases to a single-case study is modest in terms of numbers but offers four times the analytic power (Eisenhardt and Graebner 2007).

The cases to study have been selected using a critical case strategy (Flyvbjerg 2004). The value of a critical case is determined, not by how it is representative of a larger population but by the amount of information and learning that can be derived from the case (Flyvbjerg 2004).

The critical cases have been selected on the basis of the following criteria:

1. The entrepreneur is focused on sustainable architecture.
2. Project designs and actions are focused on creating value from natural environment.
3. Architects have the freedom to practice non-sustainable designs (no commercial or policy constraints).

This research evaluates three case studies of building architects, who are motivated by sustainable designs and use bricolage extensively.

Case Study 1: Vikram Varma

Vikram's definition of sustainability is "living for less." "Sustainability is different from green. Many green buildings are technology-based. They do not care about energy cost. They are more about efficiency and better technology."

Eye Hospital in Goa, India

One of Vikram's key projects was in Goa, in the western part of India. Here he experimented and learnt much about sustainable architecture. He was tasked with building a 30,000 sq. ft eye clinic.

The client had taken proposals from various architects. One of the proposals was based on futuristic material and used an exterior envelope of aluminum and steel. The facade looked stunning. The second brief the client got was a design based on modular furniture and clutter-breaking decor. Both were modern architectural proposals.

Vikram's own proposal was starkly different. He proposed that he would do an 80,000 sq. ft eye hospital with inpatient facilities as well. He would also build it so that it would be a very energy-efficient building from an air-conditioning perspective

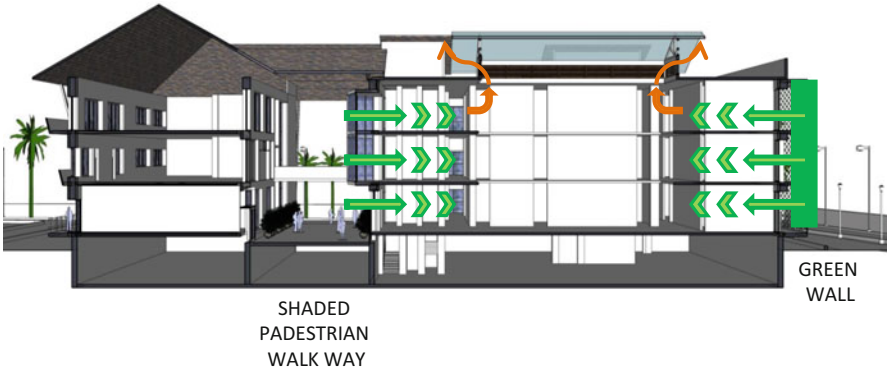

Fig. 1 Schematic of airflow for natural air conditioning

(Fig. 1). As the operational cost would be low, it would be a facility with low operating costs. He also suggested that he would do the project in phases.

As an experiment, he wanted to use coconut wood. He had heard of some architects using coconut wood in Tamil Nadu, a southern coastal state in India. Coconut wood does not need seasoning. His reasoning was that coconut wood would be widely available in Goa as well as it is also a coastal state. He surveyed the local constructions. While there were a few domestic users, there were no commercial buildings that had used coconut wood. He made up his mind on using coconut wood as it would be a novelty for Goa. The wood would be drawn from trees which had become non-fruit giving.

For the cooling solution without air conditioning, he proposed a novel vertical garden which has double-sided ventilating capability – a vertical garden with a "double skin." The hospital waste would be used for irrigation of the vertical garden. The construction material would be coconut waste material (Figs. 2 and 3).

Case Analysis

Vikram made systematic and extensive use of the resources at hand – what Baker and Nelson (2005) refer to as bricolage. The understanding of how resource-oriented entrepreneurship leads to the creation of environmentally sustainable practices and solutions is discussed below.

Scavenging (Baker and Nelson 2005) is understood as the collecting of resources that others have discarded or do not intend to use. Vikram's use of coconut wood which others had not intended to use is an example of scavenging.

Scavenging provides Vikram the confidence that he can derive resources for a new project. This broadens his bricolage capabilities. Scavenging practices are also evident in Vikram's use of resources that are by-products or waste products from the hospital. Such practices reduce strain on the environment, as they substitute other

Fig. 2 Vertical garden setup

products that would have incurred production costs. It also makes local waste management convenient.

Use of waste material in irrigating the vertical garden is a form of recycling as well. Recycling, as practiced by Vikram, where the resources to be recycled are acquired at no cost, represents a form of bricolage that reduces the strain placed on the natural environment as the environmental costs of production have already been incurred. Moreover, it reduced the financial burden for the client.

In some cases where recycled materials were not available, Vikram made an effort to use locally available resources, i.e., resources that are naturally available in the local setting in which the practice takes place. The attempt at using coconut wood was in this direction.

Using locally available resources ideally reduces strain on the environment, mainly due to the transportation costs.

Another practice is the use of unprocessed materials. Coconut wood does not require seasoning and hence can be used directly.

Vikram extended this further and used another form of bricolage in his closed/semi-closed systems – using the hospital waste is the best example there.

Vikram not only reduced his use of water but also derived value from the system.

Deriving value from such closed system constitutes a "making do," as value is created with resources that are available and that under normal circumstances would be fed into the public waste management system.

The above mentioned six forms of bricolage used by Vikram are summarized in Table 2.

The case analysis and various forms of bricolage demonstrate that resource-oriented environmentally sustainable entrepreneurship exists as a phenomenon in

Fig. 3 (**a**) and (**b**) Vertical garden close-up

Table 2 Forms of bricolage used in Case 1

Form of bricolage	Examples of use
Scavenging	Visible from the many resources used by scavenging
Recycling	In the water recycling systems
Using local materials	Intent to use local material like coconut wood
Using unprocessed materials	Coconut wood which does not require seasoning
Establishing semi-closed systems	In the waste systems reusing the hospital wastes
Extracting value from semi-closed systems	In the use of novel air-conditioning solution

building industry. It indicates the importance of resources in sustainability architecture.

This type of entrepreneurship is innovative and disruptive – with focus on recombinations of resources. The actions performed by the entrepreneur are distinct from the classical view of entrepreneurs.

Baker and Nelson (2005) cite three examples of bricolage that have harmful environmental consequences and where new resources – from an environmental perspective – should have been acquired.

The six forms of bricolage practiced by Vikram need to be more sustainable than other forms of architectural practices. For example, scavenging is sustainable only if the resources scavenged and stored do not lead to the emission of toxic or otherwise harmful substances. The same is the case for recycling, which is sustainable if the potential environmental damages offset those caused by the production and use of a newer alternative.

Hence, it cannot be said that all forms of resource-oriented entrepreneurial actions are environmentally sustainable.

In terms of inspiring others, Vikram's most valuable contribution to sustainability is providing a response to two key challenges in terms of sustainable resource consumption:

(i) Making visible the flow of resources (such as airflow system and recycled waste)
(ii) Anchoring these flows in a closed system

Vikram accomplished both tasks successfully.

Case Study 2: Chitra Vishwanath

Chitra runs her firm Biome Environmental Solutions Pvt. Ltd. in Bangalore, India. She has 21 years of experience in the field, though she has not had any formal training in sustainability.

She believes that sustainable construction is the only way forward. She is getting more and more entrenched into the concept that we see social unrest due to unsustainable lifestyle choices being made. "Lack of water and the race for energy are the top-most unsustainable lifestyle choices that people are making."

She started freelancing in her name in 1990 in Bangalore. She built their own home in 1995 with stabilized mud blocks (or compressed and stabilized earth blocks), rainwater harvesting, and solar installations which eventually became a very easy product to convince the clients. "We walked the talk and that made a lot of difference to our prospective clients."

Chitra's House ("San Souci")

The house was built to conserve and enhance biodiversity on-site and also make use of all natural resources available on it. In the design, a basement was put in which provided all the earth required to make the compressed stabilized earth blocks for the home. The basement is a thermally balanced space with temperatures never going above 23° C and is used as a study and playroom (Fig. 4a). The house has been designed to work with rainwater harvesting and organic waste disposal, and gray-water reuse are practiced.

Fig. 4 (**a**) and (**b**) Chitra's house

The roof is another part of the house designed to capture rainwater and use solar energy for cooking, water heating, and for lighting. An "ecosan" toilet placed here provides nutrients to grow rice in a rooftop paddy patch which is irrigated using wastewater from the washing machine which is treated using a reed drum system. Rice and millet grown on the rooftop provide food, while vegetables are grown in pots. The mulch layer rests upon silpaulin lining sheets to prevent dampness. The rooftop garden also helps to keep the house cool (Fig. 4b).

The house inside has no plaster or paint and works with mezzanines to use the volume available to the maximum. One mezzanine area is a sleeping loft, and the other is a study room for the son.

No artificial cooling systems such as fans or ACs have been used in this home. The green walls through creepers bring 32 different types of birds plus the occasional

snake on to the rooftop. Sans Souci is an open house to study the various ecological ideas used and has been frequented by kids, college students, students of architecture, and others of the curious variety.

Bio-pool (Fig. 5a–d)

Built as part of the Native Village Eco Resort at Hessarghatta, a town in Karnataka state in India, this is a natural swimming pool that tries to recreate nature's mechanisms for purifying and maintaining water quality. Rather than using chemicals, the bio-pool incorporates reeds and other living organisms that replicate the kind of system existing in a lake.

Broadly there are two sections – one for swimming and another for purifying the water. Reeds and plants help to oxygenate the water while microorganisms and other creatures like frogs help keep it clean. Water circulation is achieved using a difference in levels thereby eliminating the need to artificially pump and circulate the water.

Playing Parks (Fig. 6a, b)

Kilikili is an NGO in India which works with disabled children (www.kilikili.org) with a focus on creating playspaces for such kids in public parks. Their concern stems from the fact that one never really finds a disabled child playing in a park – mainly due to lack of access and equipment. Kilikili first approached Biome in 2006 to help out with the design of such a play area in Coles Park, Bangalore, India. Chitra's aim is not to have separate spaces for disabled kids but rather a play area where all children – regardless of their abilities – can play together. Since all public parks are under the purview of Bruhat Bengaluru Mahanagar Palike (Municipal Corporation of Bangalore), India, Chitra and her team have been constantly engaging with them to sensitize the authorities and get their support for these activities. She has done five more similar projects since then – all in Bangalore.

Her innovation approach is based on the use of sustainable materials. She believes that there needs to be a lot of focus on sustainable materials, water treatment systems, and energy. "We want to always be able to give the client a salad bowl of various choices and we need innovations in them." In doing so, she foresees that there are sometime "end of the pipe" risks for such novel innovation. She mitigates such risks by first testing them on projects where the client is agreeable to test new ideas.

Most of their innovations can be easily implementable and are replicable. Most of the innovations are adopted in their designs. For example, they were one of the first to suggest adding a basement in the home designs in Bangalore. It was not a common practice to have it in homes. They have been also insisting that the basement be a habitable space since it is suited climatically too. The earth excavated from the basement is used for making the walling and roofing units.

She has found that sustainable designs are not more expensive than the conventional ones and in the longer run cheaper to maintain. It is sometimes the lack of conviction on the part of the future owner to do things which is not in-line with what

Fig. 5 (continued)

Fig. 5 (**a**–**d**) Phases in construction of the bio-pool

is seen commonly. It is also partly not enough knowledge about the consequences of one's actions as well as total disregard of the same in some cases.

The strategy she uses to convince her prospective clients are the following:

1. Walking the talk
2. Engaging them with her existing clients
3. Gently making them aware on what is unsustainable and that we will leave a sorry earth for our kids

There are times when this gentle cajoling and sharing of best practices do not help. In about 10% of the cases, the clients do say no to such sustainable ideas. Most of the resistance comes on the use of mud, bare walls without paint, treatment of gray/black water and its reuse, and the usage of ecosan options.

When this happens, she considers it as a new challenge and strives to make the design a lot more appealing while still incorporating what she believes is the best for the environment.

Case Analysis

Chitra has made use of bricolage to a great extent. Some of the uses of bricolage by Chitra are given in Table 3.

The concept of bio-pool is of significant value as there are many places in India where it can be used.

Fig. 6 (**a**) and (**b**) Playing parks

Case Study 3: Sanjay Prakash

Sanjay Prakash is an architect with a commitment to energy-conscious architecture, eco-friendly design, people's participation in planning, music, and production design. Over the years, he has integrated all his work with the practice of new urbanism and sustainability in his professional and personal life.

His area of practice and research over the last 33 years includes passive and low energy architecture and planning, hybrid air conditioning, autonomous energy and water systems, bamboo and earth construction, community-based design of common property, and computer-aided design. Under his guidance, hundreds of persons have developed capabilities in performing design, conceptual, or management work in these areas.

Table 3 Forms of bricolage used in Case 2

Form of bricolage	Examples of use
Scavenging	Visible from the many resources used by scavenging, e.g., use of truck tires in children parks
Recycling	In the water recycling systems, e.g., ecosan solutions and bio-pool
Using local materials	Intent to use local material like reeds and plants in bio-pool
Using unprocessed materials	Reeds, plants, etc. to create water filtration solution
Establishing semi-closed systems	In the bio-pool system
Extracting value from semi-closed systems	In the use of novel bio-pool system

He is the principal consultant of his design firm, SHiFt: Studio for Habitat Futures (formerly Sanjay Prakash and Associates) which has 15 associates. He is a senior advisor at the Indian Institute for Human Settlements (IIHS). His name and work are mentioned in the twentieth edition of one of the main reference works in architectural history, *A History of Architecture*, by Sir Bannister Fletcher.

Sanjay knows no other way of working – but only the sustainable way. He believes that "it is authentic, unself-conscious and natural for me." He just cannot follow non-sustainable practices – even at the cost of losing work, though his reputation precludes that. His interest in sustainability was triggered by reading Schumacher's *Small is Beautiful*. His first projects were in designing and developing solar houses in Srinagar, Jodhpur, and Delhi (all cities in India). The most important innovations for him are the ones that are resource-conserving and which are integral to the architecture.

Some of the risks that he takes cognizance of are as follows:

1. Innovations that do not work or do not work as well as planned.
2. There are few vendors and contractors who are conversant with the best sustainable methods, and hence the vendors would need to be developed from a scratch.

The biggest barrier in adoption of sustainable innovations and technologies is the misunderstanding of green versus sustainable versus innovative. "Going green" does not necessarily imply being sustainable.

He has seen demand for sustainable buildings increase over the years. As his reputation has also grown over the years, he has seen that his clients self-select on the basis of his reputation. He has also seen that now there are a lot of "charlatans in the garb of green" offering their services.

He does not anymore need to convince clients to accept sustainable solutions. The most often discussion he has now is the "sufficiency discussion." The clients want to know how much is enough.

Based on his own experiences, his thoughts are centered around the following six tactics to manage physical stock and flows in a community:

1. Use less with Factor 4 technologies for supply and social limits of sufficiency and equity on demand.
2. Grow your own tapping harvestable yields as autonomously as possible.
3. Build two-way networks for security: every consumer is also a producer.
4. Store a lot because renewable resource yields are often diurnal and seasonal.
5. Transport less over shorter distances using least life-cycle cost technologies.
6. Exchange using intelligent wireless networks to enable real-time trade and delivery of goods.

He then explained the approach to mainstream green and sustainability for large development and settlements and how to go beyond (bringing in equity, sufficiency, resilience).

Residence in Delhi, India

This was one of Sanjay's early projects in Delhi and is of EASE (environmentally appealing and saving energy) type (Fig. 7).

The following were the design features:

- The house was oriented to face south so that every habitable room has liberal solar exposure. Shading was designed to prevent solar gains during summer and allow the same during winter.
- External wall and roof insulation help the thermal mass to act in tandem with the inner space.
- Reflective finishes of wall and roof for heat reflection.

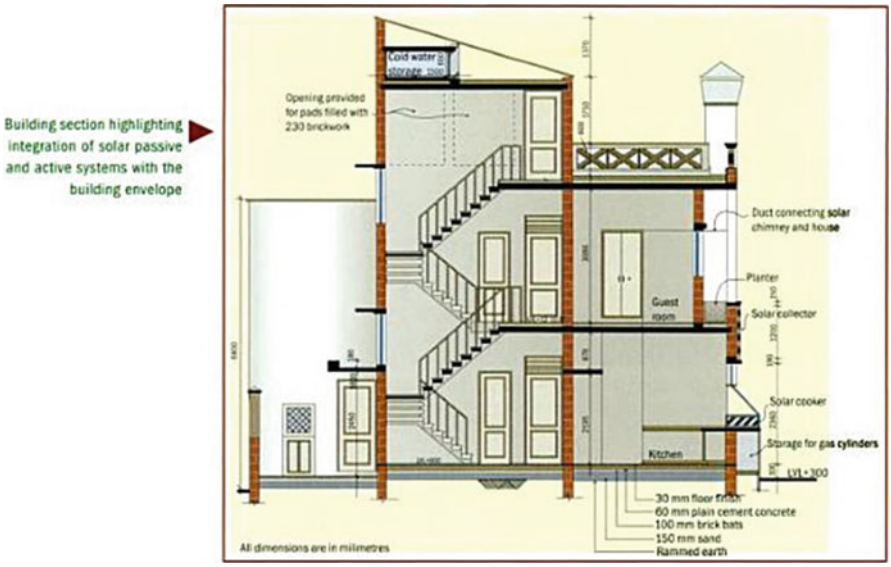

Fig. 7 Schematic of a residence designed in Delhi

- Multidirectional evaporative wind tower atop stairwell, for cooling of house during dry summer.
- Monsoon comfort dependent on strategically opening and closing of windows.
- South-facing solar chimneys assist air exhaust during summer.
- Architecturally integrated solar water heating system and solar cooker.
- Compost pits in garden for composting of kitchen wastes.
- Low water flush valves without cisterns.

Mirambika, New Delhi

The building was conceived as a place to hold an innovative program of education, research, training, and scholarship. Mirambika is a "free progress" school where the stress is on child-centric value-oriented education. The spaces were designed to be organic, amorphous, and such that the boundary between inside space and outside space would vanish.

The building is planned as a space-filling modular grid on a basic structural dimension of 7.2 m, with concrete ribs subdividing the slab into eight or four equal panels. Though they are very few, walls can be shifted to any of these locations on the ribs, and the floor which is made under them will need to be ground, while the electrical services in the ceiling are redundantly arranged so that they can just drop down according to flexible arrangements of the spaces below. Water-based services (sinks, toilets, water play areas) are placed in defined, relatively inflexible, locations.

The building is furnished with white terrazzo and china mosaic roofs, extensive courtyards and vegetation for cooling and ventilation, and integrated solar hot water.

The design team was apprehensive that the type of building detailed – almost like a verandah, with few walls, therefore open to dust – might prove a liability due to heat and dust, but as it turns out, the dust-free environment of the ashram around has allowed this building to actually be comfortable in all seasons.

Case Analysis

Some of the uses of bricolage by Sanjay are given in Table 4.

Table 4 Forms of bricolage used in Case 3

Form of bricolage	Examples of use
Scavenging	South-facing construction so that every habitable room has liberal solar exposure
Recycling	Compost pits in garden for composting of waste materials
Using local materials	Use of natural sunlight for lighting/heating, etc.
Using unprocessed materials	Use of natural sunlight
Establishing semi-closed systems	Use of wind tower/solar chimneys/solar systems
Extracting value from semi-closed systems	Multidirectional evaporative wind tower atop stairwell, for cooling of construction during dry summer

Bricolage: A Feasible Option in Construction Industry that Can Address Sustainability Concerns

Schaltegger (2002) suggested ecopreneurial types: alternative actors, bioneers, and ecopreneurs do not fall in the above cases of *bricoleur entrepreneurs*. It is suggested that there is a novel type of ecopreneur: bricoleur sustainable entrepreneurs. They are inventors, with high R&D focus, *and* use the material that is readily available. They interact with the market in a large way.

Responses from the three ecopreneurs are summarized in Table 5.

Some of the themes which emerge from the above three cases are given in Table 6.

Proposed Model for Bricoleur Entrepreneurs

Resource-based entrepreneurship as a phenomenon exists in the building architecture industry, not highly reputed for innovation. Bricoleur ecopreneurship exists as a phenomenon as evident from the above three cases. The forms of bricolage as identified from the analysis are given in Table 7.

Ecopreneurs exist in building architecture industry. They play an important role in catalyzing the sustainable designs. Ecopreneurs see themselves differently from others – the others who are "charlatans in green." Ecopreneurs innovate – however, they are also concerned about the effectiveness of their innovations ("end of the pipe risks," "innovations do not work as well as desired").

Some of them are concerned about what customers want and make designs suitable to customer needs ("we then look at how we can strive to make the designs a lot more appealing"). However there are others who do not change their design style ("I do not need to convince them. They come to me").

Ecopreneurs practice bricolage extensively. The model for such entrepreneurs is presented in Fig. 8.

Table 5 Responses from ecopreneurs

	Sanjay Prakash	Vikram Varma	Chitra Vishwanathan
Special training in sustainability	No	Yes	No
Importance of what customer wants	Emphatic no	Yes	Emphatic yes
Understanding of implications of long-term use of non-sustainable designs	Yes	Yes	Yes
Importance of latest technology/innovation	Yes	Yes	Emphatic yes
Importance of vendor base to succeed	Yes	Yes	Yes
Lifestyle of customers as a factor in sustainable designs	No	No	Yes
Walking the talk	No need	Ambiguous	Strongly needed

Table 6 Themes emerging from the case analyses

Repetitions	1. Designs to address climate/environment issues 2. Vendor base for executing sustainable designs is weak 3. Growing demand for sustainable designs 4. Innovations do not work as well as desired 5. Lifestyle needs of customers is a deterrent
Indigenous typologies	1. Ecosan designs 2. Bricolage applications in various forms
Metaphors used	1. Millimeters make a meter and meters make kilometers 2. Small is beautiful 3. Walk the talk 4. End of the pipe risks 5. New avatar of innovations 6. Charlatans in green
Linguistic connectors	1. . . . "we then look at how we can strive to make the designs a lot more appealing"

Table 7 Forms of bricolage

Form of bricolage
Scavenging
Recycling
Using local materials
Using unprocessed materials
Establishing semi-closed systems
Extracting value from semi-closed systems

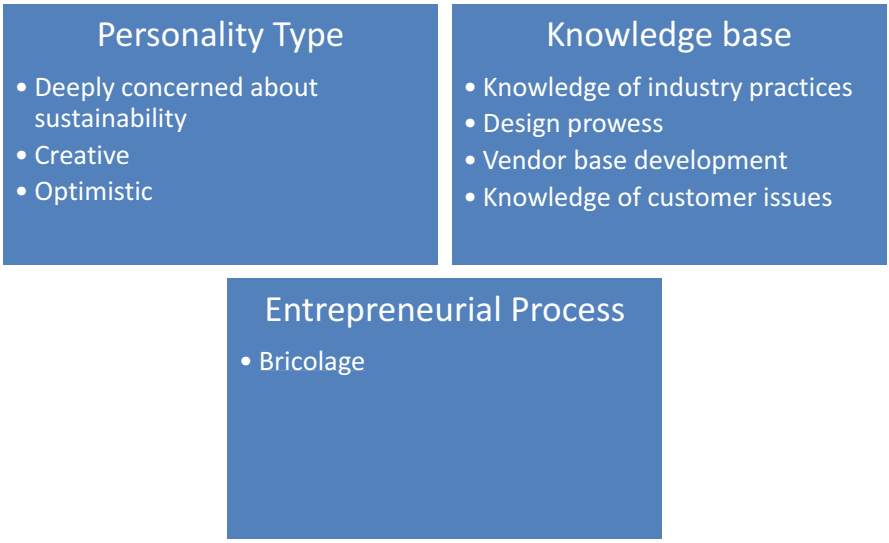

Fig. 8 Model for bricoleur entrepreneurs

The contributions within entrepreneurship literature relate bricolage use of knowledge domains (Baker et al. 2003) and creation of "something from nothing" in resource-poor environments (Baker and Nelson 2005). Ferneley and Bell (2006) have applied bricolage to information systems and term it as "a useful concept as it deals with the need for SMEs to learn about the possibilities of IS in situ, simultaneously exploiting the can-do approach." Wu et al. (2017) have concluded that "bricolage hastens new-product development." Weick (1993) identified bricolage as one of the sources of resilience and useful in creating order out of whatever is available impacting the firm's resilience in resource-constrained environments.

The three cases discussed here add to the knowledge on the understanding of *bricoleur ecopreneurs*. This is a new generation of ecopreneurs seeking to combine environmental awareness with business success and conventional entrepreneurial activity and creating new forms of business models. In ecopreneurship paradigm, such entrepreneurial activity may become increasingly central to market success as environment concerns become more prominent.

Cross-References

- ▶ Low-Carbon Economies (LCEs)
- ▶ People, Planet, and Profit
- ▶ Sustainable Living in the City
- ▶ The Spirit of Sustainability
- ▶ The Theology of Sustainability Practice

References

Aldrich, H. E., & Fiol, C. M. (1994). Fools rush in – The institutional context of industry creation. *The Academy of Management Review, 19*(4), 645–670.

Anderson, A. (2000). The protean entrepreneur: The entrepreneurial process as fitting self and circumstance. *Journal of Enterprising Culture, 08*, 201.

Association for the Conservation of Energy (ACE). (2004). (http://www.ukace.org/category/ace-research/). Briefing on the energy performance of buildings directive.

Baker, T., & Nelson, R. E. (2005). Creating something from nothing: Resource construction through entrepreneurial bricolage. *Administrative Science Quarterly, 50*(3), 329–366.

Baker, T., Miner, A. S., & Eesley, D. T. (2003). Improvising firms: Bricolage, account giving and improvisational competencies in the founding process. *Research Policy, 32*(2), 255–276.

Beveridge, R., & Guy, S. (2005). The rise of the eco-preneur and the messy world of environmental innovation. *Local Environment, 10*(6), 665–676.

Dean, T., & McMullen, J. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing, 22*(1), 50–76.

Duymedjian, R., & Rulings, C. C. (2010). Towards a foundation of bricolage in organization and management theory. *Organization Studies, 31*(2), 133–151.

Eastwood, D., Eaton, M., Guyer, C., & Stark, T. (2001). An examination of employment change in Northern Ireland's environmental industry 1993–2003. *European Environment II, 11*, 197–210.

Eisenhardt, K. M. (1989). Building theories from case study research. *The Academy of Management Review, 14*(4), 532–551.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal, 50*(1), 25–32.

Elkington, J. (1994). Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California Management Review, 36*(2), 90, Berkeley, Calif.

Ferneley, E., & Bell, F. (2006). Using bricolage to integrate business and information technology innovation in SMEs. *Technovation, 26*(2), 232–241.

Flyvbjerg, B. (2004). Five misunderstandings about case-study research. In C. Seale, G. Gobo, J. F. Gubrium, & D. Silverman (Eds.), *Qualitative research practice* (pp. 420–434). London: Sage.

Garud, R., Jain, S., & Kumaraswamy, A. (2002). Institutional entrepreneurship in the sponsorship of common technological standards: The case of Sun Microsystems and Java. *Academy of Management Journal, 45*, 196–214.

Gibbs, D. (2009). Sustainability entrepreneurs, ecopreneurs and the development of a sustainable economy. *Greener Management International, 55*, 63–78.

Harbi, S. E., Anderson, A. R., & Ammar, S. H. (2010). Entrepreneurs and the environment: Towards a typology of Tunisian ecopreneurs. *International Journal of Entrepreneurship and Small Business, 10*(2), 181–204.

Hart, J. (2006). The new capitalists: Is it possible to make money and really make a difference? *Utne, 135*, 39–43.

International Energy Agency (www.iea.org/) IEA. (2008). *World energy outlook*. Paris: IEA.

Jong, J., & Muizer, A. (2005). *De meest innovatieve sector van Nederland, ranglijst van 58 sectoren*. Zoetermeer: EIM.

Kirzner, I. (1973). *Competition and entrepreneurship*. Chicago: University of Chicago Press.

Levi-Strauss, C. (1967). *The savage mind*. Chicago: The University of Chicago Press.

Linnanen, L. (2002). An insider's experiences with environmental entrepreneurship. *Greener Management International, 38*, 71–80.

Maguire, S., Hardy, C., & Lawrence, T. B. (2004). Institutional entrepreneurship in emerging fields: HIV/AIDS treatment advocacy in Canada. *The Academy of Management Journal, 47*(5), 657–679.

Pacheco, D. F., Dean, T. J., & Payne, D. S. (2010). Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development. *Journal of Business Venturing, 25*(5), 464–480.

Parrish, B. D. (2006). *Beyond cleaner production: Entrepreneurship and the design of sustainable enterprise*. Paper presented to the international conference on green and sustainable innovation, Chiang Mai, p. 29.

Post, J. E., & Altman, B. W. (1994). Managing the environmental change process: Barriers and opportunities. *Journal of Organizational Change Management, 7*(4), 64–81.

Randjelovic, J., O'Rourke, A. R., & Orsato, R. J. (2003). The emergence of green venture capital. *Business Strategy and the Environment, 12*(4), 240–253.

Revell, A., & Blackburn, R. (2007). The business case for sustainability? An examination of small firms in the UK's construction and restaurant sectors. *Business Strategy and the Environment, 16*, 404–420.

Revell, A., & Rutherfoord, R. (2003). UK environmental policy and the small firm: Broadening the focus. *Business Strategy and the Environment, 12*, 26–35.

Schaltegger, S. (2002). A framework for ecopreneurship. *Greener Management International, 2002*(38), 45–58.

Schlange, L. E. (2006). *What drives sustainable entrepreneurs*? Paper presented at applied business and entrepreneurship association international conference, Kona, pp. 16–20.

Schlange, L. E. (2009). Stakeholder identification in sustainability entrepreneurship. *Greener Management International, 55*, 13–32.

Shane, S. & S. Venkataraman (2000). "The promise of entrepreneurship as a field of research. *Academy of Management Review 25*, 217–226

Stevenson, H. H., & Jarillo, J. C. (1990). A paradigm of entrepreneurship – Entrepreneurial management. *Strategic Management Journal, 11*, 17–27.

Tilley, F. (2000). Small firm environmental ethics: How deep do they go? *Business Ethics: a European Review, 9*(I), 31–41.

Tilley, F. (2007). *Conceptualising sustainability entrepreneurship*. Paper presented to the first world symposium on sustainable entrepreneurship, University of Leeds.

Tilley, F., & Parrish, B. D. (2006). From poles to wholes: Facilitating an integrated approach to sustainable entrepreneurship. *World Review of Entrepreneurship, Management and Sustainable Development, 2*(4), 281–294.

United Nations Environment Program – Sustainable Buildings & Climate Initiative (UNEP-SBCI). (2009). *Buildings and climate change summary for decision makers*. www.unep.org/sbci/pdfs/sbci-bccsummary.pdf.

Walley, E. E., & Taylor, D. W. (2002). Opportunists, champions, mavericks. . .? *Greener Management International, 38*, 31.

Weick, K. E. (1993). The collapse of sensemaking in organisations: The Mann Gulch disaster. *Administrative Science Quarterly, 38*(4), 628–652.

Willis, R., Webb, M., & Wilsdon, J. (2007). *The disrupters: Lessons for low-carbon innovation from the new wave of environmental pioneers*. London: NESTA.

Wu, L., et al. (2017). Bricolage effects on new-product development speed and creativity: The moderating role of technological turbulence. *Journal of Business Research, 70*, 127–135.

Yin, R. K. (2009). *Case study research design and methods* (4th ed.). Thousand Oaks: Sage.

York, J. G., & Venkataraman, S. (2010). The entrepreneur–environment nexus: Uncertainty, innovation, and allocation. *Journal of Business Venturing, 25*(5), 449–463.